

Feminizing Decentralized Renewable Energy Programs: A Study of a Community Renewable Energy Project from India

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Abstract

The increasing impact of global forces on local communities in the 21st century has necessitated a shift in focus from macro narratives to the micro-politics of planning. One of the critical areas of such micro-politics is energy policy-making in the Global South. It is argued that a bottom-up approach to energy intervention would increase the control and access of the end consumer to the sites of production, shift away from colonial energy production systems, and create more avenues for equitable community development. Within this context, this study critically evaluates a community-based renewable energy project from a feminist perspective. The study is based on data provided by Barefoot College International (BCI), which is one of the leading non-governmental organizations working towards fulfilling SDG goals. The study has used a document analysis approach to produce rich documentation of the community energy program under study. Findings from the study indicate that the current approach to gender inclusion within energy transition lacks a focus on the interlocked subordinations that exist within a community, and the lack of intersectionality in its model design could potentially reinforce the existing inequalities in the form of gendered resource access, livelihoods, and labor work. The study calls for further research on evaluating decentralized renewable energy programs to examine whether the way the energy transition to a low-carbon intensive future will produce equitable outcomes across genders.

Keywords: feminist energy system, gender and development, renewable energy, decentralized renewable energy, feminist political ecology

1. INTRODUCTION

Off-grid renewable energy projects have been implemented in developing countries but with varying degrees of success [1]. Research shows that renewable energy technology by itself does not guarantee development. It needs to be embedded in the social, cultural, economic, and environmental aspects of the site where it is implemented. The design of Renewable Energy Technology (RET) must consider how access to sustainable energy can be made equitable to ensure

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the development of all [1]. This requires a shift from the current masculinist approach to energy technology, which is a top-down, engineering-based solution, towards a feminist approach, which is decentralized, is concerned with the marginalization of women, people of color, and takes the needs, skills, and interests of the beneficiaries into account [2]. One of the leading causes of failure of the current Gender and Development (GAD) framework of development projects (including solar-led development) is the lack of meaningful engagement of women in decision-making, despite their physical presence [3,4]. The unequal participation across gender can be traced back to gendered differentiation in livelihood activities and, even further, to the gendered access to knowledge and resources. Due to gendered division of labor, the work undertaken by women within and outside the household is devalued. In planning and implementing energy programs, there are dominant voices that yield more hold over the distribution of the benefits in the community.¹

There are power structures that legitimize the dominant voices and subdue the weaker voices [6]. The policymakers, program designers, and development practitioners can only hear the dominant voice, which acts like the community's voice, even though some interests could be vested. Hence the development model perpetuates the existing inequality across gender, resulting in the gendering of energy development.

A study on off-grid solar projects in India using randomized field experiments showed that despite positive technological effects and resource access, there was no evidence to establish a causal relationship between access to renewable energy technology and social or economic development [7]. The impact on gender empowerment was even further negligible [7]. Another study by Burling and Preonas [8] for 400,000 villages in India failed to prove a positive impact of rural electrification on socio-economic development. Programs focused solely on electrification and access to energy services for rural areas have yet to cause any sizeable economic gains or other development outcomes [8].² In this article, I conduct a model evaluation of a decentralized energy program in India to determine the social, cultural, and political factors that impact the success or failure of community RET projects (CREP). A typical CREP is based on the Decentralized Renewable Energy (DRE) system, which is an energy system that is located close to the site of final consumption (end-user) [9]. The energy could be produced by solar, wind, geothermal, or combining two or more energy sources. Such a system reduces household consumption of conventional fuels, increases the security of supply due to proximity, reduces transmission and distribution loss, increases ease of access, and lowers economic and environmental costs of supply and consumption. I attempt to understand whether such a renewable energy-led development model leads to equitable gender development or perpetuates existing gender inequalities.

I evaluate the program model of Barefoot College International (BCI) called *Women Prosper*. It combines three objectives: (1) equitable access to energy, (2) empowerment of women, and (3) community development. The organization has been selected due to its background of social enterprise-based approach to active community involvement, training to build confidence among participant stakeholders, and the focus on creating a policy change through interventions.

¹For the purpose of this study, I define community as a group of actors who engage in a social setting to contest and access different resources which shape collective action [5]. The actors' actions give rise to different positions defined by their class-caste-gender identities. This grouping can result from geographical proximity, shared interests in a common goal, or common identity.

²Energy services are those functions performed using energy that are the means for a household to perform basic life activities and/or facilitate the desired state of living.

