

Women's Empowerment and Energy Access

Insights from India, Nepal, and Pakistan

Muzna Alvi, Farha Sufian, Claudia Ringler, Tushar Singh, Ezaboo Beniwal, and Sehrish Raja

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Gendered inequities in access to and use of energy sources and technologies affect all five impact areas that CGIAR is contributing to: poverty alleviation, food security and nutrition, climate action, environmental health, and inclusion. This policy note identifies indicators that reflect women's and men's agency in the context of energy use and develops a first version of the Women's Empowerment in Energy Index (WEEI) to measure changes in women's agency over time.

Introduction

In most low- and middle-income countries, women in rural areas face significant challenges in accessing reliable and sustainable energy sources and technologies. Due to a lack of modern energy services, women and children often spend many hours collecting and carrying firewood and water over long distances, limiting their time for education, income-generating activities, and community participation. The lack of gender-responsive energy infrastructure can exacerbate existing gender gaps in access to resources and harm women's economic, educational, and social opportunities.

The lack of access to clean sources of energy also has a significant impact on health. Reliance on inefficient and polluting cooking methods, such as open fires and traditional stoves, poses serious health risks to women and their families due to household air pollution. Women, as primary caregivers, are disproportionately affected by these hazards, which can lead to respiratory illnesses and other health complications.

Women's access to modern energy technologies in agriculture is crucial to transforming rural economies. Women play a central role in agricultural activities yet face challenges due to limited access to reliable energy sources and machinery. Modernizing farming practices with energy-efficient technologies can significantly increase agricultural productivity and reduce women's labor burden, particularly for the labor-intensive tasks they are traditionally engaged in. Access to modern sources of energy or energy technologies such as mechanized tools for planting, harvesting, and post-harvest processing as well as irrigation systems can empower women and their households to optimize their agricultural activities. Better energy access and use can not only improve food security but also contribute to economic empowerment, fostering resilient and sustainable development in rural communities.

Empowering women through energy access therefore not only improves their quality of life but also has broader societal benefits: it enables women to participate in income-generating activities, promotes economic independence, and contributes to poverty reduction. However, we currently lack validated measures of women's empowerment through energy access. We attempt to fill this gap by developing metrics for measuring women's agency through energy access for both domestic and productive purposes. We test the metrics with data from India, Nepal, and Pakistan and check how measures of women's empowerment in energy are associated with individual outcomes for women and their overall household wellbeing.

Data

The data used in this study come from primary farm and household surveys conducted between December 2022 to February 2023 in India, Nepal, and Pakistan, as part of the CGIAR Initiative on NEXUS Gains. In India, surveys were conducted in Bihar, a large agrarian state in the central-eastern region of the country and Jharkhand, a state in eastern India. A total of 2,198 farming households were randomly selected for the study. In Nepal, the survey covered two provinces – Madhesh and Karnali – and six districts, with an equal representation from the plains (Terai) and mid-hills region, covering 998 households. In Pakistan, the survey covered 1,018 farming households in Rahim Yar Khan district of Punjab province. The survey sample was designed to ensure equal representation from four tehsils (sub-districts) of Rahim Yar Khan: Khanpur, Liaquatpur, Rahim Yar Khan, and Sadiqabad. The intra-household survey covered demographics, socioeconomic status, agricultural practices, and food consumption patterns. Both men and women answered modules on the Women's Empowerment in Agriculture in Index (A-WEAI), and additional questions on access to and decision-making over mechanized assets and energy sources for domestic and productive use. In Pakistan, only women were administered the questions on energy use, access, and decision-making.

