

Women, energy, and economic empowerment

Applying a gender lens to amplify the impact of energy access

Deloitte
University
Press



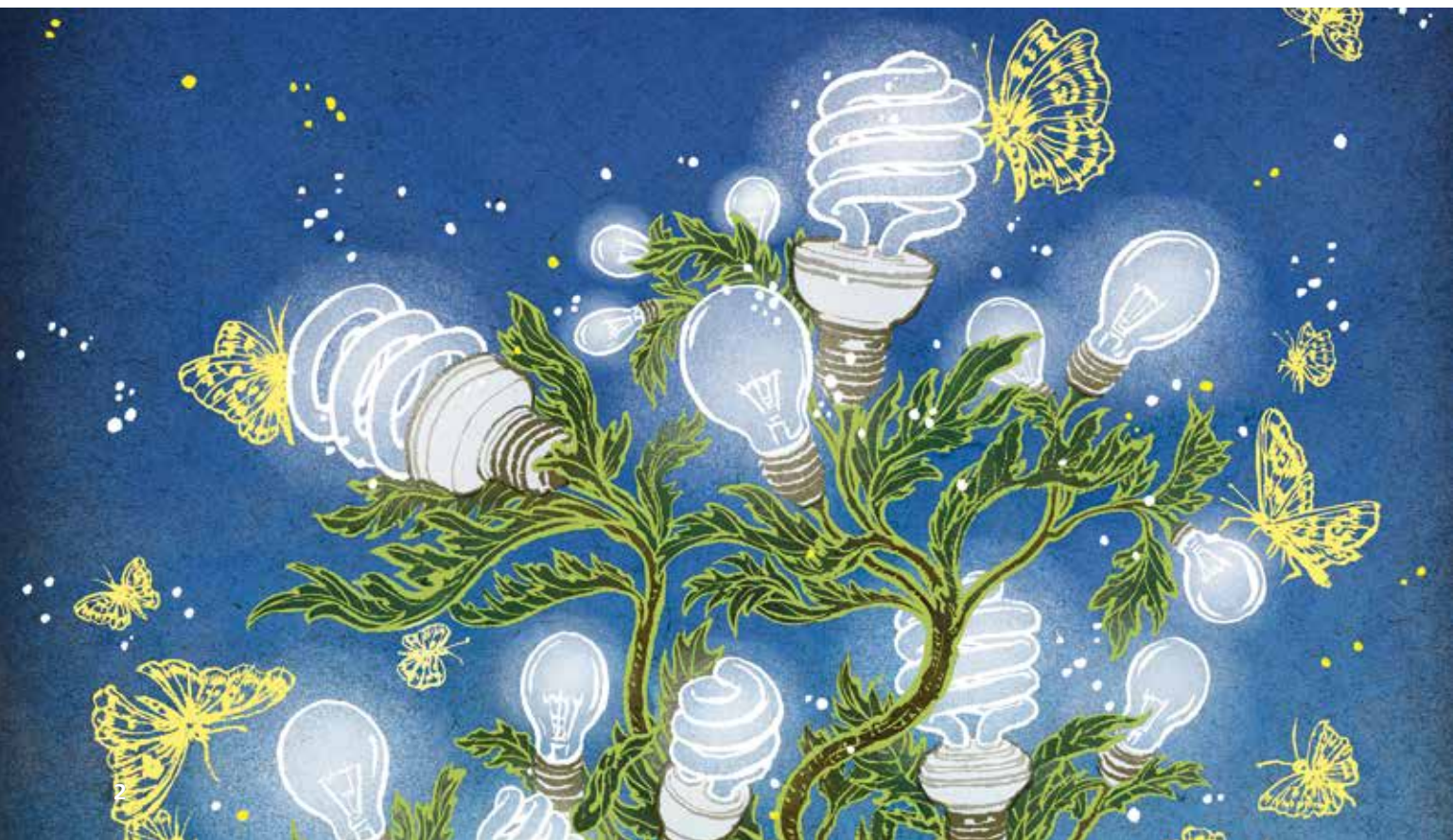
Contents

| | | |
|---|--|----|
| Executive summary | | 2 |
| The untapped link between gender and energy | | 3 |
| To have and to have not | | 5 |
| Energy as a catalyst for women's economic empowerment | | 8 |
| Energy programs with a gender lens | | 11 |
| Conclusion | | 15 |
| Appendix | | 16 |
| Endnotes | | 18 |

