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Women's leadership in renewable transformation, energy justice and energy democracy: Redistributing power

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ABSTRACT

As women take on more leadership roles in the United States advancing social and political change, analysis of women's contributions to the transformation occurring within the energy sector is critically important. Grassroots movements focused on energy justice and energy democracy focus on: (1) resisting the power of large multinational fossil fuel energy companies that exacerbate inequities and disparities in energy, (2) reclaiming the energy sector with more community and public control to redistribute benefits and risks, and (3) restructuring the energy sector to prioritize equity and justice with community ownership and distributed governance. This research analyzes women's leadership by focusing on how two women-led, non-profit organizations are advancing the renewable energy transition, operationalizing the concept of energy democracy and contributing to the energy justice movement. The two organizations are Grid Alternatives, a solar installation and workforce training organization, and Mothers Out Front, an advocacy organization focused on addressing climate change by promoting a transition to renewable energy. These organizations differ in their mission and approaches, yet both intentionally link climate and energy action with other forms of social justice activism, by expanding community engagement, strengthening participation, and fundamentally redistributing power to promote a transition to more equitable, resilient and sustainable energy systems. This paper contributes to the theoretical understanding of gender in energy justice and energy democracy movements, and to the practical consideration of the role that women's leadership is playing in accelerating energy system change and advancing the principles of energy justice and energy democracy.

1. Introduction

The words of former Irish president and U.N. human rights commissioner Mary Robinson resonated with many renewable energy transition activists when she stated, "climate change is a man-made problem and must have a feminist solution" [1]. The role of gender dynamics, and specifically women's leadership, in social movements that advocate transformation in the energy sector is an important area of study deserving of more theoretical and practical analysis. Integrating a gendered lens into analysis of the dynamic landscape of energy transformation offers multiple possibilities for accelerating change. While male dominated systems of power and privilege control many sectors of society [2], and research is revealing multiple ways in which data biases men creating a world designed primarily for men [3], energy decision-making has been particularly homogeneous and hierarchical [4]. As issues of equity, inclusion, exclusion, and justice become more prominent in climate and energy policy and discourse, research on the role of women's leadership in energy is increasingly

valuable.

Socially constructed gender roles not only shape climate change vulnerabilities, but also how society responds to climate change. It is increasingly recognized that gender dynamics influence social and political factors determining who participates in decision-making about energy systems and responses to climate change [5–7]. Prior research has explored the ways in which climate change impacts are differently distributed for men and women globally [8,9], how gender identities interface with perceptions of climate change science and policy alternatives [6,10], and how political and social action to address climate change might reinforce or reduce gender inequality [6,11,12]. At the same time, a large body of scholarship focuses on the intersection of gender issues and environmentalism and varied framings of the role of women in environmental justice activism [13–21,118]. Relationships between women's issues and energy systems have received significant attention in development literature [22–27].

As the destructive effects of climate change become increasingly severe, scientists and policy makers are advocating for technological

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and policy innovations to reduce carbon emissions [121]. Central to these proposed measures is a transition from fossil fuel-based energy systems to renewable-based energy generation [28–32]. The benefits of a transition to renewable energy are not, however, limited to climate change mitigation and lowering carbon emissions [33–36]. This shift also represents an opportunity to create more equitable, localized, and democratic energy systems [31,32,37–41].

Renewable energy generation differs from conventional fossil fuel-burning generation in two major ways that could support a transformation in energy governance: (1) renewable energy can be deployed in local, small-scale installations, in a dispersed manner that allows for structural opportunities for diversifying who owns, manages, and benefits from energy infrastructure, and (2) once the technology is in place to harness energy from the sun, wind or water, the source is perpetual and abundant, eliminating competition for access in the same way that fossil fuel based energy requires competition for a scarce limited resource [38,42]. These features provide the foundation for future energy systems that are decentralized, and thus more accessible and inclusive than traditional fossil fuel based energy systems [43].

Literature on energy justice addresses disparities among socio-economic groups in terms of impacts from energy infrastructure, and access to energy and energy decision-making power [44–46]. There are multiple dimensions of energy justice, specifically: 1) distributional justice, which addresses spatial inequities in the allocation of energy and exposure to the externalities from energy production, 2) procedural justice focused on inequities in energy governance and decision-making processes, and 3) recognition justice focused on inequitable representation of diverse stakeholders [35,46]. Energy justice has emerged as an important conceptual tool uniting disparate justice concerns, as a valuable analytical tool for researchers to situate values within energy systems, and as a critical decision-making tool for energy planning [35,47]. Recent energy justice work has also inspired the development of a new concept of “embodied energy injustice” which identifies the transboundary injustices of energy systems [36]. To date, explicit gendered analysis of energy justice, gender equity, and gendered leadership in the renewable energy transformation has received minimal attention in the literature [48–50].

The vision for a just and equitable renewable energy future that links environmental sustainability, community resilience, social justice and economic equity has been termed energy democracy [38]. The concept of energy democracy draws on energy justice concepts, but in contrast has emerged largely from social movements, and is less grounded in academic theory and more oriented toward articulating an agenda for system transformation [40,41]. The energy democracy movement includes a diversity of interpretations and priorities [51]. In one influential framing advanced by Trade Unions for Energy Democracy, a multi-partner coalition coordinated by the New York-based International Program for Labor, Climate and Environment and the Rosa Luxembourg Stiftung New York Office, energy democracy has been formulated around three broad goals: (1) resist the dominant fossil fuel energy agenda, (2) reclaim social and public control over the energy sector, and (3) restructure the energy sector to better support democratic processes, social justice and inclusion, and environmental sustainability [52]. These energy democracy goals can be operationalized around the following actionable items: (1) disrupt the current fossil fuel-based energy system, (2) replace centralized energy production for distributed generation systems, (3) establish democratic and community-based control of energy systems, including both supply and demand, and (4) achieve more equitable ownership and access to energy by race, gender, and socioeconomic status [53]. In the United States, organizations focused on energy justice pursuing energy democracy goals have recently framed their vision and approach in direct opposition to the Trump administration’s policy of energy dominance, which seeks to accelerate fossil fuel extraction, and thereby amplify benefits to wealthy, powerful corporations while exacerbating inequalities in energy access [54].

Building on prior research on energy transitions, energy justice and energy democracy, this paper asks how women’s leadership and the principles of gender diversity and inclusion intersect with the work of organizations advocating for the renewable energy transformation and principles of energy justice and energy democracy. We consider how women’s leadership in the energy transition space builds upon traditions of women’s leadership and activism in the broader environmental movement and explore variations in how gender intersects with energy justice and energy democracy in practice. This paper takes a case study approach to analyze two US-based non-governmental organizations whose mission and approach embrace the principles of energy justice and energy democracy. Both organizations include women in key leadership positions and focus on representing women’s voices and advancing women’s skills within the renewable energy transformation. Grid Alternatives is a solar installation and workforce training organization. Mothers Out Front is a policy advocacy organization focused on addressing climate change through local action to accelerate the transition to renewable energy.

The paper begins with background on renewable energy transition movements and the multi-faceted intersections of gender and energy issues globally. We then briefly review the large body of scholarship on women’s leadership and activism in the environmental movement and consider the emerging body of literature that specifically addresses women in movements for an energy transition. After describing the theoretical contribution of our analysis and the research methodology, we explore the goals and organizational structures of each of the two case study organizations. The results and discussion section examines the relationship between women’s leadership and approaches toward energy justice and energy democracy goals within the case study organizations. We conclude by considering the multi-faceted contributions of women’s leadership in advancing energy system transformations and propose directions for further study.

2. Background

2.1. Energy justice and energy democracy within renewable transformation

The energy justice framework considers disparate health and well-being impacts of traditional fossil fuel-based energy, inequities in access to renewable energy, environmental racism, and disproportionate impacts of climate change on vulnerable populations and women [34,35,44,55]. Energy justice has evolved from decades of environmental justice research [56–58] and is also related to recent debates on how to integrate issues of climate justice, fairness and equity into large-scale shifts in the energy sector [59–61]. A diversity of social and movements have emerged globally with the goal of reducing reliance on fossil fuels and thereby addressing many of the energy justice concerns associated with legacy energy systems. Organizations vary in their framing of the problems to be addressed, goals, strategies, organizational structures, and theories of change. Emerging renewable energy technologies, including solar, wind, geothermal, and biogas can be deployed at different scales and by different categories of investors than traditional fossil fuel energy generation, enabling communities, individuals, cooperatives, and small companies to invest in and benefit from renewable energy technology development [32,40]. Socio-technical transitions are inherently political, and in the United States context, energy justice and the concept of energy democracy have emerged as powerful principles around which different climate and energy activist organizations have coalesced.