We find significant differences in access to and use of mechanized assets and energy sources, both within and across countries. For example, in Nepal, less than half of the households in our sample reported access to irrigation. However, this masks important intra-country differences: only 8 percent of households in the mid-hills had access to irrigation, while in the Terai region the figure was 86 percent. The distribution of traditional sources of energy use for cooking was similar: 60 percent of households in the mid-hills and 36 percent of households in the Terai region used dirty cooking fuels. In India and Pakistan, access to irrigation is more equally distributed across survey sites, although there are differences within the sample in the types of energy sources used for irrigation (for example, diesel, electricity, and solar energy). In Pakistan, despite the high use of mechanical equipment in agriculture, households mostly use traditional polluting energy sources for cooking (which is the primary responsibility of women). In India, 30 percent of households rely exclusively on traditional, polluting energy sources for cooking, while the majority of households (63 percent) use a mix of traditional sources, liquefied petroleum gas, and electricity.

Measurements of empowerment through energy

To examine gendered differences in access to and decisions on energy sources, we identify indicators that reflect women's and men's agency in the context of energy use. Each indicator is formulated using survey responses to several questions on individual access to energy-dependent technologies and on individual involvement in household decisions on energy sources for both productive and domestic purposes. We identify eight indicators that capture different aspects of access to energy sources, participation in decisions on the use of energy sources and energy-dependent technologies, as well as their procurement (Table 1), and define adequacy based on the level of participation in decisions in these domains.

Table 1. Indicators on energy decision-making and definitions of adequacy

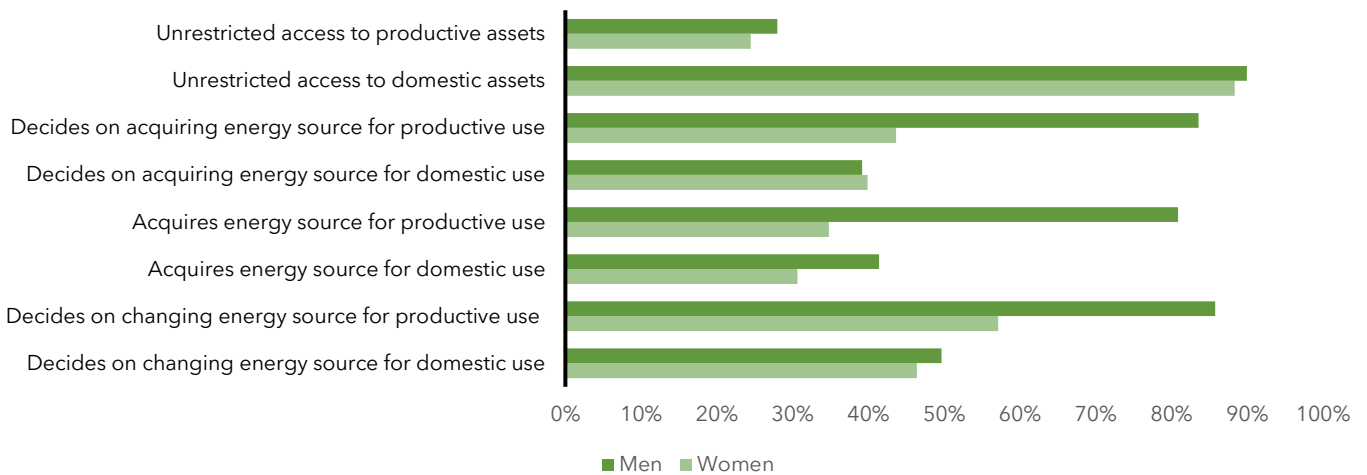
	Indicator	Adequacy definition
1	Has unrestricted access to mechanized productive assets	Adequate if respondent has unrestricted access to at least one mechanized asset that the household has access to for income generation (tractor, pump, sewing machine, etc.)
2	Has unrestricted access to consumer durables for domestic use	Adequate if respondent has unrestricted access to at least one mechanized consumer durable the household has access to for domestic use (television, fridge, cookstove, etc.)
3	Decides on acquiring energy source for domestic use	Adequate if solely or jointly decides which energy source to acquire for cooking, heating, and lighting
4	Decides on acquiring energy source for productive use	Adequate if solely or jointly decides which energy source to acquire for all agricultural and other income-generating activities applicable to the household
5	Acquires energy source for domestic use	Adequate if solely or jointly responsible for acquiring energy source for cooking, heating, and lighting
6	Acquires energy source for productive use	Adequate if solely or jointly responsible for acquiring energy source for all agricultural and other income-generating activities applicable to the household
7	Decides on changing energy source for domestic use	Adequate if solely decides OR can participate to a medium or high/er extent in decisions about changing from unclean to clean energy sources for domestic use (for all sources needed for cooking, heating, and lighting)
8	Decides on changing energy source for productive use	Adequate if solely decides OR can participate to a medium or high/er extent in decisions about changing from unclean to clean energy sources for productive use (sources for use in all agricultural, post-harvest and non-farm business activities applicable to the household)