2. LITERATURE REVIEW

2.1. Gender and Development paradigm

Until the 1950s and 1960s, development organizations viewed the economic role of women in reproductive activities only: homemakers, bearers and rearers of children, and taking care of the household. This perception was reflected in the approach to development programs: family planning and birth control, mother and child health care, nutrition, and household economics were the major themes. It was not until Ester Boserup (1970), through her book *Women's Role in Economic Development*, showed that women do not benefit commensurately given their contribution to economic activities. She was one of the pioneering authors to document that development has degraded women's role relative to men. Her seminal work showed that modernization and mechanization of agriculture had a negative effect on women in the Global South by changing the gender division of labor due to the displacement of women from their traditional areas of work [10]. Her work was instrumental in establishing Women In Development (WID) as an area of study. WID was coined in the early 1970s and became an institutionalized approach to development after the Nairobi Conference on Women and Development in 1985.

Another important event during the 1970s was the oil crisis. In October 1973, the Organization of Arab Petroleum Exporting Countries (OAPEC) instituted an oil embargo in the United States [11]. The embargo ceased oil exports to the U.S. and had ripple effects across the Global North that altered the world price of oil. Development planning needs to pay more attention to sustainable energy planning for the future. This crisis, coupled with growing interest in women's relation with the environment in the countries of the Global South, created the discourse for Women, Environment, and Sustainable Development (WED) [10]. WED discourse started within the academic and grassroots activities in the forestry and agriculture sector. The oil crisis impacted women's labor input more than men's. They had to spend more time obtaining energy sources (firewood, biomass, etc.), water, fodder, and food for the household. WED discourse recognized that women's problems were tied to unjust natural resource management practices. WED stimulated the debate on recognizing women's role as imperative to sustainable development [12].

Even though these developments created a watershed movement in gendering the development discourse, the WID and WED approach had some problematic features. WID approached women's relations with development and their subordination as separate issues. There was a lack of research on the influence of gender relations in determining women's access to economic activities [13]. There was a need to differentiate biological sex and social gender. This led to a different approach during the 1980s when emphasis was given to the importance of power, conflict, and gender relations to understand subordination that reinforced the kind of activities undertaken by men and women [13,14]. Therefore, Gender and Development (GAD) emerged as the transition from WID that integrates women in development and looks for potential in development initiatives to transform the existing unequal gender relations to empower women.

The gender division of labor is a relationship of separation, one that is embedded in the process of resource allocation within the household [15]. This intricate relationship influences development planning and targeted interventions, such as renewable energy. The flaw with the current GAD model, including in RET projects, is the assumption of gender as a monistic concept. This logical simplification has been applied in policy literature as the fundamental reasoning for women-oriented development programs. The binary position of women as either the most vulnerable or the most virtuous in the energy transition and climate change narrative has led to the premature failure of many RET projects [16]. This binary position has influenced the

design and implementation of DRE programs, increasing the burden on women as climate change champions in addition to their household responsibilities. Understanding that gender is a complex structure requires the recognition of the power structures in communities and how that influences intra-household gender roles and relations [17]. The household is not a homogenous single entity, instead is an institution where decisions on the allocation of, access to, and control of resources are made that define gender equity [13]. The decision-making within the household and the resulting domestic role of women is decided for and reinforced by the community's formal/informal power structures [18]. In the context of DRE programs, a lack of understanding of the micro-power structures can result in the programs failing to deliver energy justice and equitable livelihood opportunities.

2.2. Flaw in current energy systems

For the longest time, the dominant narrative among policymakers and development practitioners has been that energy is gender-neutral [19]. This assumption implies that the energy system, access to energy services, and work opportunities are viewed from the lens of equality, not equity. The energy policies that guide the design, planning, production, distribution, and consumption of energy are gender-neutral without considering the disproportionate impacts climate change has on gender [20]. There is substantial academic scholarship on the differential impact of energy on men vs. women in the Global North [19]. There is also a growing body of scholarship on how a gendered approach to energy transition to a renewable energy system is essential not to reinforce the existing inequalities [21].

The gender division of labor, environmental racism, unequal development, exploitation, and devaluation have made women of the Global South, indigenous groups, rural communities, and people of color disproportionately impacted by this gender-neutral energy system [18,20,22]. The vision of centralized power production systems represents the neocolonial, masculinist power system that generates profits for energy corporations through oppression in many forms – by locating energy structures in sites resided by marginalized communities, by selling power at higher tariffs that excludes many households from accessing essential energy services, through the exploitation of territories for resource extraction, etc.