The energy democracy concept describes a vision for restructuring the political, economic, and social makeup of the energy system by transitioning to renewables while establishing democratic energy decision-making processes [52], equitable access to energy, energy-ownership for marginalized groups [38], and distributed, renewable energy resources [52]. Szulecki [40] defines energy democracy as an ideal political goal, in which citizens are recipients, stakeholders (as

consumers/producers) and account holders of the entire energy sector policy, stating that to maintain civic empowerment, “high levels of ownership of energy generation and transmission infrastructure through private, cooperative or communal/public means are necessary” [40]. Early uses of the term energy democracy occurred in 2012 at the Lausitz Climate Camp in Germany and a global trade union roundtable, Energy Emergency, Energy Transition, held by the Global Labor Institute (GLI) at Cornell University [62]. Organizers at the GLI global roundtable drafted a framing document which established the three broad energy democracy objectives that have been widely embraced: *resist, reclaim, and restructure* [62,52,63].

Within this energy democracy framing, the first objective, *resist*, encompasses actions taken to counter the status quo of fossil fuel energy generation and its political agenda. This includes slowing and eventually ceasing the extraction of fossil fuels from the ground, stopping the expansion of fossil fuel energy infrastructure including natural gas pipelines, and phasing out policies that favor fossil fuel energy over renewable and distributed energy. The second objective, *reclaim*, involves the democratization of the energy industry and sources of energy generation. Specifically, this describes individuals and communities reclaiming control over decisions about their energy supply. In many framings of energy democracy goals, the proposed approach to reclaiming control involves returning parts of the energy system that are controlled by private, for-profit corporations to the public, and establishing new publicly owned and managed energy providers. The third energy democracy objective, *restructure*, entails a transformation toward a more democratic, equal and distributed energy system. Key steps in this process include empowering historically marginalized groups to play a leading role in the energy system and establishing community energy systems [38]. It should be noted here that most literature on energy democracy frames the movement as a response to the current energy regime experienced in modern democratic Western countries with near-universal access to energy. Thus, the concerns that drive energy democracy activism are not lack of access to energy, but a response to 1) the limitations of centralized public corporations, and 2) privatization, “with its illusory promise of individual empowerment through shareholder democracy and consumer sovereignty” [41]. Intended outcomes related to the central three goals of the energy democracy movement are detailed in Table 1.

The energy democracy movement explored here is situated as part of a broader trend in research and practice, termed ‘resource democracy’, which brings issues surrounding society’s relationship to material resources to the forefront of the political process [41]. Some scholars have argued that public participation through material engagement can play a vital role in reviving democracy by including new actors and practices of engagement [32]. Although a robust movement, achieving

the vision of energy democracy is extraordinarily complex and challenging in practice—requiring the sustained focus of a diverse public, coherent messaging capable of overcoming disinformation campaigns led by powerful interests, and coordination among multiple decision-making entities. Recent scholarship looks at diverse narratives emerging about what energy democracy means in practice and considers the range of approaches to operationalizing, or implementing, this vision [31,32,39,41,122]. Organizations who self-identify as contributing to the energy democracy movement have different approaches to articulating the social groups to be connected and empowered—variously focusing on workers, households, or specific marginalized groups, including low-income communities and communities of color [31,51]. Energy democracy organizations also embrace varying theories of change and stability, and work to enact institutional change at different scales, ranging from focusing efforts on resisting fossil fuel use at a global and national scale, to focusing on households and neighborhood-scale decentralized energy infrastructure [31,51].

Hess [31] considers the diverse structures and approaches of energy-transition organizations and applies a multi-coalition perspective to understand the ways in which energy-transition organizations can form networks, thereby making use of a wider sets of frames and successfully advancing a common set of overarching objectives. Some coalitions are oriented around *sunsetting*, or ending unwanted practices, policies, social inequalities, and technologies, while others have a *sunrising* orientation, and focus on supporting alternatives to the dominant system such as renewable energy generation and local ownership [31].

Literature on energy justice and energy democracy centralizes a vision of active, engaged energy citizenship. Yet it is important to acknowledge a more critical perspective offered by others who ask to what extent participation in energy decision-making is influenced by social and economic factors, including race, economic status, and home ownership and gender [41].

2.2. Gender, climate change, and energy

Energy researchers and policymakers need to pay more attention to gender and identity, because these constructs mediate access to resources, exposure to pollutants, and opportunities to participate in energy resource management, policy, and science [27,64]. Traditionally, the academic discussion of the intersection of gender, climate change and energy has bifurcated into two relatively distinct literatures. The first is concerned primarily with developing nations and employs a *Women In Development or Gender And Development* framing to understand inequalities in access to energy and differential impacts of energy access, impacts of climate change and opportunities to engage in

Table 1
Energy democracy goals and intended outcomes (Adapted from [38]).

Goals for energy democracy	Intended outcomes
Resist the dominant energy agenda	<ul style="list-style-type: none"> ● Fossil fuels remain in the ground. ● Expansion of fossil fuel infrastructure and extraction stops. ● Fossil fuel subsidies end. ● Undermining of climate protection stops. ● New social alliances are created (e.g., unions, environmental groups, municipalities).
Reclaim the energy sector	<ul style="list-style-type: none"> ● Energy corporations democratize and localize. ● Social/public control of energy production and consumption normalizes. ● Parts of the energy sector that have been privatized or marketized return to public control. ● Principles of public interest within and democratic control over publicly-owned energy companies is restored. ● New energy companies, ownership models and financial investment systems under social and public control develop.
Restructure the energy sector	<ul style="list-style-type: none"> ● Energy access and assets are shared broadly and community wealth-building is supported. ● Energy systems are governed as a commons. ● Community power and capacity to control energy systems strengthen. ● Economic and political power is decentralized and distributed. ● Solidarity, inclusion and open, democratic participation advances. ● Low-income communities and communities of color have decision-making power within energy systems.

decision-making about energy and climate action [65]. In the developed world, discussion around women, climate and energy has focused on the gender divide in perceptions of climate change [10], as well as the gender disparity in energy sector careers [4].

In the context of developing nations, it is noted that women are the primary producers and managers of energy at the household scale (for example, collecting firewood for fuel), and thus there are calls for consideration of gender roles in renewable energy and microfinancing economic development programs [22]. Globally, international aid for energy development has traditionally emphasized large infrastructure projects, which do not always provide improved access to energy for the most vulnerable populations [22,23,26]. Osunmuyiwa and Ahlborg [27] write that a narrative of “women’s poverty” has prompted programs and policies that design electricity systems to address “women’s problems” and focus on improving household energy access. This narrative can reinforce gendered ideas about who has decision-making power in society by focusing on women’s proximity to the home. Also, electrification may have limited effect on gender equity issues and may be linked to some weakening of the strength of community ties [27,65]. Since women’s ability to take advantage of new energy-related employment options is often constrained by legal or social barriers that limit their education, property rights, land tenure, and access to credit, it is crucial that government policies go beyond energy sector planning to optimize economic opportunities for women [25,65].

In the developed world analysis of the relationship between women and energy has focused largely on careers in the industry. Social, cultural, and political context shapes women’s and men’s involvement in energy system ownership, investing and decision-making [50]. Differences in who holds decision-making power in the energy sector cannot be explained by individual preferences and attitudes alone [66]. Rather, individuals’ levels of agency in energy decision-making is determined by multiple factors including gender, wealth, occupation, and tax landscape [50,66].

While the recent boom in US oil and gas extraction has led the fossil fuel industry to expand their outreach to women in order to rapidly train and hire a skilled workforce [67], women make up a small minority of leaders and professionals in the energy sector [4]. Globally, an estimated 22% of the full-time oil and gas workforce is female [68]. As of 2012, the energy industry had the lowest representation of female board members in any sector of the US economy, with 61% of energy companies in the United States having no female board members [4]. And within the renewable energy industry, gender equity lags behind other sectors of society. According to a recent global survey, an estimated 28% of the STEM-related workforce and 45% of administrative employees in the renewable energy sector are female [68]. In the solar industry in the United States, women made up 21.6% of the workforce in 2014 [4].

In 2016, U.S. licensed electricians were 83.2% white and 97.9% male [69], and it was estimated that 60% of the men who hold leadership positions in the electricity sector are within 5 years of retirement [70]. As this aging workforce retires, there are opportunities for a more diverse group of people and ideas to enter the industry [66]. Additionally, producing and distributing energy is more labor intensive for renewable-based systems than for most fossil fuel based systems [25,68]. Thus, the transition to increased renewable energy generation is creating new employment opportunities in remote and under-served communities [25,68].

Despite the persistent lack of gender diversity in the energy industry, the benefits of hiring and retaining women in the energy workforce are well documented. Companies that invest in women and include gender-diverse teams have more innovation and revenue growth than their competitors [4,71,72]. Increased gender parity in groups has also been linked to more effective and inclusive results in decision making [71]. Women are more likely to champion sustainability and environmental action in the workplace, and companies with more women on the board of directors are more likely to invest in

renewable energy and reduce carbon emissions [4].