Source: Authors.

Figure 1a and 1b present the share of women and men respondents who are adequate in the selected eight indicators of energy empowerment in India and Nepal, respectively. We find statistically significant gender differences across several indicators, with the greatest differences in productive use. In India, more than 80 percent of rural men reported having at least some input in decisions on acquiring an energy source for productive use, whereas nearly half of the women respondents reported having little to no input. Similarly, only 35 percent of the surveyed women said they would purchase an energy source alone or jointly for productive use, compared to 81 percent of the surveyed men. This inequality is likely due to the limited mobility of women in rural India, which limits their ability to actively meet energy needs for productive use. The differences are less pronounced for indicators of energy empowerment for domestic use, which include energy sources for cooking, heating, and lighting.

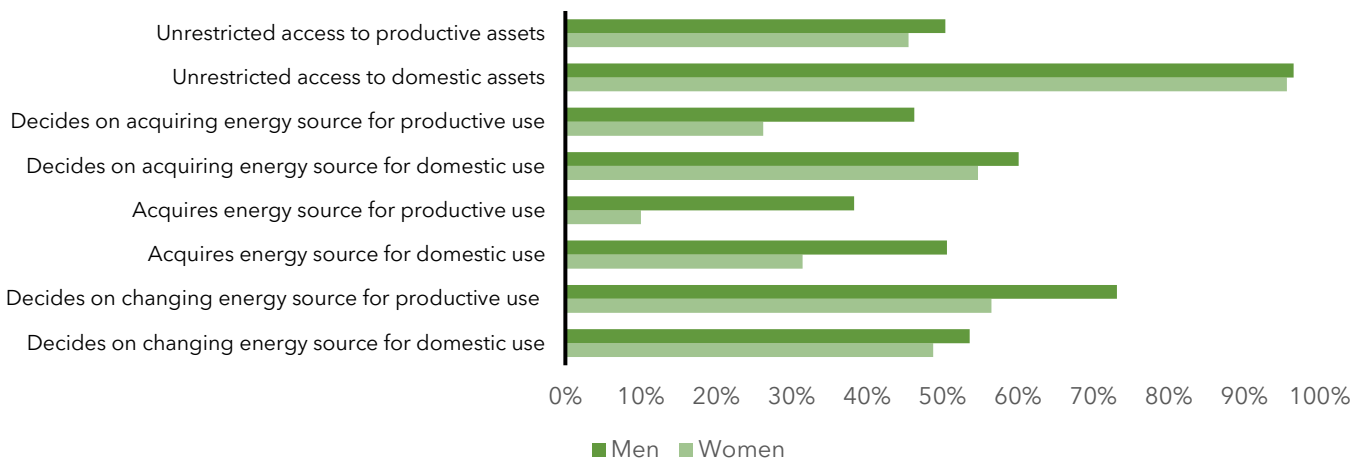
The results from Nepal (Figure 1b) show similar differences, with men reporting higher adequacy across all indicators compared to women in the sample. When deciding which energy source to use for productive use, 46 percent of men are adequate, compared to only 26 percent of women. Furthermore, women in Nepal report significantly lower odds of acquiring both productive (10 percent) and domestic (31 percent) energy sources than men.