A just energy transition will require the recognition of the injustices faced due to our current energy production and consumption system. In the current format, capital (profit) accumulation is the primary objective, leading to unequal distribution of benefits and costs (hazards and externalities). Greenhouse gas generation and the climate crisis are symptoms of the injustices created due to a sustainable system of oppression and marginalization of people and communities.

2.3. Towards a feminist energy transition

Given the flaw with the dominant development model and the gender-neutral policy guiding the energy transition, we gaze towards a feminist approach to energy systems. The process of an energy transition is more than just an economic and engineering problem. A pure efficiency-based approach will leave out the distribution of costs and benefits resulting from the transition and the inclusion/exclusion of people from decision-making [22]. Moving away from a strict efficiency and technology-based intervention to a virtue-based and equitable intervention will require understanding existing social inequalities and power dynamics tied to unjust energy culture [24]. The feminist approach can inform just energy transition by deepening our understanding of the unsustainable energy culture [24]. Hence, a feminist approach to energy systems will provide the framework for designing a just energy transition.

As Sheena Wilson has said, "energy transition is a feminist issue because decarbonization of energy offers opportunities of developing just ways of living that places the concerns of gender along with the intersection of class, caste, ethnicity at the center of energy transition politics" [2]. Thus, the four dimensions of just energy transition, political, economic, socio-ecological, and technological, must be critically reviewed through a feminist lens [24]. Energy systems are not only a technological intervention in the pathway to just energy transition. Rather it is a feminist system that changes/perpetuates the gender roles in climate change, engenders vulnerability, and requires a democratic, decentralized view of such systems.

A feminist approach to energy transition places a household's care, health, and basic subsistence needs at the center of decision-making when designing energy intervention programs [25]. This approach guides the planning and distribution of energy services (electricity, cooking, indoor heating solutions, etc.) with well-being and equality as prerogatives and not decided by profit or efficiency [24]. There is evidence of the same globally, such as the Feminist Green New Deal in the UK, *Acción Ecológica* in Ecuador, and *Nous Sommes la Solution* (We are the Solution), a network of African ecofeminists [26].

In the Global South, small-scale, off-grid, renewable energy systems have been recognized as the most effective, economically viable, and convenient choice for increasing access to clean, modern energy in remote rural communities in Nepal, Pakistan, Bangladesh, and India [27]. Evidence from community renewable energy programs shows that renewable energy can address gender issues such as – reducing the time cost associated with the collection of biomass; improving the health and safety of women and children in the household by replacing conventional polluting fuels; reducing the unpaid and unrecognized labor work of women in the household that includes agriculture allied activities as well (tending to livestock, fodder collection, fieldwork, etc.) [28]. It opens up opportunities for women's entrepreneurial ventures; increases and diversifies livelihood opportunities from farm to non-farm sector. Developing such small-scale renewable energy technologies is fundamental to gendering sustainable development [28]. There is a strong argument in favor of DRE in South Asia because those systems are aligned with the feminist energy system framework. There is ample evidence to show that centralized energy systems interact with economic and political systems to propagate a top-down energy access structure. Disproportionate control in the hands of a few increases the injustices – lack of access, high cost of use, and disproportionate impacts of climate change across gender [27]. This shows that decentralized, small-scale RE solutions have better chances of producing equitable development outcomes.

This study analyzes the CREP using the Feminist Energy System (FES) framework developed by Bell et al. [24]. The FES framework has four dimensions: political, economic, socio-ecological, and technological (Table 1). While technology and economic dimensions are the primary conditions for cost-benefit analysis (CBA) when designing a policy and the unit pricing for energy load consumed, the other two dimensions speak of the feminist approach by including the understanding of socially constructed roles and responsibilities of each gender. The FES framework has theoretical underpinnings in the Feminist Political Ecology (FPE) discourse. FPE is the antithesis of the fixed singular focus on women and/or gender. It is a constant circulation of theory, practice, policies, and politics based on the synergy of gender, class, race, ethnicity, religion, etc. [29]. This intersectional focus of FPE on society-environmental relations and multi-dimensional gender analysis makes FPE suited for an analytical discussion of the GED framework. The importance of recognizing FPE rests on the fact that FPE shows ways in which social structures and complex gender identities are embedded in the history of the political structure of a particular place and how it has constituted gender roles over time. The main argument in favor of using FPE is that it shows power stems from inequality of gender relations with the economy, energy access, and knowledge and has been constructed historically through social and cultural factors [30]. It

recognizes that gender is a dynamic complex identity, as discussed earlier, and provides pathways to unpack those complexities through an approach that is grounded in community characteristics.