2.3. Women’s leadership in environmental movements

Historically, there are many points of intersection in women’s political activism, feminist activism, environmental social movements and direct action [20,73]. There is evidence that organizations and governments act differently when women are better represented in positions of power and the rise of women’s status in a nation is associated with greater support for environmental protection [74]. Women’s environmental leadership in the United States has taken a broad range of forms historically, including black women’s community organizing around environmental justice and health issues, Native American women’s action to protect biodiversity and white women’s engagement in the early 20th century conservation and preservation movement [21].

Concepts of women’s closeness to nature, virtuousness, and roles as mothers and protectors have frequently been strategically invoked in environmental activism [11,13,16–18,48]. Women environmentalists speak of protecting children, ensuring a future for future generations, preserving home and family life and maintaining health and quality of life for people in their communities [12,21]. Perceptions of women’s vulnerability, virtuousness and their predisposition to being more environmentally conscious are echoed in much of the literature about gender and climate change [8,9]. Arora-Jonsson [11] argues that this focus on women’s vulnerability to climate change impacts and emphasis on women’s virtuousness in protecting their families from environmental harms can have the consequence of deflecting attention from power relations in institutions at all levels.

Some scholars suggest that women’s engagement in environmental movements does not originate in the women’s movement or stem from a feminist perspective, but constitutes a separate tradition of women’s social movement engagement [75]. But others draw a direct connection between feminist ideology and women’s environmentalism [21,76,77]. Emergent feminist consciousness in the 1960s empowered some women to become leaders in mainstream environmental groups. McCammon et al. [21] note that many of these movement leaders adopted traditionally masculine leadership styles to gain acceptance from male peers. In the 1970s, ecofeminism emerged as a critical community of scholarship and activism linking patriarchy and the subordination of women to the destruction of nature [76,78,79]. Women active in ecofeminist organizations are generally resistant to an “assimilation style” leadership strategy, and are more likely to adopt non-hierarchical structures founded on the intersection of feminism and environmentalism [21].

Cable [13] looks at the rise of local organizations responding to environmental threats in their own communities throughout the 1980s. Many of these “concerned citizen” movements were led by women without a prior history of political engagement [13]. Typically, initial recruitment to engage in these environmental activist organizations occurred through social networks, activating structurally available actors [13]. While structural availability continues to shape who engages in environmental action groups and the manner in which they engage, Cable finds that over time women engaging in social movements often change their gender role behavior, for example, assuming leadership roles and speaking publicly, which can subsequently prompt similar changes in their domestic lives [13].

Many women engaged in environmental justice movements invoke racial, ethnic and religious identities to explain their activism and leadership [21,80,81]. In interviews with Californian women environmental justice activists, Perkins [19] finds a diverse array of paths into activism. Women become environmental justice activists for reasons that include: personal experience of societal problems, concern about the health of their families, prior experiences of activism, the influence of role models, negative interactions with government agencies, the effects of broad historical upswings in activism and the influence of educators, organizers, family, friends who helped make connections between personal struggles and larger social problems [19]. Although it

is important to recognize that concerns for protecting family and one's home are a legitimate basis for political action, some have warned that scholars of environmental activist movements should not over-generalize women's motivations and strategic approaches [19].

2.4. Current United States context: women's leadership in energy and climate

Women's leadership in social movement organizations is on the rise at a time in history when calls for widespread climate change action and an energy system transformation are receiving unprecedented attention in the popular press. The Global Women's March, which took place January 21, 2017 and involved an estimated 7 million marchers globally was both a reaction to the election of Donald Trump, and a broad-based call for society to address gender, economic, racial, and environmental injustices. The March represented an amalgamation of progressive resistance causes, including women's reproductive rights, environmental justice, Black Lives Matter, immigrant rights, and religious inclusion. The Women's March and related demonstrations and movements leading up to and following the March represent a pivotal moment in history that demonstrates the increasing importance of women's organizing power and leadership in social change and resistance movements [82–84]. The Women's March also demonstrated the power of an integrated approach to political activism. The election in 2018 of a record 117 women in Congress is another demonstration of growing political power of women.

Maintaining a commitment to the 1.5-degree C warming target as outlined in the October 2018 IPCC summary for policy makers will require “transforming the world economy at a speed and scale that has no documented historical precedent” according to a New York Times editorial published in October 2018 [85]. In this context, paleoceanographer and thought leader in the climate science communication field, Sarah E. Myhre, PhD, spoke to the online news magazine Jezebel, calling for the climate movement to look to women of color as the leaders in this space based on the “lens of moral attention” that they bring to their public work [86]. Myhre stated, “the existing paradigm of climate leadership has been focused on white men's leadership. And their leadership is reductionist, technocratic, top-down, and it does not have a comprehensive moral attention to the people who are in the most danger” [86].

Literature is emerging to explore the issues and motivations that drive women's activism in climate and renewable energy transition movements. McCright [10] finds that contrary to expectations from scientific literacy research, women possess greater scientific knowledge of climate change than do men. However, women underestimate their climate change knowledge to a greater degree than men. Women express higher levels of concern about climate change than men, and this gender divide is not accounted for by differences in values and beliefs or in differential social roles [10].

Research on the leadership role that women in Ohio play in opposition to fossil fuel-based energy infrastructure and fracking reveals some of the complexity of motivations that underlie women's engagement in climate and energy action [49]. The relationship between gender and the fracking resistance movement has been explored through the lens of “mothering” with women activists taking on the role of community caregivers, as well as less traditionally gendered motivations of power, control, and justice, suggesting a diversity of motivations for women environmental and energy activists [49]. In a study of the environmental justice movement in the Central Appalachian coalfields, Bell and Braun [48] find that women draw on their identities as “mothers” and “Appalachians” to justify their activism, while the hegemonic masculinity of the region, which is tied to the coal industry, has the opposite effect on men, deterring their movement involvement [48]. In this pivotal time for the energy transformation movement, it is important to understand the qualities that women in leadership positions bring to energy justice and energy democracy organizations, and

the ways in which these organizations are linking gender equity and energy system transformation goals.

3. Theoretical contribution

Discussion of gender and women's leadership has not yet been significantly integrated into either the energy justice literature or the energy democracy literature. Women's leadership in energy transition movements has received relatively little empirical attention, with the important exceptions of Bell and Braun [48] and Willow and Keefer [49] who have explored gender dynamics of resistance to coal and fracking. Given this minimal attention to gender and women's leadership, the present study explores women's leadership in movements for a transition to renewable energy in the United States by focusing on two women-led organizations. This empirical analysis provides valuable context for this under-explored area of research.

This examination of women's leadership in the movement for a transition to renewable energy focuses on the following questions: What motivates women to lead energy transition movements? How do organizations led by women position themselves with respect to the goals of energy justice and energy democracy? Exploring these questions offers insights that lay the groundwork for designing more sophisticated social science research on gender and energy in the future.

4. Research approach

To explore how women's leadership and the principles of gender diversity and inclusion intersect with the work of organizations advocating for renewable energy transformation and principles of energy justice and energy democracy, this analysis relies on case studies of two women-led organizations. The two case study organizations were selected based on their status as prominent examples of U.S. based national organizations led by women with mission statements explicitly addressing energy system transformation and social justice. There are other organizations that more explicitly focus on energy justice and energy democracy, including energy cooperatives and grassroots activist groups, but at the time this research was initiated these other organizations did not have a dedicated mission related to gender diversity. The two organizations selected are relatively mature and the voices of founding leaders are well documented online, in publicly available interviews, in personal histories, and in articles in the popular press. These organizations also both have accessible documentation of organizational strategy and specific initiatives.

Grid Alternatives is a solar installation and workforce training non-profit based in California with activities in multiple states throughout the country. Grid Alternatives specifically recruits women and people of color into their solar training programs and provides solar power to marginalized communities, including programs targeted for tribal members and programs targeted for people impacted by the criminal justice system. Mothers Out Front is a climate and energy activism non-profit with distributed operations across the United States, which primarily focus on local issues including protesting fossil fuel infrastructure and lobbying for progressive climate policies.

In addition to reviewing publicly available news, interviews and organizational materials, a participatory research approach was integrated into analysis of the case study of one of the organizations. In the case of Mothers Out Front, two of the authors of this paper have attended meetings, workshops, participated as members and have personal connections to some of the people in leadership roles within the organization. In the case of Grid Alternatives, one of the authors has had multiple professional interactions with representatives of the organization throughout the past five years.

An investigation into each organization's programs and accomplishments over time was conducted from January to June 2018. Organizational information obtained from official organizational reports, newspaper and magazine articles, and internal organization

Table 2
Comparison of Mothers Out Front and Grid Alternatives.