Executive summary

THERE are two well-accepted narratives related to economic growth. First, vast gender inequalities remain throughout the world and are closely linked to poverty and instability. Second, access to modern energy enables economic advancement. Until now, however, exploration into the relationship between these two narratives has been limited. What is missing, it seems, is the linkage between energy access and women's economic empowerment. Under what context does gender equality rise with access to electricity; what

are the channels through which this change occurs; and how significant are the economic benefits to women? Can donor institutions and governments reap more meaningful results by targeting energy development programs that enhance benefits for women, and if so, how? In this report, we explore these questions. We believe that while there are many areas critically important for women's development, energy access programs are an underexplored lever for women's economic empowerment.



The untapped link between gender and energy

GENDER has been examined many ways in international development programs, from maternal health to gender-based violence to the education of girls. Where these basic needs have been met, development programming has pivoted to focus on skills development, access to finance and credit, support for female entrepreneurs, and other efforts aimed at increasing economic engagement. Other programs tackle systemic gender issues such as land rights and property laws, political participation, and equal access laws. Noticeably less prevalent in this discussion, however, is the topic of access to energy and its impact on women and girls.

In parallel, reliable, affordable energy is increasingly recognized by the international development community as an enabler of economic growth. The United Nations launched its Sustainable Energy for All (SE4A) initiative

and declared 2014–2024 the Sustainable Energy for All Decade. Likewise, in 2013, President Barack Obama launched Power Africa, an initiative to double the number of people with access to power in sub-Saharan Africa, where two-thirds of the population is currently without access.¹ Similarly, in Asia, the Asian Development Bank launched the Energy for All Partnership, which aims to provide access to safe, affordable modern energy for an additional 100 million people in the region by 2015.²

There are two well-accepted narratives related to economic growth. First, vast gender inequalities remain throughout the world and are closely linked to poverty and instability. Second, access to modern energy enables economic advancement. Until now, however, exploration into the relationship between these two narratives has been



“Energy is very important in women’s daily lives, especially for serving food for families, lighting for teaching their children at night, and energy for their small food industries. . . . Cooking and small business are the major challenges facing women around access to energy. . . . For the women in my country, a change that would allow them to be financially independent would have the most impact in their lives.”³

Dr. Nurzainah Ginting, Indonesia

limited. What is missing, it seems, is the linkage between energy access and women's economic empowerment.

This raises several questions. Under what context does gender equality rise with access to electricity; what are the channels through which this change occurs; and how significant are the economic benefits to women? Can donor institutions and governments reap more meaningful results by targeting energy development programs that enhance benefits for women, and if so, how?

We believe that while there are many areas critically important for women's development, energy access programs are an underexplored lever for women's economic empowerment. The purpose of this report is to reach a common understanding of this linkage and to establish a framework that takes this into account.

With such a framework, the millions of dollars flowing to energy access initiatives around the globe can have a greater impact on the women and communities they are intended to serve.

To investigate this gender-energy nexus, we analyzed a combination of quantitative and qualitative data. Our quantitative analysis uses both global indicator databases and national census data to understand the complex relationship between electrification and economic opportunity. This data is supplemented by a series of interviews with women in the developing world that examines the impact of energy on their personal lives and the lives of women in their countries. We conclude by offering ideas to accelerate benefits to developing nations through a "gender lens" approach to energy access programs.



To have and to have not

ON a macro level, we know that energy increases productivity and enables new industries to thrive, ultimately contributing to improved social and economic outcomes for individuals.⁴ According to the International Energy Agency (IEA), modern energy access at the household level is “a household having reliable and affordable access to clean cooking facilities, a first connection to electricity, and then an increasing level of electricity consumption over time to reach the regional average.”⁵ As this definition conveys, energy in rural developing country settings is often a continuum, potentially first being provided by small household items like a solar lantern, kerosene lamp, or improved cookstove, then possibly a small solar home system or diesel generator, and eventually provisioned through community-based minigrid options or possibly even connection to the national grid. Along this continuum, it is the outputs made accessible to end users by the provision of this energy—lighting, cooking, mobile phone charging, refrigeration, etc.—that are of interest to our investigation rather than the electricity inputs themselves.