Table 1: *Conceptual framework of a Feminist Energy System (FES) [24]*

Dimension	Description
Political	The democratic decision-making process on choosing the energy system; a decentralized system of transition that creates ease of access to the source of production and more equitable access compared to a centralized grid solution; pluralist; publicly owned (in an ideal scenario, beneficiaries are the complete owners).
Economic	human well-being and biodiversity are prioritized over profit; generation of jobs in the community, stepping away from the growth narrative.
Socio-ecological	Relational; transparent and clear information available; engaged in efforts to mitigate the negative externalities of the energy transition; building a culture of care.
Technological	Distributed technology; community-directed; heterogenous.

Using the conceptual dimensions of FES and a gender-analysis framework, I define the parameters of a successful CREP in the context of decolonized energy policy ³. These parameters are based on two elements. First, any DRE-led intervention requires participation and support from the stakeholders (beneficiaries). Since a DRE is characterized by an energy system that places energy production and end use in close proximity, the consumers should be involved in the decision-making process regarding the choice of the energy transition. Second, a just energy transition should lead to equitable distribution in the gendered distribution of labor and resources compared to before the intervention. This implies that the intervention is designed with inputs regarding the existing gender division of labor within the household and the role of community institutions in determining gender relations [31]. These parameters, described in Table 2 below, form the framework for analysis of the Women Prosper model of BCI for their renewable energy program in India.

3. BAREFOOT COLLEGE INTERNATIONAL

Barefoot College International is a community-based organization that was established in 1972 in Rajasthan, India. The organization's original name was Social Work & Research Center (SWRC). In its current form, BCI was established in 2015 to meet communities' dynamic and growing energy needs and infuse it with technology evolution and enterprise activities [32]. The initiative was created when top-down administration and governance was the dominant model grappling with bottlenecks and delivery of social services [33]. The autocratic structure of the administration implied that social services were the prerogative only of the elite, and rural masses were excluded from access to social services [33]. BCI believes that for any rural development to be successful, it has to be based on the community members who own and manage their development path.

³A decolonial context of energy transition focuses on everyday gender relations and spatial (territorial) segregation of rights that reproduce inequalities which are exacerbated in access to and control of energy system of production and consumption [42,43]

Table 2: *Features of community energy program*

Dimension	Description
Voluntary involvement	The program is designed through community members' involvement in planning, implementing, and managing the system.
Gender participation	Participation is based on equity principles. Women are encouraged to participate and show a willingness to participate. They are involved in program design, choice of energy intervention, and implementation decision-making process. The opportunity cost of unpaid labor work in agriculture and households determines the participation cost.
Equal distribution of benefits and responsibilities	The end users have shared responsibilities proportionate to the extent of participation in program design and decision-making. Benefits are created in terms of jobs, skill training, and entrepreneurship opportunities. These are distributed according to choice and willingness to participate, existing gender bias in livelihoods, and relative economic deprivation in the community.
Organizational support	Professional support is available from energy intermediaries who network with community stakeholders and assess the energy requirement to provide technical solutions. These intermediaries could be non-governmental organizations (NGOs), grassroots organizations, or think tanks that can provide the tools and resources and the required regulatory framework.

Barefoot has taken a bottom-up approach in which the poor are prioritized in decision-making and implementation [34]. It was realized that to negate the socio, political and economic pressures of top-heavy administration, the active involvement of the community is important [34]. During the initial years, the organization realized that structural caste-based barriers hindered the experiments with various activities intended to benefit the poor [34]. Identifying such problems rooted in social and cultural settings showed that a caste-based approach would inhibit achieving the desired objectives. On the other hand, in a poverty-based approach, an individual, regardless of his/her social background, could equally participate and benefit from community development activities, given the extent of deprivation from essential services [35]. This approach was also applied to the design and implementation of RECs – identifying the economic vulnerabilities and social exclusions helps design projects that remain viable and operational when the community assumes ownership and control. BCI has successfully implemented this approach by focusing on eliminating energy poverty for its solar program.

At the core of BCI is a decentralized management approach focusing on capacity building by and through rural women. This approach is widely known now as the 'Barefoot Approach' to community development. BCI has replicated and upscaled its approach to other countries such as Sierra Leone, Liberia, Burkina Faso, Tanzania, and Madagascar.

4. METHODOLOGY

4.1. Data collection

The data for this study has been collected from BCI through consultation with stakeholders involved in implementing their Women Prosper model. Data on the model design, the implementation strategy, and the impact indicators are secondary in nature. The data was obtained in the form of project report documents from BCI that were shared for this study only and is not available in the public domain.