	Mothers Out Front (MOF)	Grid Alternatives (GA)
Organizational Classification	Policy advocacy-based non-profit.	Program-driven non-profit.
Mission Statement	“To build our power as mothers for a livable climate for all children.”	“To make renewable energy technology and job training accessible to underserved communities.”
Year Founded	2013	2001
Goals	MOF lobbies for climate action beginning at the community level and seeks to curb the carbon footprint of the communities it is involved with 3 initiatives: 1) fixing natural gas leaks to prevent methane emissions, 2) opposing new fossil fuel infrastructure, 3) advocating for community choice aggregation to bring clean energy into local homes and businesses and provide greater community control of the energy supply.	GA foster energy justice in low-income communities. GA functions as installer of no-to-low cost solar energy for low-income individuals and provides of solar installation job training for underserved communities. In 2008, GA was selected by the California Public Utilities Commission to administer the Single-Family Affordable Solar Housing (SASH) program for affordable solar energy.
Geographic Scope	Currently has established chapters in 8 states: MA, NY, VA, AL, NH, CA, OH, and WA	10 regional and affiliate offices serving CA, CO, mid-Atlantic region, Nicaragua, Nepal and a Tribal program serving families nationwide
Staff and Structure	The National Leadership Team is volunteer-driven, with a small number of paid staff. There is no physical central operation. Members are organized in community teams and statewide task forces.	The organization is composed of an Executive Leadership Team, with divisions including Workforce Development, Policy and Business Development, and Outreach. Regional operations have paid staff as well as installation volunteers. A National Board of Directors oversees operations.
Funding Sources	Fundraising	Fundraising, administers California low-income solar program
Leadership and Founding History	Founders Kelsey Wirth (Chair of Board) and Vanessa Rule (Director of Learning and Expansion) were concerned about the impact that climate change would have on their children’s lives. They created MOF to connect like-minded mothers and grandmothers and other caregivers to advocate for climate action.	Founders Erica Mackie (CEO) and Tim Sears (COO) were working as mechanical engineers in energy consulting, planning large-scale energy efficiency and renewable energy projects for the private sector. They created GA to address the disparities in access to energy efficiency and renewable energy technologies.
Programmatic Expansion	MOF house parties encourage grassroots advocacy and serve as the primary recruitment mechanism for MOF. The organization is beginning to take on climate policy at higher levels of government as well through the state taskforces and has played a part in numerous successful campaigns in Massachusetts, including lobbying for more regulation over natural gas leaks.	GA has moved beyond solar installation and workforce development in California over time, partnering with 40 Indigenous tribes in the United States to provide solar systems for over 490 Indigenous families. GA has also established international programs in Nicaragua, Nepal and Mexico, as well as regional programs in the mid-Atlantic region and Colorado.
Strategic Approach	MOF’s status as a women-led organization of mothers, grandmothers, and caregivers is an important part of its public image and strategic approach. The organization is committed to combatting climate change to preserve the world future generations.	GA is broadly focused on direct installation of renewable energy to achieve the organization’s goals. Through its operations, GA is able to directly install distributed renewable energy resources and increase access to renewable energy for marginalized groups in the places where it works.

documents such as meeting minutes, letters to members, blog posts, and social media outreach was analyzed. We also reviewed publicly available statements from the leaders of each of these organizations about the factors that motivated their personal engagement with the movement to transition the renewable energy and their perceptions of what motivates members of each organization to participate.

5. Results and discussion

5.1. Women’s leadership in practice: overview of case study organizations

Mothers Out Front and Grid Alternatives are representative of a relatively small group of non-profit, non-governmental organizations working to accelerate the renewable energy transition with a focus on social justice and gender diversity. While neither of these organizations explicitly self-identifies as being part of a movement for energy justice or energy democracy, their mission statements and organizational objectives are aligned with goals of these movements.

Mothers Out Front incorporates issues of gender directly into the organization’s mission, “We build our power as mothers to ensure a livable climate for all children”. The organization’s gendered stance on environmental activism is a strategic decision by organizers, drawing on traditional understandings of women’s social roles and values of protecting children’s health and future and opposing intrusions of

environmental hazards into the home and community [49]. Less gendered motivations of power and justice are also expressed by Mothers Out Front, reflecting the multi-faceted drivers of group members’ activism. Mothers Out Front brands itself as a group of mothers and grandmothers, similar to activist groups including Moms Demand Action, Mothers Against Drunk Driving and One Million Moms. The maternal frame is useful for political organizations to adopt in that it protects them from some degree of political attack as mothers are seen as nonthreatening and not inherently political [18]. Organizations that invoke the maternal frame can also tap into a large demographic of mothers to mobilize for political action. The maternal frame has also been criticized for evoking traditional gender roles for women, and for being apolitical when feminism is decidedly political [18].

Mothers Our Front draws from the organizing model championed by Ganz [87]. The national organization promotes a “snowflake” model, supporting members in forming teams which connect around shared values, house parties and small group meetings, and determine the issues they will focus on for actionable change they can influence at the local level. The specific issues that each local team chooses to focus on are unique; some focus on lobbying their city governments to purchase more renewable energy while others focus on campaigns to stop fossil fuel infrastructure from being built in their communities [88].

Grid Alternatives is the largest nonprofit solar installer in the U.S. and advances programs to make renewable energy technologies and

careers accessible to underserved communities. The organization has made gender inclusivity one of their priorities, acknowledging the benefits of gender diversity in the renewable energy sector. Grid Alternatives is unique among energy companies, having a female CEO and 4 out of 10 members of the board of directors who are women [89–95]. Grid Alternatives also has a dedicated program for involving women in the solar industry. This strategic decision reflects the organization's perspective on economic and cultural benefits of gender diversity in development and innovation in the renewable energy industry [4].

Grid Alternatives co-founder Erica Mackie describes the organization's approach to engaging participants as a "community barnraising method with a job training component" [96]. In installing new renewable energy infrastructure, members of the community come together to gain skills and gain economic benefits. Installation projects provide an opportunity to get training and experience in the classroom and in the field. Grid Alternatives' unique business model allows it to provide solar energy at low-to-no costs to low-income families while bringing much-needed training and jobs to underserved communities. As a nonprofit organization, Grid Alternatives relies on support from government programs, corporate sponsors, and personal donations for revenues, allowing them to provide solar installation at significantly reduced prices [97]. Additionally, the company's use of primarily volunteers and trainees in installations reduces costs and opens an opportunity for local job training [97].

Grid Alternatives and Mothers Out Front share similar end goals (establishing equitable and distributed renewable energy generation) but have different approaches to achieving those goals. Mothers Out Front seeks to transform the energy system through grassroots activism for policy action, whereas Grid Alternatives focuses on direct operations to bring solar power and job training opportunities to underserved communities. Table 2 compares the structure, history and strategic approach of both organizations. Analyzing these two case studies illustrates how these two different organizations are operationalizing and incorporating the objectives of energy democracy in their work and provides an opportunity to consider different ways that women's leadership can guide and shape movements for energy democracy.

5.2. What motivates women to lead in energy transition movements

In this section we turn to the personal narratives of founders of both Mothers Out Front and Grid Alternatives to understand the values that informed their energy system transformation activism and leadership. We also compare the factors that leaders in each organization identify as driving members to participate.

Mothers Out Front co-founder Kelsey Wirth began her career with early success as an entrepreneur, but she states that it took her years to identify the social activism cause that was right for her. Wirth fell into despair reading a book about coral reefs to her young daughters and realizing how vulnerable natural systems were, thinking about how much of her children's lives would be radically impacted by climate change. Wirth asked herself what she could do without a background as a scientist, politician, or communications expert, and she recognized a need for a social movement focused on engaging mothers around climate change [88].

Considering the question of whether motherhood encourages activism, Wirth states, "We're recognizing that we have a unique power that has not been well represented in so many rooms where important decisions get made. When it comes to protecting our kids, there is visceral determination that we will stop at nothing. So whether it's confronting a senator or a powerful CEO, we can draw strength from our own personal determination that we will protect our children at all costs" [88]. The organization notes that many of the members getting involved have never been politically active in any public way, yet because of the strength of social ties and their conviction about the urgency of the cause, they find themselves speaking up at department of

public utility hearings, for example [119]. Wirth also notes, "Mothers vote, and are the primary purchasers in their household. There's nothing gas companies hate more than having a bunch of mothers tagging gas leaks that they're not fixing. Mothers are rate payers, and we're calling out gas companies to fix something that is pretty outrageous" [88]. Based on this direct action by local Mothers Out Front teams, the organization has made gains in working with the gas companies to identify and fix gas leaks.

Grid Alternatives does not employ gendered framings of activism in the manner of Mothers Out Front, yet co-founder Erica Mackie draws explicit linkages between being a woman and engaging in the social and political movement for a transition to renewable energy. Speaking at the 2013 C3E Women in Clean Energy Symposium, where she received the Entrepreneurship and Innovative Business Models Award, Mackie reflected on her experience as an undergraduate in engineering courses, "the more abstract the subject matter, and the more the professor couldn't make a case that what we were learning was connected to the world, the fewer women would be sitting in that class" [98]. Mackie states, "I am convinced that the only solution that we can find to climate change is one that must include women... the only way to get clean power is to create inclusive, equitable solutions, and not just because that is the key to market transformation, but because that is the only way to do a just transition. We need to allow everyone, regardless of economic status, race, or gender to participate in the solution" [98].