In exploring whether power translates to empowerment, we define modern energy access as reliable and affordable. We must also define meaningful economic empowerment. Often, participation in the labor force has been a proxy for economic empowerment. But in this case, we would then have to accept a wide range of outcomes as “success”—including extremely low-wage labor, poor working conditions, and participation in the informal economy. Instead, we use a much richer definition provided by the International Center for Research on Women: Economic empowerment is when a woman



“The solar home systems allow [women] to have more income. . . . My opinion is that they tend to have more confidence if they can earn more income—sometimes equal to their husbands— and with that comes power.”⁶

Salinee Tavaranan, Thailand

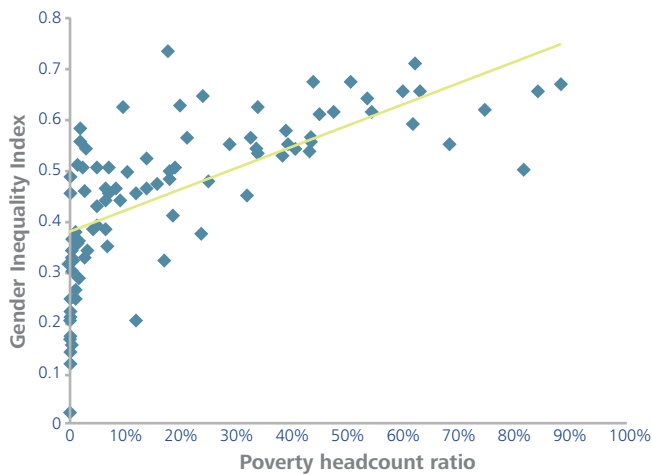
“has both the ability to succeed and advance economically and the power to make and act on economic decisions.”⁷ In this way, instead of just looking at female employment, we look at additional dimensions of employment that signify value and advancement, such as earned income, hours worked, class of work, job security, working conditions, and opportunity for advancement.⁸ We also look at the factors leading to empowerment around economic decision-making—namely skills

and education—and at the overall relationship between poverty, gender inequality, and energy access.

Women, energy, and poverty: Global trends

Global data suggests that gender inequality (as measured by the Gender Inequality Index⁹) is strongly correlated with national poverty levels, as measured by the proportion of the population living under \$1.25 a day (shown in figure 1).¹⁰

Figure 1. Poverty and gender inequality



Sources: Data on the Gender Inequality Index from <http://hdr.undp.org/en/content/gender-inequality-index-gii> and data on poverty headcount ratio from <http://data.worldbank.org/indicator/SI.POV.DDAY>. The most recent year available was used.

Graphic: Deloitte University Press | DUPress.com

Whether through causation or correlation, gender inequality and poverty are closely intertwined; tackling the former means mitigating the latter. Energy access programs that are coupled with meaningful income-generating activities can play a critical role on both fronts. Analysis of country-level data shows that the greater the proportion of a country’s population that has access to electricity, the greater its gender equality—regardless of the proportion of its population living under \$1.25 a day.¹¹

In looking at energy usage, men and women have different energy needs, and both

benefit differently from increased access to electricity.¹² For example, improved access to time-saving electric appliances has been significantly more transformative for women than men due to women’s role relative to household chores. We see this in studies examining the impact of household appliances on US women during the last century. Coen-Pirani et al. found that “diffusion of household appliances contributed to the increase in married women’s labor force participation rates during the 1960s.”¹³

Yet we also know that, while freeing up extra time for women is necessary to advance economic empowerment, it is not sufficient. Lewis shows that from 1930 to 1960 in the United States, “household electrification had no immediate impact on female employment, but is associated with increased school attendance, particularly among teenage daughters, and ultimately led to improvements in the labor market outcomes of subsequent cohorts of women.”¹⁴ This study highlights two important points: 1) critical indirect benefits from energy access can be delayed—and even cross-generational—in terms of economic outcomes for women; and 2) improved energy access should be part of a broader strategy that enables women to spend their extra time on economically empowering activities.