4.2. Data analysis

A document analysis was conducted to identify themes and parameters based on which the model evaluation has been undertaken. Document analysis is a form of qualitative research in which documents are interpreted to give voice and meaning to the assessment topic [36]. This method is a staple for analyzing organizational and institutional documents. It is primarily used in ethnographic case studies to produce detailed descriptions of a single phenomenon [37]. However, it is also applicable when the available information is non-structured yet contains valuable information that requires in-depth analysis.

5. WOMEN PROSPER MODEL

The Women Prosper Model was started in 2019, forming the model's baseline period. Data on beneficiaries and demographic details are available for four years (2019 – 2022). Based on the analysis of the model framework shared by BCI, I have drawn out the goals, methodological approach, and challenges identified by the organization that informs the design and implementation of the model. The end goals of the model were: 1) create a secondary livelihood opportunity for trained beneficiaries; 2) create a credit-based purchase system for customers to enable loan access from financial institutions, and 3) empower the beneficiaries through digital literacy.

According to the model description, a systems theory approach was applied by BCI to model design. It is based on the context that people do not function as isolated units but as members of social groups, which influences their functioning. People play different roles within different systems, and those roles across different systems impact and influence one another. Systems theory considers the interconnectedness of these different systems in planning [38]. BCI identified that the problem is a result of the mental model of the actors that drives their decision-making and resulting interaction with other actors. This leads to a problematic situation. The problem is also dynamic, which implies that the problem's future nature can influence the actors' agency.

The prospective trainees were identified by the BCI Solar team. They are trained in solar technology, digital literacy, and entrepreneurship. BCI leverages its model with local community organizations as implementing partners. Post training, the women solar engineers market and sell solar products for unelectrified households and/or households with more than 50 percent of energy dependence on kerosene and other fossil fuels for lighting and cooking. BCI supports them in setting up their solar micro-enterprises to cater to the demand within the beneficiary community and nearby areas. The trained solar engineers form a network of women entrepreneurs called "Solar Sakhis." They provide the last-mile connectivity of clean solar products and services. Each trained engineer reaches a minimum of 50 households with their solar solutions.

The model identified technology, economic, and institutional barriers as part of their community profiling and beneficiary profiling exercise. The technology barriers were: 1) access to appropriate

skills and technology due to vulnerability from low farm income and excessive dependence on traditional modes of employment, and 2) low access to digital information (internet penetration) across gender. Rural women have low digital literacy compared to rural men ⁴. The financial barriers were: 1) limited access to finance where women did not have access to low-interest finance, and risk-averse attitudes hindered the ability to pursue any form of entrepreneurship, 2) low level of penetration of solar products due to low household income and lack of diversity in products, and lastly the institutional barrier in the form of lack of any ecosystem support to train, support and collaborate with the community.

6. ANALYSIS

BCI has identified the following impact indicators to evaluate the success of the model where it has been implemented so far. These are energy and lighting (number of hours of solar product use), education (hours of study), health (indoor air pollution), livelihood (average income), finance (bank accounts), empowerment of women (feeling of safety, and role in household decision making). Using the parameters of an FES framework and the features of a CREP described earlier, I have evaluated the performance of the Women Prosper model. The objective is to show whether this model can demonstrate a positive relationship between RE intervention and socioeconomic and gender development, and if not, what are the missing elements in program/policy design that should be incorporated.

Politically, the model has been designed based on consultation with community members. As per the model framework document, meetings with community members were undertaken to discuss the current energy system available to the community and the average energy expenditure of a typical household, the order of household needs in meeting their basic needs, and openness to adopting alternative energy with self-governance. Based on consultations with community members, local institutions, and community organizations, the participants democratically chose to participate in the program and were made aware of the cost of purchase of solar products. They were informed of the costs and benefits of participating in the program. The village community selected potential trainees. A committee comprised mainly of elderly women members to monitor and manage the program in their community. The bottom-up approach and voluntary involvement align with the political dimension of a FES-based CREP. The nature of involvement of the community is democratic, and compared to a centralized energy system, there is the ease of access for the consumers to the source of energy production. The consumers own the source of energy production and are, in a sense, stakeholders of the program.