To further explain the vision a more equitable energy system future that drives the organization's approach, Mackie says, "its not just about where solar panels go and who benefits from that particular infrastructure, it's about who is going to get those jobs in the future" [96]. Reflecting on the solar energy installation business landscape, Mackie notes that there is a need for more critical reflection on the part of employers about recruiting and hiring practices, employee training, and structuring opportunities for career advancement. Mackie says, "stepping back and thinking about how we're going to grow a really different kind of solar industry that is inclusive and making sure we're intentional about that, that's a place I see a huge opportunity for becoming better, smarter businesses and more equitable" [96].

5.3. Women-led operationalization of energy justice principles and energy democracy goals

In this section we analyze the ways in which Mothers Out Front and Grid Alternatives position their work relative to the principles of energy justice and energy democracy. We find that both organizations embrace energy justice principles. Mothers Out Front programs and activities specifically target the goals of resisting dominant fossil fuel industry interests and reclaiming public control of energy systems, whereas Grid Alternative's primary focus is around restructuring the energy system to increase public access to opportunities in the renewable energy industry and share assets from energy infrastructure with historically marginalized communities. The initiatives and specific actions that Mothers Out Front and Grid Alternatives pursue are quite different, but complementary, to one another.

5.3.1. Embracing energy justice principles

Grid Alternatives' work providing low-income and marginalized people with access to solar energy gives these groups a stake in policy discussions on renewable energy, helping to bring more diverse voices into the conversation. This work acts on the mission of the energy justice movement to address inequities in access to energy and energy decision-making power. Mothers Out Front has also highlighted inequities in the impact of energy production on marginalized communities. Mothers Out Front's fossil fuel infrastructure campaigns have particularly focused on local-level impacts of new natural gas infrastructure, including disproportionate health impacts and encroachment on marginalized communities, empowering local resistance to the fossil fuel industry.

Mothers Out Front is an explicitly non-hierarchical organization. Founder Kelsely Wirth states, “We do a lot of relationship building, we share what mothers can do and we share stories about successes that teams are having in other parts of the country. One of the most important pieces of what we do is support development of relationships and among volunteers and staff. The work we do is hard, and what sustains it is the relationships” [88]. Mothers Out Front seeks to engage a broad audience, but we note that many of the organization’s members are white middle and upper-class women, and within local chapters there are conversations ongoing about working toward greater socio-economic and racial diversity.

Grid Alternatives is focused on the principle that in the current dominant energy system, low income communities are disproportionately paying for power generation, in terms of environmental and health impacts and in terms of the relative financial cost of energy access. To address inequities in access to renewable energy, Grid Alternatives focuses on installing solar electric systems exclusively for low income families and community organizations. Within the installation process, the organization structures career training opportunities for members of the public who may not otherwise be able to access professional development opportunities in this sector.

5.3.2. Energy democracy goal 1: resist

An intended outcome of the resistance objective of energy democracy is to halt the expansion of fossil fuel infrastructure and ensure that “fossil fuels remain in the ground” [38]. Resistance efforts can, for example, drive up costs for natural gas companies and make it more difficult to sell and transport fracked gas [99]. Engaging in resistance activities also raises awareness of climate issues and brings greater scrutiny to the fossil fuel industry’s activities at a local level.

Mothers Out Front’s efforts to counter fossil fuel-based infrastructure have centered on empowering local communities to resist new fossil fuel infrastructure and protecting communities from health effects of gas leaks and encroachment by infrastructure [100–103]. Mothers Out Front has helped to organize several successful campaigns to resist new natural gas pipelines. Responding to the proposed Northeastern Energy Direct Pipeline in Massachusetts, Mothers Out Front held public forums, organized calls to local government representatives, and participated in protests outside the State House [100–103]. In April 2016, Kinder Morgan, the company behind the pipeline, announced it was ceasing work on the project [104]. The strong opposition to the project was named as one of the reasons for its cancellation, along with lack of customer demand and reduced natural gas prices [105]. In Virginia, Mothers Out Front teams are running a campaign against the proposed Atlantic Coast Pipeline, arguing that the pipeline is an example of environmental racism and overhanded politics because to construct the pipeline rural land would be seized by eminent domain from local owners and encroach on African-American neighborhoods, with potentially harmful health impacts [100–103].

The primary motivation for Mothers Out Front’s local efforts to resist fossil fuel infrastructure projects is to protect communities, which is reflective of the traditionally feminine community caregiving or maternal frame taken by some environmental activists [49]. While this is not the only framing of Mothers Out Front’s resistance action, it is prominent in the organization’s advocacy work. In the increasingly divided United States, the “mothers” framing also provides some protection to this resistance work, particularly against extreme defenders of fossil fuels. The “mothering” lens depoliticizes the resistance by leveraging the women’s role as prioritizing safety and protection.

5.3.3. Energy democracy goal 2: reclaim

The energy democracy objective of reclaiming citizens’ control of the energy sector entails bolstering public engagement in decision-making about energy sources and purchasing, and normalizing a new ownership model of the energy supply with more community control [38]. Mothers Out Front’s efforts to bring Community Choice

Aggregation (CCA) to the communities where they work reflect the energy democracy objective of reclaiming aspects of the energy sector that have been privatized and returning those aspects of the system to public control. CCA is a new model of electric ownership that allows for public reclaiming of the electric supply and decision-making and often allows for the arranger to purchase an increased share of renewable energy generation in the electric mix at stable prices at residents’ behest [38]. CCA also enables more democratic oversight and participation of residents in the electricity procurement process than typical utility-customer electricity arrangements. Despite the on-average higher prices of renewable energy, CCA generally leads to stable or decreased energy costs for residents, as communities can choose the lowest cost bid for renewable energy through competitive solicitation [106,107].

As part of their efforts to reclaim public decision-making, Mothers Out Front in Massachusetts has backed several pieces of legislation concerning gas leaks at both the municipal and state level. As natural gas pipes age, they become increasingly rusty and leaks occur as the gas is transported to homes and businesses for heating and cooking [108]. Massachusetts has some of the oldest natural gas pipelines in the nation, and there are currently approximately 20,000 known natural gas leaks in the state, costing energy consumers \$50–\$128 million every year [108]. The methane emitted from gas leaks makes up approximately 10% of greenhouse gas emissions in Massachusetts, and also contributes to asthma and respiratory problems in urban areas and increased risk of gas explosions [100–103].

The organization advocated for the passage of the Boston Gas Leak Ordinance, passed by the Boston City Council in a 12-1 vote in December 2016 [109]. The ordinance requires the City to notify gas companies when a street is opened for repair, providing the companies an opportunity to conveniently identify and fix gas leaks, and requires gas companies to provide a 5-year gas leak repair plan to the city every year and increase their reporting and planning in regard to gas leaks. Mothers Out Front has also lobbied for the passage of two bills that are currently under consideration by the Massachusetts legislature. Bill H.2870 would prevent utility companies from charging consumers for the cost of gas leaks and would require them to pay for these losses themselves and Bill H.2871 would require gas companies to survey for and repair gas leaks whenever streets are under construction.

5.3.4. Energy democracy goal 3: restructure

The final core goal of the energy democracy movement is restructuring the energy system so that the majority of the electricity supply comes from distributed renewable generation [38]. Grid Alternatives is working towards the energy democracy objective of restructuring the energy system by directly increasing the supply of distributed generation resources in the areas where they work. Decentralized renewable energy has potential to also re-distribute and decentralize economic and political power [38].

Working toward increasing diversity and inclusion in the energy industry, Grid Alternatives has several initiatives specifically designed to increase career training and opportunities for historically under-represented and marginalized groups. The organization’s original solar workforce development program was called RISE (Realizing an Inclusive Solar Economy). In 2018, Grid Alternatives ended RISE as a stand-alone program and incorporated the main components of RISE as permanent features of the organization [89–95]. RISE’s purpose was to make inroads with underserved communities, and to encourage racial and socioeconomic diversity and inclusion in the solar industry through its five “R’s”: 1) recruitment to reach members of underserved communities and promote solar job opportunities, 2) real-world experience for people attempting to enter the solar energy workforce, 3) readiness – working with industry leaders to provide relevant job training that meets industry needs, 4) referrals to connect job seekers with industry, and 5) retention – bringing the issue of inclusion to the forefront of the conversation happening in the industry.

Grid Alternatives’ workforce training programs include an initiative

for recently incarcerated individuals, a tribal solar energy program, and the Women in Solar Initiative. These programs are meant to create more diversity within the solar industry, to elevate the profile of people from historically marginalized groups working in the industry, and to give representatives of these communities the opportunity to participate in the industry. Grid Alternatives' Women in Solar Initiative was originally started in 2014 with a \$1 million donation from Sun Edison [120]. The campaign is designed to attract more women to the solar industry and to improve retention by making the industry more inclusive to the women already working in it. This includes a series of "We Build" women-only solar system installations, along with a pledge to train 1000 women in solar installation and 30 women to be solar installation team leaders [120]. The campaign also includes a quarterly "We Lead" webcast series revolving around the issues facing women in the solar industry and providing advice for women attempting to enter the solar industry. Grid Alternatives also pledged to include at least 20 women in its SolarCorps program in the coming years, ensuring a 50/50 gender ratio [110]. Additionally, the campaign launched the "We Give" circle of women donors to Grid Alternatives to form connections between the women involved with the solar industry [89–95].