FIGURE 1a. Share of respondents adequate in energy empowerment indicators in rural India



Source: IFPRI India NEXUS Gains survey.

FIGURE 1b. Share of respondents adequate in energy empowerment indicators in rural Nepal

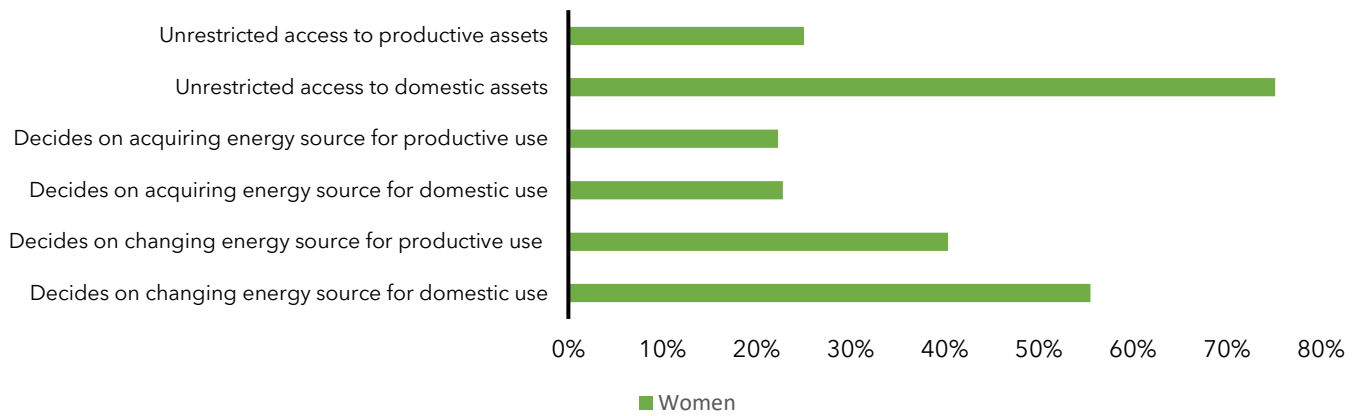


Source: IFPRI Nepal NEXUS Gains survey.

In Pakistan (Figure 1c), where data are only available for women, 75 percent of women surveyed reported having unrestricted access to energy technologies for domestic use, while only 25 percent reported having full access to energy-dependent assets for productive use. Additionally, more than three-quarters of the women reported that they had little or no input into decisions regarding the purchase of energy sources for both productive and domestic uses.

We used six of the eight indicators (that were common across the three countries and were not highly correlated with other indicators) to construct the Women’s Empowerment in Energy Index (WEEI), which is a composite score calculated by equal weighting. The WEEI serves to better understand the intra-household dynamics of energy empowerment in dual-adult households and to monitor changes in empowerment through energy over time. Its score ranges from 0 to 1, with higher values signifying higher agency in energy use.