Economically, the trainees, referred to as women engineers and entrepreneurs, can earn income from a skill-based livelihood source through this program. They either work as assemblers or distributors and provide sales services for the solar products sold in the community. The equality of benefits, the priority of well-being over profits, micro-enterprising venture, and capacity-building characteristics align with the economic dimension of an FES-based CREP. The potential trainees are able to diversify into non-agricultural sources of income as well as witness an increase in their income level prior to participation in the program. The beneficiaries are able to reduce their energy expenditure upon shifting to solar energy compared to fossil fuel prior to the program. The benefits have to pay to purchase the product, and the program also provides a credit access facility to link them with financial resources.

⁴Digital literacy: The ability to seek out information, when necessary, with the use of the internet given the following conditions: (1) the ability to detect and address illegal and harmful content on the internet; (2) the ability to communicate appropriately; (3) the ability to protect privacy.

From the technological and organizational support perspective, BCI partners with either a local NGO or any community-based organization (CBO) to create horizontal linkage with the community, provide space for training, and facilitate consultation with the community. The institutional support of BCI is evident from their model description and the role of local partners in effective implementation. The program implements a decentralized technology solution in household solar systems. Each household has its own technology system. Hence the consumer is the decision maker regarding the choice of energy production and amount of energy consumption from each source (renewable and fossil fuels). BCI makes The product available, which provides institutional support for capacity building and technology, and partners with local community-based organizations for effective penetration.

Finally, from a socio-ecological/gendered participation perspective, for a decentralized renewable energy technology to be considered a feminist energy transition, it should recognize the existing uneven power relations and gender division of labor in its program design. A household is not a homogenous unit but rather a heterogenous system defined by unequal power relations and is a system of production of output and reproduction of labor power [17,39]. Energy production and exchange are activities that require labor effort, which is predominantly the responsibility of women of the household [18]. Thus, a feminist energy transition's goal should be a redistribution of labor work equitably within the community.

Gender mainstreaming through an energy intervention is not the same as feminizing the energy transition. Many REPs confuse gender mainstreaming as feminizing energy intervention. While a CREP may fulfill the community participation and distributed/decentralized technology aspects, it could also achieve equality in the distribution of costs of participation and benefits from participation; it will still not be decolonial and lead to equitable distribution of labor if women are considered "agents of change" as in this model, and hence placed at the center of the program design, without prior information on the existing power dynamics, gendered labor work, and cost of transitioning away from existing livelihood sources to a technology-based source of income [17,20,40]. The use of dichotomy in the analysis of gender relations in the community makes the segregation of indicators and analysis easier. This approach excludes the economic labor of women and only considers household/community as a space of energy production and consumption. In this study, the impact indicators fail to capture the change in the division of labor across gender regarding the segregation of activities undertaken and the time cost associated with each activity within a household. My analysis shows that the model does not fulfill the socio-ecological/gendered participation feature as described in the study. Merely including women as skilled beneficiaries and rising income levels (from previous near zero) does not translate to engendering the energy transition. I have identified specific thematic indicators that could be considered when designing the model to align it with a feminist energy transition agenda.

The first is changes in the institutional norms of the community (if any) brought by the energy intervention. Suppose the model does not positively impact existing inequalities and subordination of gender but rather contributes to the responsibilities of women being seen as champions of climate change. In that case, it cannot be considered a just energy transition. Secondly, a change in the ownership of resources across gender will answer whether the intervention has led to an equal distribution of resource access and use. If not, how can it be achieved? Lastly, changes in gender roles within and outside the household will answer whether the intervention has brought any shift in the economic and reproductive labor work division across genders.

Facilitating an energy transition away from fossil fuel (and not as complimentary) is not only a lack of energy service problem. In this study, this CREP can be considered an economic, political, and technologically sustainable outcome. However, the intervention cannot be characterized as a

feminist transition because it does not speak to and inform the uneven power relations and gender segregation in the community. The binary approach to indicator design to measure model impact considers women only as consumers of the intervention and leaves out the importance of their role in shaping and sustaining the intervention. On the one hand, the intervention has raised their income levels, technical skills, and ability to operate enterprises. On the other hand, the existing gender expectations institutionally determined have also helped implement the intervention. Thus, the current input and impact indicators do little to show causation between CREP and socio-economic development except for changes in the source of energy consumption and increase in income for women. It cannot be asserted beyond doubt that the intervention has positively impacted development outcomes without feminizing the CREP.

7. CONCLUSION

Since the development of the GAD scholarship during the 1980s, linkages between gender, the environment, and development have become a major focus of research. The emergence of energy justice scholarship in the early 2000s put the spotlight on gender again. Social issues have also received increasing attention in development policymaking during the same period. However, interventions have yet to be remarkably successful. In some cases, they have been counterproductive, neither improving women's command over resources or redistribution of labor nor assisting in the effectiveness of the project goals.