In 2008, Grid Alternatives was selected by the California Public Utilities Commission to administer the Single-Family Affordable Solar Housing (SASH) program, California's primary affordable solar energy program [89–95]. SASH was enacted by California Assembly Bill 2723 in 2006, requiring that at least 10% of California Solar Initiative funds be used for low-income solar programs [111]. The program originally received \$108 million in funding and was slated to end in 2016 but was extended to 2021 and received \$54 million in new funding through California Assembly Bill 217 in 2013. Apart from affordable solar energy, SASH also includes provisions for job training and affordable energy efficiency [111,116]. By 2016, Grid Alternatives had installed solar systems on over 5200 homes and trained over 13,000 volunteers in California through the SASH program alone [89–95]. Grid Alternatives is currently working with stakeholders to replicate SASH in other jurisdictions, including Washington D.C. and Illinois [89–95].

6. Conclusions

The critical role of women's leadership in accelerating the transition away from fossil fuels toward a renewable-based future has not been widely recognized or analyzed in the growing area of social science research on energy systems. This analysis of two organizations led by women provides initial insights about how women's leadership and the principles of gender diversity and inclusion intersect with the work of organizations advancing the renewable energy transformation while embracing principles of energy justice and energy democracy. This research contributes perspectives on what motivates women to lead energy transition movements and how women's leadership takes shape in practice.

Analysis of how Mothers Out Front and Grid Alternatives structure and frame their programs and activities reveals the different ways that women's leadership can be instrumental in advancing energy system change and operationalizing energy justice and energy democracy goals. Both organizations have primarily focused on local-level activities for capacity-building and relationship-building to advance goals related to renewable energy transformation. Forming relationships with the communities in which they work and supporting individuals' leadership, professional development, and career advancement are central to the approach employed by both organizations.

Given the influence of the fossil fuel industry in creating a culture of climate denial that does not often prioritize the renewable energy transformation [112,113], non-governmental organizations such as Mothers Out Front and Grid Alternatives play a critical role culturally in addition to their intended impact on policy, politics, the environment and jobs. Other organizations in different contexts are also working on integrating energy justice and energy democracy ideals with economic

justice, racial justice, and women's rights and gender diversity concerns. The two case study organizations explored here highlight several models for doing this that provides some lessons about effective movement building and advancing energy system transformation.

Mothers Out Front and Grid Alternatives have unique approaches to advocating for gender diversity in energy systems and women's leadership with respect to energy democracy. Both organizations have prioritized supporting distributed or community-controlled forms of renewable energy generation. Mothers Out Front strategically draws on traditional societal expectations of women as protectors of future generations and defenders of their local communities. Grid Alternatives employs less gendered framing of mission and vision and integrates more explicitly racial and socio-economic diversity. Mothers Out Front focuses on policy advocacy and initiatives targeting the energy democracy goals of resisting dominant fossil fuel industry and reclaiming public control over decision-making about energy infrastructure, whereas Grid Alternatives focuses on restructuring energy systems to promote more equitable access to renewable energy and sharing of energy system assets within communities.

Both of these organizations rely on volunteers. Mothers Out Front focuses on harnessing the power of activist volunteers to influence policy, while Grid Alternatives harnesses the power of volunteers and trainees to reduce the costs for solar installation. From a social justice perspective, this reliance on volunteers can be viewed as problematic especially for Grid Alternatives if the trainees provide free labor and then are unable to find longer-term jobs when the training is finished.

Both of these organizations demonstrate how the voices of diverse women are powerful in resisting fossil fuel industry interests. Clearly, women's leadership plays a vital role in shaping and contextualizing innovative approaches to advancing energy system transformation. Multiple opportunities are emerging for additional research in this rapidly changing landscape.

The power and potential of women's leadership in renewable transformation is exemplified by Representative Alexandria Ocasio-Cortez's leadership in the United States Congress advancing The Green New Deal, a proposed policy package for major national-level investment in distributed renewable energy and energy job creation. By broadening engagement and recognizing the role of women, a new form of collaborative leadership is emerging that is redistributing power to promote a transition to more equitable, resilient, and sustainable energy systems.

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References

- [1] Z. Tabry, Climate Change a 'Man-Made Problem with a Feminist Solution' Says Robinson, June 10. Retrieved from: Thomson Reuters Foundation, 2018, <https://www.reuters.com/article/us-global-climatechange-women/climate-change-a-man-made-problem-with-a-feminist-solution-says-robinson-idUSKBN1JE2IN>.
- [2] K. Manne, *Down Girl, The Logic of Misogyny*, Oxford University Press, 2018.
- [3] C.C. Perez, *Invisible Women: Data Bias in a World Designed for Men*, Harry N Abrams, 2019.
- [4] R. Pearl-Martinez, J. Stephens, Toward a gender diverse workforce in the renewable energy transition, *Sustain. Sci. Pract. Policy* 12 (1) (2016).
- [5] B. Leduc, Climate change and gender justice, *Clim. Dev.* 2 (4) (2010) 390–392.
- [6] J. Nagel, *Gender and Climate Change: Impacts, Science, Policy*, Routledge, 2015.
- [7] R. Pearce, *Gender and climate change*, *Wiley Interdiscip. Rev. Clim. Change* 8 (2) (2017) 451.
- [8] F. Denton, Climate change vulnerability, impacts, and adaptation: why does gender matter? *Gen. Dev.* 10 (2002) 10–20.
- [9] A. Brody, J. Demetriades, E. Esplen, *Gender and Climate Change: Mapping the Linkages. A Scoping Study on Knowledge and Gaps*, BRIDGE, Institute of Development Studies (IDS), Brighton, 2008.
- [10] A.M. McCright, *The effects of gender on climate change knowledge and concern in*