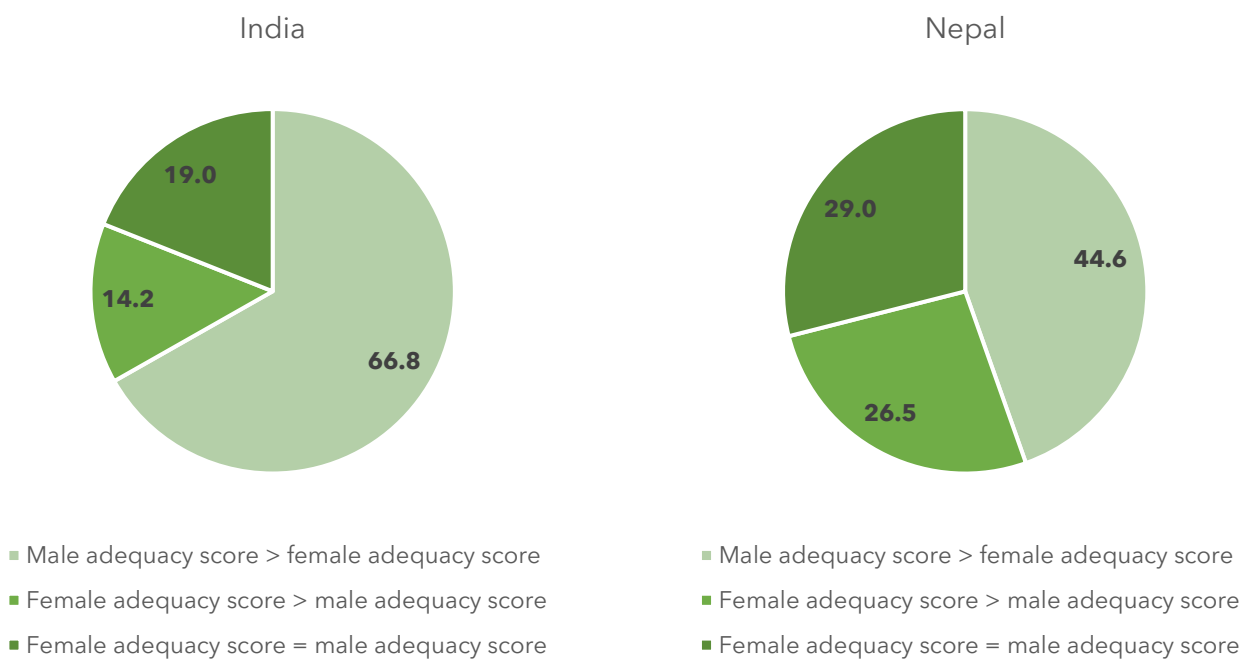
FIGURE 1c. Share of women respondents adequate in energy empowerment indicators in rural Pakistan



Source: IFPRI Pakistan NEXUS Gains survey.

Figure 2 compares the energy agency of men and women in rural India and Nepal. In India, 67 percent of households had men with higher WEEI scores than women, and in Nepal, 45 percent of households had men with higher WEEI scores. As such, a high share of households in Nepal includes women with equal or higher adequacy compared to men.

FIGURE 2. Intra-household WEEI scores in dual-adult households in India and Nepal



Source: IFPRI South Asia NEXUS Gains survey.

Women’s agency over energy and household-level outcomes

Although women are disproportionately responsible for energy-dependent household tasks, men typically make decisions related to fuel choices, domestic energy appliances and infrastructure (including the type of cookstoves and ventilation systems), and lighting preferences. However, there is very little empirical evidence on whether women’s implementation of their preferred energy portfolios leads to positive outcomes. We tested these relationships by regressing selected outcomes of interest on the WEEI. The results of the regressions are presented in Table 2.

In our sample for India and Nepal, we find that women with higher empowerment scores are more likely to participate in the labor market, based on their self-reported labor participation. However, this relationship is not significant for the women surveyed in Pakistan. This can possibly be explained by the overall very low labor force participation in the Pakistan data (5 percent). Furthermore, in Nepal and Pakistan, we find positive and significant associations between women's WEEI score and the likelihood of households using cleaner energy sources for cooking. Such findings reflect the need to empower women in energy decision-making, thereby creating potential for the transition to cleaner energy sources for domestic use.

There is literature on how access to energy reduces women's drudgery. However, we do not find a clear connection between women's agency in energy use and drudgery. Evidence from India and Pakistan suggests that women with higher agency in energy spend more hours on productive work, whereas women in Nepal with higher energy empowerment scores are more likely to work fewer hours. Higher empowerment is also associated with better diets, as demonstrated by the increased likelihood of women meeting the minimum dietary diversity in Pakistan. Finally, we find that household-level food insecurity in Nepal is lower in households where women have higher WEEI scores.