Even though detailed results are not available regarding the model, there is enough evidence in this study to suggest that energy intervention efforts and the program's success is attained at the expense of women's participation, adding to their existing responsibilities the success of program implementation. There are certain design characteristics such as the exclusive focus on women's current roles (the Women Prosper model heavily emphasizes the deprivation narrative of women), the singular focus on women being agents of change without considering the dynamics of interaction with male members of the household and outside the household (the model concept note does not specify any roles and responsibilities for men to participate in the program), the perception that only women can be efficient managers of each stage of the intervention (a flawed assumption that relates more responsibility in the community with social empowerment), and the absence of any discussion on the heterogeneity among women (marital status, age, caste, and other intersecting identities) that also impacts to what extent women would be willing to participate in the program.

Analysis of the operational parameters in the above section has been constrained by limited data available on the impact evaluation of these organizations. Independent research on program evaluation needs to be included in the public domain. The available data is qualitative in nature, supplemented by descriptive statistics that speak little to the analysis of impacts/outcomes for a given geography of operation. Based on the existing literature review and qualitative analysis of grey literature, this study cannot ascertain the sustainability of the stated impacts over time and space.

While the model has been able to integrate women in the RE intervention, enhance their agency through skill training, and increase their economic capital, there are factors that need to be added that limit the scope of the intervention. In order to answer the question – "what are the factors of a renewable energy intervention that can positively impact socioeconomic development?" the CREP intervention should feminize the energy transition. This implies that the model design (in this case), or program/policy design, should abandon the reductionist approach to defining women's conditions, assumptions based on information provided by dominant voices among the stakeholders. Moving away from the dichotomous understanding of men vs. women and

adopting a feminist understanding implies that impacts are not only an increase/decrease in the numbers of a specific parameter, instead also what caused the increase/decrease and whether those causes are existing conditions or new conditions brought about by the intervention.

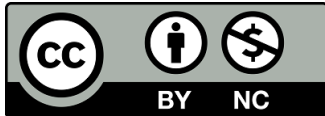
Declaration of interest: None

REFERENCES

- [1] Terrapon-Pfaff J, Gröne MC, Dienst C, Ortiz W. Impact pathways of small-scale energy projects in the global south—Findings from a systematic evaluation. *Renewable and Sustainable Energy Reviews* 2018;95:84-94.
- [2] Wilson S. Energy imaginaries: Feminist and decolonial futures. *Materialism and the Critique of Energy* 2018;31:5-20.
- [3] Bhattarai B. How do gender relations shape a community's ability to adapt to climate change? Insights from Nepal's community forestry. *Climate and Development* 2020;12:876-887.
- [4] Buchy M, Subba S. Why is Community Forestry a Social and Gender-blind Technology? The Case of Nepal. *Gender, Technology and Development* 2003;7:313-332.
- [5] Marquis C, Lounsbury M, Greenwood R. Community as an institutional order and a type of organizing (introduction to volume on communities and organizations). *Research in the Sociology of Organizations* 2011;33:ix-xxvii.
- [6] Mosse D. Authority, gender and knowledge: theoretical reflections on the practice of participatory rural appraisal. *Development and Change*. 1994;25:497-526.
- [7] Aklin M, Bayer P, Harish SP, Urpelainen J. Does basic energy access generate socio-economic benefits? A field experiment with off-grid solar power in India. *Science Advances* 2017;3:e1602153.
- [8] Burlig F, Preonas L. Out of the darkness and into the light? development effects of rural electrification. Energy Institute at Haas WP, 2016.
- [9] UNESCAP, Low carbon green growth roadmap for Asia and the Pacific: turning resource constraints and the climate crisis into economic growth. 2012. <https://hdl.handle.net/20.500.12870/301>.
- [10] Braidotti R, Charkeiwicz E, Hausler S, Wieringa S. *Women, the Environment and Sustainable Development*. Zed Books, London, 1994.
- [11] Corbett M. Oil shock of 1973-74. <https://www.federalreservehistory.org/essays/oil-shock-of-1973-74>.
- [12] Tiondi E. *Women, Environment and Development: Sub Saharan Africa and Latin America*. Graduate Theses and Dissertations, University of South Florida, 2000.
- [13] Miller C, Razavi S. From WID to GAD: Conceptual shifts in the women and development discourse. United Nations Research Institute for Social Development (UNRISD), Geneva, 1995.
- [14] Moore HL. Gender and status: Explaining the position of women. *Feminism and Anthropology*. University of Minnesota Press, 1988, pp. 12-14.
- [15] Kabeer N. Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and Change*. 1999;30:435-464.
- [16] Arora-Jonsson S. Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change* 2011;21:744-751.
- [17] Little J. Gender relations in rural areas: the importance of women's domestic role. *Journal of Rural Studies*. 1987;3:335-342.