Electricity and income generation: Evidence from Brazil

To dig deeper into these complex relationships, we look at a sample of nearly 2 million women and men in rural Brazil—a country that saw a 2.8 percent annual growth in energy access between 1990 and 2010 and is one of the top 20 “fast-moving” countries in terms of electrification.¹⁵ In our analysis, we look at two measures of economic activity: employment and income.

First, we ask: What individual characteristics make a woman in rural Brazil more likely to be employed? Our analysis shows that rural women and men with access to energy are 10.2

percent more likely to be employed than their counterparts without access, after controlling for other important variables such as marital status, ownership of dwelling, household size, education level, and state of residence.¹⁶ We also see that electric appliances are key. Women with a washer, for example, are 6.4 percent more likely to be employed than women without; for men, the effect is negligible.¹⁷ These results are consistent with previous findings that household appliances positively impact female labor force participation rates.

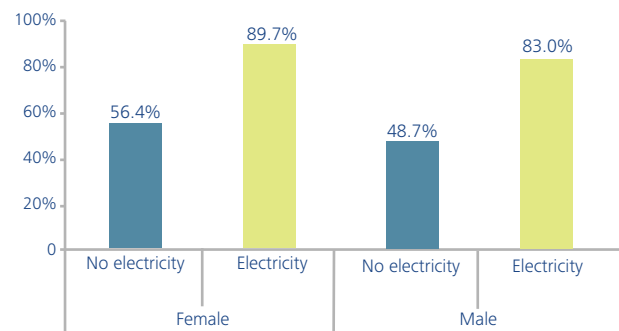
We also note that of the factors included in the analysis, education was the strongest predictor of women’s employment. This is important because initial access to electricity is most often used for lighting, which in turn increases productive time for work and study,¹⁸ contributing to improved education outcomes¹⁹ and thus to women’s prospects for employment and advancement.

Evidence from Brazil is consistent and compelling: Girls in rural areas with access to electricity are 59 percent more likely to complete primary education by the time they are 18 years old than those without (see figure 2).²⁰

Next, we ask: How strongly is access to energy correlated with higher income for women? An initial look at the data reveals a striking gap in income for women with and without energy access. For example, the income of self-employed rural women with access to energy is over twice that of their counterparts without access to energy. For rural female wage/salary workers, access to energy is correlated with 59 percent higher wages. Similar trends hold for men. These gaps are even more pronounced in urban settings—148 percent to 322 percent higher incomes for those with electricity—as shown in figure 3.²¹

To determine that these differences in income levels are correlated with access to electricity, rather than with characteristics like level of education, industry, or occupation, we use a basic regression model. Again, we see that access to energy and a household

Figure 2. 18-year olds in rural Brazil with at least primary education

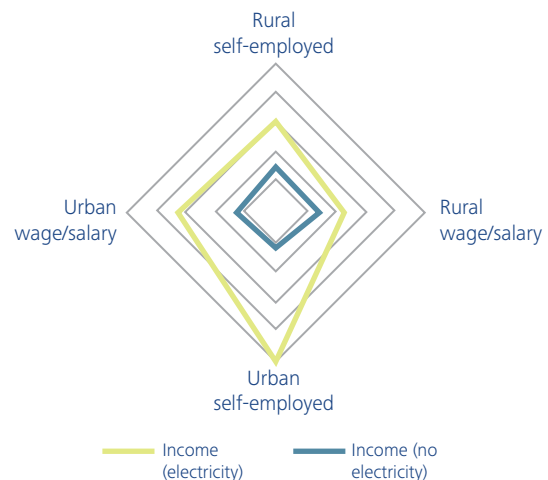


Source: Census data from Brazil was obtained through the Minnesota Population Center’s Integrated Public Use Microdata Series, International: Version 6.3. Data was originally produced by Brazil’s Institute of Geography and Statistics.

Graphic: Deloitte University Press | DUPress.com

appliance like a washer are positive predictors of income. Given the average rural incomes for men and women (\$571 and \$365, respectively), we see that having access to energy is correlated with a 10 percent higher income and having a washer with a 33 percent higher income—for both women and men.²² Importantly, the correlation of washer ownership with employment only exists for women.