- the American public, *Popul. Environ.* 32 (1) (2010) 66–87.
- [11] S. Arora-Jonsson, Virtue and vulnerability: discourses on women, gender and climate change, *Glob. Environ. Change Part A* 21 (2) (2011) 744–751.
- [12] C. Ergas, R. York, Women's status and carbon dioxide emissions: a quantitative cross-national analysis, *Soc. Sci. Res.* 41 (4) (2012) 965–976.
- [13] S. Cable, Women's social movement involvement: the role of structural availability in recruitment and participation processes, *Sociol. Q.* 33 (1) (1992) 35–50.
- [14] D. Rocheleau, B. Thomas-Slayter, E. Wangari, *Gender and environment: a feminist political ecology perspective*, International Studies, Routledge, London, 1996, pp. 3–23.
- [15] M.G. Reed, Taking stands: a feminist perspective on 'other' women's activism in forestry communities of northern Vancouver Island, *Gend. Place Cult.* 7 (4) (2000) 363–387.
- [16] G. Di Chiro, Environmental justice from the grassroots: reflections on history, gender, and expertise, in: Daniel Faber (Ed.), *The Struggle for Ecological Democracy: Environmental Justice Movements in the United States*, The Guilford Press, New York, 1998, pp. 104–136.
- [17] M. Leach, Earth mother myths and other ecofeminist fables: how a strategic notion rose and fell, *Dev. Change* 38 (1) (2007) 67–85.
- [18] C. Stavrianos, M.K. Jennings, L. Oaks, E. Smith (Eds.), *The Politics of Motherhood: Maternal Frames in Women's Political Action*, ProQuest Dissertations Publishing, 2008.
- [19] T.E. Perkins, Women's pathways into activism: rethinking the women's environmental justice narrative in California's san Joaquin Valley, *Organ. Environ.* 25 (1) (2012) 76–94.
- [20] R.K. Musil, *Rachel Carson and Her Sisters: Extraordinary Women Who Have Shaped America's Environment*, Rutgers University Press, 2014.
- [21] H.J. McCammon, A. McGrath, D.J. Hess, M. Moon, *Women, Leadership, and the US Environmental Movement. 100 Years of the Nineteenth Amendment: An Appraisal of Women's Political Activism*, Oxford University Press, 2018, <https://doi.org/10.1093/oso/9780190265144.001.0001>.
- [22] B.C. Farhar, Gender and renewable energy: policy, analysis, and market implications, *Renew. Energy* 15 (1–4) (1998) 230–239.
- [23] E. Cecelski, *The Role of Women in Sustainable Energy Development*, National Renewable Energy Laboratory. NREL/SR-550-26889, 2000, <https://www.nrel.gov/docs/fy00osti/26889.pdf>.
- [24] V. Shiva, *Staying Alive: Women, Ecology and Development*, South End Press, Boston, MA, 2010.
- [25] B. Baruah, Renewable inequity? Women's employment in clean energy in industrialized, emerging and developing economies, *Nat. Resour. Forum* 41 (2017) 18–29, <https://doi.org/10.1111/1477-8947.12105>.
- [26] T. Winther, K. Ulsrud, A. Saini, Solar powered electricity access: implications for women's empowerment in rural Kenya, *Energy Res. Soc. Sci.* 44 (2018) 61–74.
- [27] O. Osunmuyiwa, H. Ahlborg, Inclusiveness by design? Reviewing sustainable electricity access and entrepreneurship from a gender perspective, *Energy Res. Soc. Sci.* 53 (2019) 145–158.
- [28] T. Princen, J.P. Manno, P.L. Martin (Eds.), *Ending the Fossil Fuel Era*, MIT Press, Cambridge, MA, 2015.
- [29] B. McKibben, Why We Need to Keep 80 Percent of Fossil Fuels in the Ground (February 15): Retrieved from, YES, 2016, <http://www.yesmagazine.org/issues/life-after-oil/why-we-need-to-keep-80-percent-of-fossil-fuels-in-the-ground-20160215>.
- [30] A. Massol-Deyá, J.C. Stephens, J.L. Colón, Renewable energy for Puerto Rico, *Science* 362 (6410) (2018) 7.
- [31] D.J. Hess, Energy democracy and social movements: a multi-coalition perspective on the politics of sustainability transitions, *Energy Res. Soc. Sci.* 40(Complete) (2018) 177–189, <https://doi.org/10.1016/j.erss.2018.01.003>.
- [32] L.L. Delina, Energy democracy in a continuum: remaking public engagement on energy transitions in thailand, *Energy Res. Soc. Sci.* 42(Complete) (2018) 53–60, <https://doi.org/10.1016/j.erss.2018.03.00>.
- [33] S. Fuller, D. McCauley, Framing energy justice: perspectives from activism and advocacy, *Energy Res. Soc. Sci.* 11 (2016) 1–8.
- [34] N. Healy, J. Barry, Politicizing energy justice and energy system transitions: fossil fuel divestment and a “just transition”, *Energy Policy* 108 (Suppl. C) (2017) 451–459.
- [35] K. Jenkins, Setting energy justice apart from the crowd: lessons from environmental and climate justice, *Energy Res. Soc. Sci.* 39 (2018) 117–121.
- [36] N. Healy, J.C. Stephens, S. Malin, Fossil Fuels Are Bad for Your Health and Harmful in Many Ways Besides Climate Change, 7 February 2019 The Conversation, 2019, <https://theconversation.com/fossil-fuels-are-bad-for-your-health-and-harmful-in-many-ways-besides-climate-change-107771>.
- [37] D. Fairchild, A. Weinrub (Eds.), *Energy Democracy: Advancing Equity in Clean Energy Solutions*, Island Press, 2017.
- [38] M.J. Burke, J.C. Stephens, Energy democracy: goals and policy instruments for sociotechnical transitions, *Energy Res. Soc. Sci.* 33 (2017) 35–48.
- [39] M. Lennon, Decolonizing energy: black lives matter and technoscientific expertise amid solar transitions, *Energy Res. Soc. Sci.* 30 (2017) 18–27, <https://doi.org/10.1016/j.erss.2017.06.002>.
- [40] K. Szulecki, Conceptualizing energy democracy, *Environ. Polit.* 27 (1) (2018) 21–41.
- [41] B. van Veelen, D. van der Horst, What is energy democracy? Connecting social science energy research and political theory, *Energy Res. Soc. Sci.* 46 (2018) 19–28.
- [42] M.J. Burke, J.C. Stephens, Political power and renewable energy futures: a critical review, *Energy Res. Soc. Sci.* 35 (2018) 78–93.
- [43] S.M. McCauley, J. Stephens, Changing human geographies of the electricity grid: shifts of power and control in the renewable energy transition, *Handbook on the Geographies of Energy*, Oxford, 2017.
- [44] S.H. Baker, Mexican energy reform, climate change, and energy justice in indigenous communities, *Nat. Resour. J.* 56 (2) (2016) 369–390.
- [45] R.J. Heffron, D. McCauley, The concept of energy justice across the disciplines, *Energy Policy* 105 (2017) 658–667.
- [46] K. Jenkins, D. McCauley, R. Heffron, H. Stephan, R. Rehner, Energy justice: a conceptual review, *Energy Res. Soc. Sci.* 11 (2016) 174–182.
- [47] B.K. Sovacool, M.H. Dworkin, *Global Energy Justice - Problems, Principles, and Practices*, Cambridge University Press, 2014.
- [48] S.E. Bell, Y.A. Braun, Coal, identity, and the gendering of environmental justice activism in central Appalachia, *Gend. Soc.* 24 (6) (2010) 794–813.
- [49] A.J. Willow, S. Keefer, Gendering extraction: expectations and identities in women's motives for shale energy opposition, *J. Res. Gen. Stud.* 5 (2) (2015) 93.
- [50] C. Fraune, Gender matters: women, renewable energy, and citizen participation in Germany, *Energy Res. Soc. Sci.* 7 (2015) 55–65.
- [51] M.J. Burke, Shared yet contested: energy democracy counter-narratives, *Front. Commun.* 3 (2018) 22.
- [52] S. Sweeney, Resist, Reclaim, Restructure: Unions and the Struggle for Energy Democracy. Trade Unions for Energy Democracy. Discussion Document Prepared for the Energy Emergency: Developing Trade Union Strategies for a Global Transition Trade Union Roundtable, 10–12 October 2012, New York City, Retrieved from (2012) www.unionsforenergydemocracy.org.
- [53] J. Farrell, Beyond Sharing: How Communities Can Take Ownership of Renewable Power: Energy Democracy Initiative, Retrieved from Institute for Local Self-Reliance, 2016, <https://ilsr.org/report-beyond-sharing/>.
- [54] J. Schneider, J. Peeples, The energy covenant: energy dominance and the rhetoric of the aggrieved, *Front. Commun.* 3 (5) (2018).
- [55] M.C. LaBelle, In pursuit of energy justice, *Energy Policy* 107 (2017) 615–620.
- [56] R.D. Bullard (Ed.), *Confronting Environmental Racism: Voices from the Grassroots*, South End Press, 1993.
- [57] R.J. Brulle, D.N. Pellow, Environmental justice: human health and environmental inequalities, *Annu. Rev. Public Health* 27 (2006) 103–124.
- [58] R.D. Bullard, *Dumping in Dixie: Race, Class, and Environmental Quality*, Westview Press, 2008.
- [59] P. Newell, D. Mulvaney, The political economy of the “just transition”, *Geogr. J.* 179 (2) (2013) 132–140.
- [60] J. Goodman, From global justice to climate justice? Justice ecologism in an era of global warming, *New Polit. Sci.* 31 (4) (2009) 499–514.
- [61] S. Fisher, The emerging geographies of climate justice, *Geogr. J.* 181 (1) (2015) 73–82.
- [62] J. Angel, *Strategies of Energy Democracy*, Retrieved from Report for the Rosa Luxembourg Foundation, Brussels, 2016 <http://www.rosalux.eu/publications/strategies-of-energy-democracy-a-report/>.
- [63] A. Weinrub, A. Giancattarino, *Toward a Climate Justice Energy Platform: Democratizing Our Energy Future*, (2015).
- [64] S.E. Ryan, Rethinking gender and identity in energy studies, *Energy Res. Soc. Sci.* 1 (2014) 96–105.
- [65] R. Listo, Gender myths in energy poverty literature: a critical discourse analysis, *Energy Res. Soc. Sci.* 38 (2018) 9–18.
- [66] R. Kahsar, The psychology of socio-technical systems: professionalism, power, and personality in the electricity sector, *Energy Res. Soc. Sci.* 53 (2019) 121–125.
- [67] A. Neuhauser, *Energy's Latest Target: Women: Colleges Designed to Train Workers for Hydraulic Fracturing and Drill Sites Set Their Sights on Recruiting Women*, 1 December 2014. Retrieved from US News and World Report, 2014, <https://www.usnews.com/news/special-reports/energy-of-tomorrow/articles/2014/12/01/oil-and-gas-industrys-latest-target-women>.
- [68] IRENA, *Renewable Energy: A Gender Perspective*, IRENA, Abu Dhabi, 2019.
- [69] Data USA, *Electricians*, Retrieved from (2018) <https://datausa.io/profile/oc/472111/#demographics>.
- [70] G. Bakke, *The Grid: The Fraying Wires Between Americans and Our Energy Future*, Bloomsbury Publishing, USA, 2016.
- [71] A. Woolley, C. Chabris, A. Pentland, N. Hashmi, T. Malone, Evidence for a collective intelligence factor in the performance of human groups, *Science* 330 (6004) (2010) 686–688.
- [72] G. Pellegrini, S. D'Amato, A. Weisberg, *The Gender Dividend: Making the Business Case for Investing in Women*, From <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Public-Sector/dtl-ps-thegenderdividend-08082013.pdf>.
- [73] L.A. Banaszak, H.J. McCammon, *Women's Activism From Electoral Campaigns to Protest Action: Into the Next 100 Years. 100 Years of the Nineteenth Amendment: An Appraisal of Women's Political Activism*, Oxford University Press, 2018, <https://doi.org/10.1093/oso/9780190265144.001.0001>.
- [74] A. Kronsell, Gender and transition in climate governance, *Environ. Innov. Soc. Transit.* 7 (2013) 1–15.
- [75] R. Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement*, Island Press, 2005.
- [76] C. Merchant, *Earthcare: women and the environment*, *Environ. Sci. Policy Sustain. Dev.* 23 (5) (1981) 6–40.
- [77] D.M. Prindeville, J.G. Bretting, Indigenous women activists and political participation: the case of environmental justice, *Women Polit.* 19 (1) (1998) 39–58.
- [78] C. Mallory, Ecofeminism and forest defense in Cascadia: gender, theory and radical activism, *Capital. Nat. Social.* 17 (1) (2006) 32–49.
- [79] S.A. Mann, *Pioneers of US ecofeminism and environmental justice*, *Fem. Form.* (2011) 1–25.
- [80] L. Pulido, *Community, Place, and Identity. Thresholds in Feminist Geography:*