- [18] Jackson C. Doing what comes naturally? Women and environment in development. *World Development* 1993;21:1947-1963.
- [19] Clancy J, Roehr U. Gender and energy: is there a Northern perspective?. *Energy for Sustainable Development*. 2003;7:44-49.
- [20] Carr ER, Thompson MC. Gender and climate change adaptation in agrarian settings: Current thinking, new directions, and research frontiers. *Geography Compass* 2014;8:182-197.
- [21] York R, Bell SE. Energy transitions or additions?: Why a transition from fossil fuels requires more than the growth of renewable energy. *Energy Research & Social Science*. 2019;51:40-43.
- [22] Shiva V. Reductionism and regeneration. *Ecofeminism: Critique Influence Change*. Zed Books, New York, 2014.
- [23] Sovacool BK, Dworkin MH. Energy justice: Conceptual insights and practical applications. *Applied Energy* 2015;142:435-444.
- [24] Bell SE, Daggett C, Labuski C. Toward feminist energy systems: Why adding women and solar panels is not enough. *Energy Research & Social Science*. 2020;68:101557.
- [25] Rocheleau DE. Political ecology in the key of policy: From chains of explanation to webs of relation. *Geoforum* 2008;39:716-727.
- [26] Daggett CN, Labuski C, Bell SE. Designing feminist energy systems: climate politics beyond 'job' and 'babies'. 2022.
- [27] Mohideen R. The implications of clean and renewable energy development for gender equality in poor communities in South Asia. 2012 IEEE Conference on Technology and Society in Asia (T&SA), 2012.
- [28] Cecelski E. The Role of Women in Sustainable Energy Development. National Renewable Energy Laboratory (NREL), Colorado, 2000.
- [29] Rocheleau D, Nirmal P. Feminist political ecologies: Grounded, networked and rooted on Earth. *The Oxford Handbook of Transnational Feminist Movements*. Oxford University Press, Oxford, 2015.
- [30] Resurreccion BP. Gender and environment from 'women, environment and development' to feminist political ecology. *Routledge Handbook of Gender and Environment*. Routledge, Milton Park, 2017.
- [31] Ryder SS. Developing an intersectionally-informed, multi-sited, critical policy ethnography to examine power and procedural justice in multiscale energy and climate change decisionmaking processes. *Energy Research & Social Science*. 2018;45:266-275.
- [32] Barefoot College. Operating bodies. Barefoot College, 2016.
- [33] Maiorano D. Indian politics and society in the 1970s. *Autumn of the Matriarch: Indira Gandhi's Final Term in Office* Oxford Academic, Oxford, 2015.
- [34] Kummitha R. Barefoot College: Philosophy and governance. *Social Entrepreneurship and Social Inclusion*. Palgrave Macmillan, London, 2017.
- [35] Roy B, Hartigan J. Empowering the rural poor to develop themselves: The barefoot approach. *Innovations: Technology, Governance, Globalization*. 2008;3:67-93.
- [36] Bowen GA. Document analysis as a qualitative research method. *Qualitative Research Journal*. 2009;9:27-40.
- [37] Angers J, Machtmes K. An ethnographic-case study of beliefs, context factors, and practices of teachers integrating technology. *The Qualitative Report* 2005;10:771-794.
- [38] Friedman BD, Allen KN. Systems theory. *Theory & Practice In Clinical Social Work*. Cognella, San Diego, 2021.
- [39] Clark TN. Community power and decision-making. *Current Sociology* 1972;20:6-53.
- [40] Arora-Jonsson S. Forty years of gender research and environmental policy: Where do we stand? *Women's Studies International Forum* 2014;47:295-308.

- [41] Fell MJ. Energy services: A conceptual review. *Energy Research & Social Science*. 2017;27:129-140.
- [42] Rocheleau D, Slayter BT, Wangari E. *Feminist Political Ecology: Global Issues and Local Experiences*. Routledge, London, 1996.
- [43] Tornel C. Decolonizing energy justice from the ground up: Political ecology, ontology, and energy landscapes. *Progress in Human Geography* 2023;47:43-65.



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