Figure 3. Energy access and income for women in Brazil



Source: Census data from Brazil was obtained through the Minnesota Population Center’s Integrated Public Use Microdata Series, International: Version 6.3. Data was originally produced by Brazil’s Institute of Geography and Statistics.

Graphic: Deloitte University Press | DUPress.com

Energy as a catalyst for women's economic empowerment

OUR analysis draws a clear line from modern energy access to women's economic participation. What are those factors, then, that translate energy into a reliable mechanism for women's economic empowerment at the community level? From our experience implementing energy programs in developing countries and interviewing women on the ground, there can be many ways that energy access accelerates opportunities for women by moving them into more productive activities.

Reduced time burdens leading to higher-earning jobs and increased entrepreneurial opportunities

Women are often disproportionately responsible for household duties. This is particularly acute in rural settings, where women spend considerable time on tasks such as

collecting firewood for basic cooking, heating, and lighting needs. Access to energy allows for more efficient products—from those as basic as a solar lantern to those as advanced as a washing machine. These products can reduce the time burdens of domestic responsibilities and create time for more productive, formal engagement in the local economy outside the home. Empirical studies that have examined the impact of electrification on female labor rates in developing country settings reinforce this hypothesis.

A study executed by Taryn Dinkelman in South Africa during the mass rollout of electrification found that rural electrification raised female employment in electrified communities by 9.5 percent, likely because it released women from home production and enabled microenterprises, while having an indeterminate impact on male labor rates in the same communities.²⁴ Another study by Grogan and Sadanand in Nicaragua illustrates that access



“Ninety percent of the women in my country have the responsibility of housewife. To run a house requires resources, and energy is one of the most important requirements for that. Keeping the house warm, cooking, washing, and cleaning all require reliable sources of energy.”²³

Roqia Motammhid, Afghanistan

to reliable electricity increases the propensity of rural women to work outside the home by approximately 23 percent due to more efficient home production in the form of lighting and modern cooking appliances, while it has no impact on male employment.²⁵



“From one side, there’s always the potential for new businesses and new jobs for women, whether it’s in particular in the energy sector or even in the supporting businesses around it.”²⁶

Ruba A. Al-Zu’bi, Jordan

Microenterprises are recognized as key contributors to rural job creation and poverty alleviation, and electricity is often a necessary and important input.²⁷ Women are able to dedicate time to wealth-enhancing activities—whether it be starting a small franchise, selling crafts, or working in the local store—and have reliable electricity for productivity-enhancing machinery. Microenterprises in particular

require electricity to draw in customers, extend operating hours, improve working conditions, automate production, preserve products, and communicate beyond the local market.²⁸

Improved baseline conditions leading to greater access to economic opportunities

There are a multitude of studies that demonstrate that improved access to electricity improves baseline living conditions for women. These studies show improvements to women’s health through cleaner indoor air; better nutrition and food safety due to improved refrigeration; and improved health knowledge through better access to mass media and more time to read.²⁹ Interior and exterior lighting in rural settings often means improved security for women, enabling greater mobility to engage in productive activities under safe conditions. Anecdotal evidence also shows improved education for girls as a result of access to electricity, although most empirical studies do not show gender-differentiated impacts.³⁰ Improving these baseline conditions facilitates the ease by which women can participate in the local economy: Healthy, safe, and informed individuals are more apt to be productive.

A niche role: Employing and utilizing women in the electricity value chain itself

There are opportunities to directly employ women in the electricity sector along the entire value chain, from installation and maintenance to distribution to billings and collections. Each aspect of the sector has a particular value proposition for women’s involvement. For example, collection rates on electricity bills, in both urban and rural settings, are extremely low across developing countries. The fields of microfinance and gender lens investing suggest that women are generally better credit risks for



“The single biggest challenge is security; the absence of affordable electricity opened the way for the ex-combatants to turn into armed robbers, unleashing mayhem on residents of areas not provided with electricity. Personally, my mother almost died because of the lack of affordable electricity.”³¹

Tenezee Miatta Emeka, Liberia

lending institutions and have better repayment rates than men.³² This makes them uniquely suited to be part of the collection system.