Conclusion

The aim of our study is to develop metrics to measure women's access to and control over energy resources, and decision-making in rural contexts. These include productive uses - including non-agricultural uses - and domestic uses, including recreational uses. Our findings highlight the diverse, context-specific and complex ways in which energy access is associated with women's wellbeing outcomes in South Asia. While the index is a first step toward developing a comprehensive metric that can be used in conjunction with other metrics to measure rural women's empowerment in energy, additional components that address other aspects of empowerment through energy access need to be tested and validated. These include time spent collecting and procuring energy sources, health impacts associated with the use of dirty fuels, and information and awareness about more efficient energy sources and energy-dependent technologies.

Efforts to address the intersection of gender and energy access in rural areas have gained momentum in recent years. Several initiatives have been created with the aim of providing clean and affordable energy solutions, such as solar power and clean cookstoves. These also aim to reduce the time women spend collecting fuel, improve agricultural productivity, and their overall wellbeing. However, these impacts still need to be systematically measured. When rural energy solutions include and empower women, transformative change that improves a series of developmental outcomes - including food security and nutrition, climate resilience, and equity - is feasible.

Table 2. WEEI and individual outcomes: Regression results by country

	INDIA				NEPAL					PAKISTAN				
Variables	Workload	LFPR	Clean energy use	MDDW	Workload	FIES	LFPR	Clean energy use	MDDW	Workload	FIES	LFPR	Clean energy use	MDDW
WEEI score	1.101***	0.367***	-0.212***	-0.019	-0.577*	-1.032***	0.0632**	0.213***	-0.06	2.098***	0.675	-0.007	0.157***	0.440***
	(0.30)	(0.05)	(0.04)	(0.05)	(0.34)	(0.19)	(0.03)	(0.06)	(0.07)	(0.77)	(0.49)	(0.03)	(0.05)	(0.07)
Observations	1795	1390	1792	1795	998	998	998	998	998	721	945	870	844	945
R-squared	0.11	0.10	0.09	0.03	0.07	0.09	0.07	0.27	0.05	0.04	0.05	0.01	0.07	0.13
Mean value	8.73	0.33	0.62	0.36	10.60	0.69	0.96	0.49	0.51	9.44	2.56	0.05	0.15	0.33

Source: Calculated by authors based on the IFPRI India, Nepal, and Pakistan NEXUS Gains surveys.

Notes: Workload measured in hours; LFPR (self-reported labor force participation) =1 if a woman is employed or seeking work; clean energy use =1 if household uses clean energy for cooking (partially or fully); MDDW (minimum dietary diversity for women) =1 if a woman consumed more than 5 out of 10 defined food groups in the previous 24 hours, FIES (food insecurity experience scale) is the raw score from the standard FIES survey module and ranges from 0 to 8. All regressions control for individual and household characteristics including women's age, literacy, marital status, household size, wealth index, and female-headed household status. ***Significant at the level 0.01; **Significant at the level 0.05; *Significant at the level 0.1.

**Muzna Alvi, Research Fellow, Natural Resources and Resilience (NRR) Unit,
International Food Policy Research Institute (IFPRI), India, m.alvi@cgiar.org**

Farha Sufian, Gender Consultant, farha.deba.sufian@gmail.com

**Claudia Ringler, Director, NRR Unit, IFPRI Washington, DC, and co-lead, CGIAR
Initiative on NEXUS Gains, c.ringler@cgiar.org**

Tushar Singh, Senior Research Analyst, NRR Unit, IFPRI India, tushar.singh@cgiar.org

**Ezaboo Beniwal, Research Analyst, Development Strategy and Governance (DSG)
Unit, IFPRI India, e.beniwal@cgiar.org**

Sehrish Raja, Research Analyst, DSG Unit, IFPRI Pakistan, r.sehrish@cgiar.org

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