- Difference, Methodology, Representation, (1997), pp. 11–28.
- [81] D.E. Taylor, The rise of the environmental justice paradigm: injustice framing and the social construction of environmental discourses, *Am. Behav. Sci.* 43 (4) (2000) 508–580.
- [82] J. Felsenthal, These Are the Women Organizing the Women's March on Washington, *Vogue Magazine*, 2017.
- [83] K. Waddell, The Exhausting Work of Tallying America's Largest Protest, 23 January 2017. Retrieved from *The Atlantic*, 2017, <https://www.theatlantic.com/technology/archive/2017/01/womens-march-protest-count/514166/>.
- [84] B. Darrow, More Than 1 in 100 of All Americans Were at Women's March Events, (2017).
- [85] C. Davenport, Major Climate Report Describes a Strong Risk of Crisis as Early as 2040, Retrieved from *The New York Times*, 2018, <https://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html>.
- [86] E. Wang, Climate Scientist Dr. Sarah Myhre on the Peril and Possibilities Ahead: 'We Need Leadership That Is Not Old and White and Male, October 8, 2018. Retrieved from *Jezebel*, 2018, <https://theslot.jezebel.com/climate-scientist-dr-sarah-myhre-on-the-peril-and-poss-1829602131>.
- [87] M. Ganz, *Leading Change: Leadership, Organization, and Social Movements*, (2008).
- [88] M. Aarons-Mele, No Match for Moms [Audio podcast] (Producer). (May 22). Retrieved from, (2018) <https://podcasts.apple.com/us/podcast/hiding-in-the-bathroom/id1102773197?mt=2>.
- [89] GA (Grid Alternatives), Commitment to Equity, Retrieved from (2018) <https://gridalternatives.org/who-we-are/commitment-to-equity>.
- [90] GA (Grid Alternatives), Financials, Retrieved from (2018) <https://gridalternatives.org/annual-report-15/financials>.
- [91] GA (Grid Alternatives), Mission and History, Retrieved from (2018) <https://gridalternatives.org/who-we-are/mission-history>.
- [92] GA (Grid Alternatives), National Board of Directors, Retrieved from (2018) <https://gridalternatives.org/who-we-are/board-of-directors>.
- [93] GA (Grid Alternatives), Policy and Program Development, Retrieved from (2018) <https://gridalternatives.org/what-we-do/policy-and-program-development>.
- [94] GA (Grid Alternatives), Tribal Program, Retrieved from (2018) <https://gridalternatives.org/what-we-do/tribal-program>.
- [95] GA (Grid Alternatives), Women in Solar Program, Retrieved from (2018) <https://gridalternatives.org/what-we-do/workforce-development/women-in-solar>.
- [96] K. Zipp, Solar Power World: Ask a Solar Vet: Somewhere Between Social Work and Engineering, Erica mackie of Grid Alternatives [Audio Podcast] (Producer) May 30. Retrieved from: (2018) <https://www.solarpowerworldonline.com/2018/05/ask-a-solar-vet-somewhere-between-social-work-and-engineering-with-erica-mackie-of-grid-alternatives/>.
- [97] M. Green, Grid Alternatives Combats Poverty by Installing Solar Arrays on Roofs of Low-Income Households, (2013).
- [98] MIT Energy Initiative, C3E Women in Clean Energy Symposium. Entrepreneurship and Innovative Business Models Award—Erica Mackie [YouTube Video], January 6. Retrieved from: (2016) https://www.youtube.com/watch?v= SXiZYWwzSPk&list=PLPhedGFHe8CljXVjAC3KS_k_KzRk2Vs-H&index=6.
- [99] M. Lee, E. Klump, Pipeline Builders, Gas Drillers Fret About Protesters, *Energy and Environment News*, 2018 Retrieved from <https://www.eenews.net/stories/1060075773> 8 March 2018.
- [100] MOF, Join a Local Team, Retrieved from (2018) https://www.mothersoutfront.org/mothers_out_front_teams.
- [101] MOF, Pipelines, Retrieved from (2018) <http://va.mothersoutfront.org/pipelines>.
- [102] MOF, VA - Hampton Roads Team Pipeline Tagging in Norfolk!, Retrieved from (2018) https://www.mothersoutfront.org/va_hampton_roads_team_pipeline_tagging.
- [103] MOF, We're Working to Fix Gas Leaks, Retrieved from (2018) https://ma.mothersoutfront.org/working_to_fix_gas_leaks.
- [104] M. Serreze, Kinder Morgan Pulls the Plug on Northeast Energy Direct-Tennessee Gas Pipeline, Retrieved from *MassLive*, 2018, https://www.masslive.com/news/index.ssf/2016/04/kinder_morgan_pulls_the_plug_o.html.
- [105] M. Douglas, NED Gas Pipeline Killed by Lack of Demand and Customers, and Intense Opposition, Retrieved from *The Berkshire Edge*, 2018, <https://theberkshireedge.com/33377-2/>.
- [106] J. Duda, T. Hannah, M. Burke, *Building Community Capacity for Energy Democracy: A Deck of Strategies*, *Democracy Collaborative*, 2017.
- [107] MOF, Community Choice Aggregation (CCA), Retrieved from (2017) https://ma.mothersoutfront.org/cce_opt_up.
- [108] D. Zeek, Plugging Gas Leaks, Retrieved from *Sierra Club*, 2017, <https://www.sierraclub.org/massachusetts/plugging-gas-leaks>.
- [109] P. Shanley, City Council Passes Gas Leaks Ordinance, Retrieved from *Jamaica Plain Gazette*, 2016, <http://jamaicaplainingazette.com/2016/12/23/city-council-passes-gas-leaks-ordinance/>.
- [110] Women's Environmental Network, Erica Mackie and GRID Alternatives, Retrieved from (2014) <https://www.wencal.org/spotlights/2014/07/erica-mackie/>.
- [111] SASH, Single-Family Affordable Solar Housing (SASH) Program Progress Reports, (2017).
- [112] P.C. Frumhoff, R. Heede, N. Oreskes, The climate responsibilities of industrial carbon producers, *Clim. Change* 132 (2) (2015) 157–171.
- [113] G. Supran, N. Oreskes, Assessing ExxonMobil's climate change communications (1977–2014), *Environ. Res. Lett.* 12 (8) (2017) 084019.
- [116] GA (Grid Alternatives), SASH Progress Reports, Retrieved from (2017) <https://gridalternatives.org/what-we-do/solar-programs/single-family-solar/sash/reports>.
- [118] D.E. Taylor, Gender and racial diversity in environmental organizations: uneven accomplishments and cause for concern, *Environ. Justice* 8 (5) (2015) 165–180.
- [119] K. Wirth, When Moms Get Out Front, Retrieved from *HuffPost*, 2014, https://www.huffingtonpost.com/kelsey-wirth/when-moms-get-out-front_b_5149211.html.
- [120] K. Chrisman, Women Apply Here: The Solar Industry is Trying to Fix Its Gender Issue, *CNBC News*, 2014 Retrieved from: <https://www.cbc.com/2014/12/04/women-apply-here-the-solar-industry-is-trying-to-fix-its-gender-issue.html> (December 4 2014).
- [121] IPCC, Summary for Policymakers, Global warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, *World Meteorological Organization*, Geneva, Switzerland, 2018, p. 32.
- [122] J.C. Stephens, M. Burke, R. Watts, Operationalizing energy democracy: challenges and opp ortunities in Vermont's renewable energy transformation, *Front. Commun.* 3 (2018) 43.