Recent evidence from a pilot program in Ghazni, Afghanistan, shows that the local water utility was able to increase collections by 75 percent in the first month of a program that employed a brother and sister team to read utility meters. Among other factors, the woman was able to access meters at times when only women were home, which was

culturally impermissible when the utility readers were men only.³³

As such, women’s particular roles in their families and communities, as well as their credit risk profile, make them potentially more effective than men for specific roles within the sector. In turn, this helps women to benefit from new employment opportunities and higher incomes, as well as creating positive implications for the community at large.



“In my community, consumed electricity is metered according to the communal meter. . . . If even one household fails to pay the electricity bill, the whole community is disconnected. I assist my community in collecting electricity bills in the community to ensure timely and accurate payment of the bill that guarantees uninterrupted electricity supply to the village.”³⁴

Marika Taniashvili, Georgia

Energy programs with a gender lens

MAXIMIZING the benefits accruing to women is as straightforward as applying a “gender lens” throughout, from the initial assessment to design and implementation, all the way through to monitoring and evaluation. In a sector that has normally not used a gender perspective, this is important. These gender-focused additions act as “X factors” that donor institutions and host governments can layer on to expand rural energy programs into economic empowerment programs, thereby magnifying the impact for local communities. We offer some considerations for each aspect of the process.

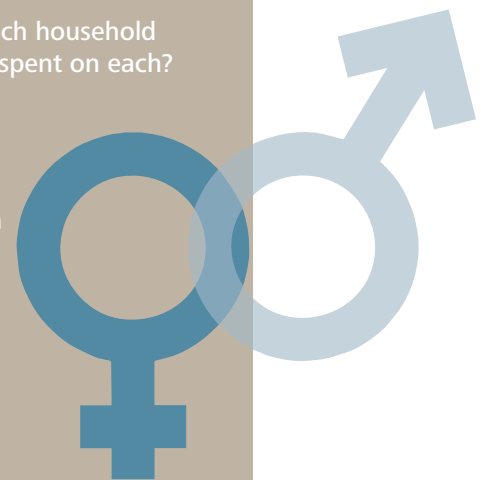
Invest in an initial assessment to understand the local environment for women

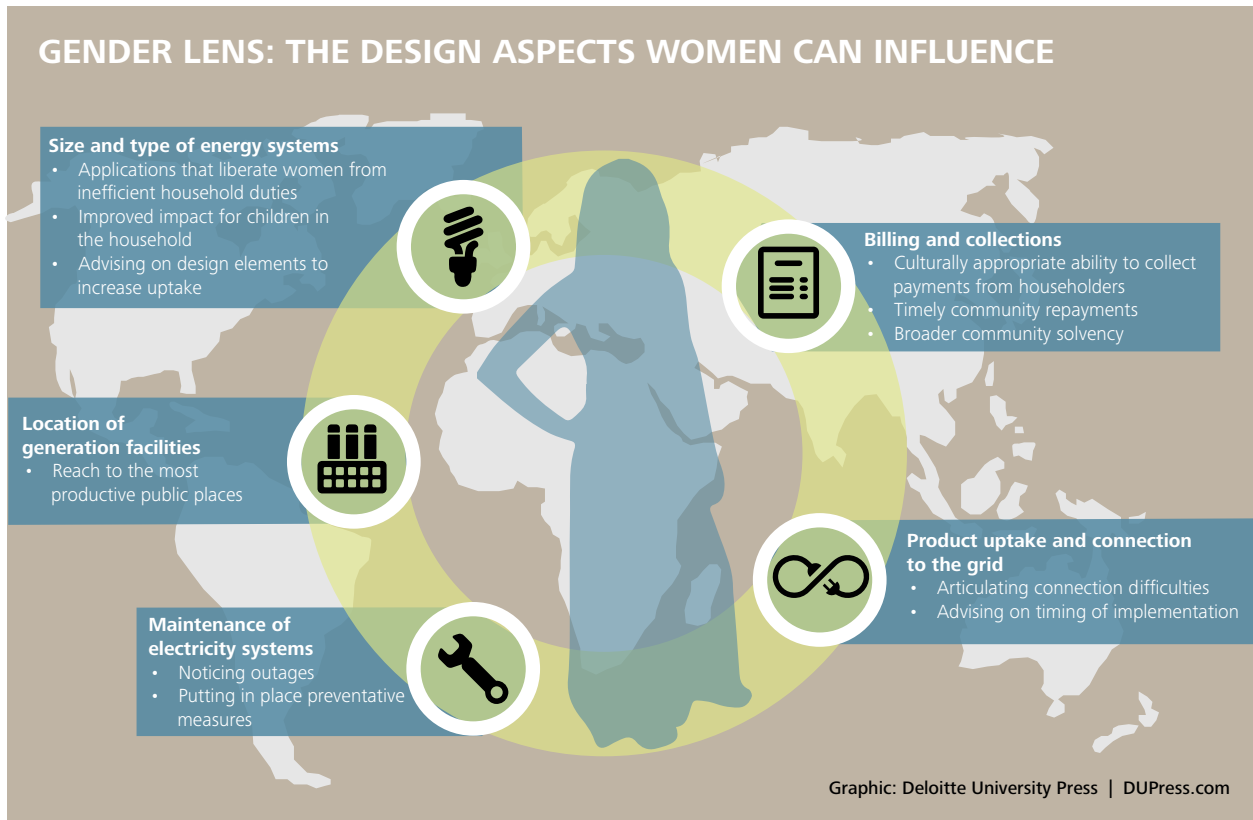
Before programs are designed, investigate the challenges of uptake in target communities, the demand factors for labor, and the potential areas for economic growth in the community, all with a gender-differentiated lens. Energy access and its potential impact on women is highly contextual to cultural sensitivities, religious beliefs, intra-household dynamics, ability to pay, and other economic and social factors. Furthermore, demand in local economies and drivers of labor will differ across communities, states, and countries. Understanding what kinds of jobs women want and how energy

programs can be designed to foster them can enable an even more effective program design. Gendered assessments can illustrate the nuances of the local economy and, more specifically, how women interact with that economy. This in turn can lead program designers to better understand what type of rural electricity should be delivered, in what location, at what scale, and at what cost.

GENDER LENS: ILLUSTRATIVE QUESTIONS FOR AN INITIAL ASSESSMENT

- What is the breakdown of male- to female-headed households?
- What are the main uses for electricity in the household? In the community?
- Who has responsibility for which household duties, and how much time is spent on each?
- What appliances (fuel- or electric-based), if any, are in the household? Is there sufficient fuel/electricity to run them as desired?
- Under what conditions can women get credit for capital purchases? For starting a business?
- What are the primary barriers to women entering the job market?
- What are the cultural and logistical constraints to women’s mobility?
- Where are the job centers? Do they require travel?





Bring women into the design process

Once the initial assessment has been conducted, consult with women before rolling out an energy access program. This can provide insights into elements such as preferred methods for delivering electricity systems, how to design communications about new energy systems, and how to price the new systems, among other important factors. Including women in the planning stages is particularly important with electricity, which has traditionally been a male-dominated sector but is increasingly focused on the profiles of end users. Because of this, donors and host governments should be inclusive and creative, consulting with local women on a conscious, continuous, and concerted basis.

Governments could consider reserving dedicated spots for women as community representatives and within the electricity entities

themselves, whether a rural electricity cooperative board of directors or a distribution billing and collections team. Intentionally seeking women's opinions may lead to new insights and surprising innovations that can enhance a program's effectiveness.

Set up enabling conditions for women's economic participation

Piggyback energy access onto complementary programs that improve job prospects or enable entrepreneurship. Certain factors, such as access to capital, reliable Internet access, business associations or networks, training and education, and access to markets will increase the economic growth value of improved electricity access when sewn into rural energy programs.

Women's particular challenges, such as fewer assets and the need to still fulfill household duties such as caring for children, must

LAO PDR'S NATIONAL ELECTRIFICATION PROGRAM: WHY WEREN'T WOMEN CONNECTING?

In Lao PDR's rural electrification program, an assessment unearthed that grid connection uptake rates (that is the number of households that connect to the grid once it has been extended to a village) remained disproportionately low among female-headed households. In response, the program created a pro-poor, gender-sensitive subsidy targeted at female-headed households.



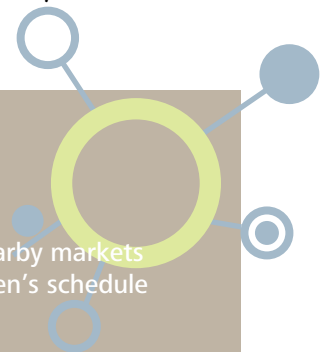
This was done through gender-appropriate materials that highlighted the benefits of electricity, gender-inclusive consultation and participation (for example, by scheduling meetings at times women were likely to be available, and female-friendly lending techniques. Without a targeted gendered assessment, this insight would not have been available. Connection rates went to well over 90 percent, even reaching 98 percent in several instances.³⁵

be considered. In order to capture the entrepreneurial gains, donors and host governments should incorporate one or two carefully selected factors into program design so that beneficiaries are presented with a multifaceted package. They may want to consider pilot

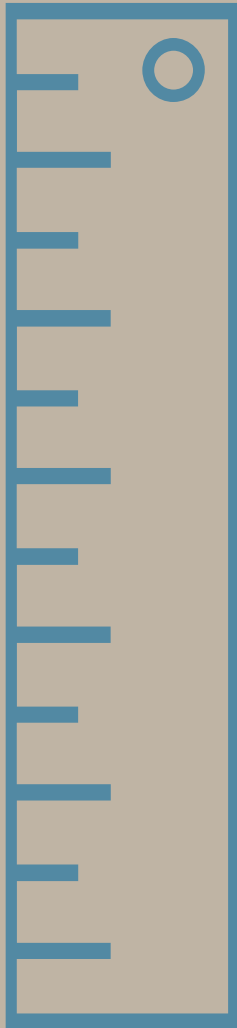
programs in communities that already demonstrate some of these factors—for example, communities that offer strong women's networks and female-friendly lending institutions—to increase the likelihood of early pilot successes.

GENDER LENS: ECOSYSTEM FACTORS THAT INFLUENCE WOMEN'S PRODUCTIVITY³⁶

- Banks with woman-friendly lending practices
- Financial literacy classes
- Soft skills and life skills training
- Culturally appropriate child care
- Transportation options that accommodate female needs
- On-the-ground women's networks and associations for mentorship and guidance on employment- and business-related questions
- Integrated entrepreneurship support
- Women leaders already active in the local economy
- Access to nearby markets that fit women's schedule and needs
- More productive machinery and inputs, tailored to use in the home
- Equitable access to information and communications technology and tailored training on how to access



GENDER LENS: ILLUSTRATIVE KEY PERFORMANCE INDICATORS TO MEASURE THE IMPACT ON WOMEN



- Number of women-owned businesses
- Number of dedicated women's associations or networks
- Percentage of female-headed households with a grid connection
- Number of hours spent on household duties
- Increase in income levels for women
- Percentage of females in the formal labor force
- Percentage of women with bank accounts
- Number of women with improved access to market information
- Percentage of residences with refrigerators, lighting, and/or improved stoves
- Percentage of public spaces with lighting

Utilize quantitatively rigorous monitoring and evaluation (M&E) to capture causality and impacts for women

During and after energy access program implementation, use gender-differentiated indicators to measure the impact. Although there has been a significant investment in rural electrification, gender-disaggregated results are rarely captured, which impedes the ability to understand effective design factors and degree of impact by gender. Utilizing a targeted M&E framework of key performance indicators not only allows gender-differentiated linkages to be drawn, but also creates space for modifications to be made over time. Rigorous, regular, and objective measurement holds donors, governments, and implementing organizations alike accountable for their outcomes. Likewise, this accountability provides motivation to review and refine implementation strategies that are not working.

Conclusion

GIVEN the global emphasis on energy access, many of these programs are likely to be rolled out in the near future, with millions of dollars in funding being committed. This represents a rare opportunity to intentionally shape programming so that it is not only electrifying communities, but empowering women within those communities to be more efficient in their household duties, make further gains in education, enter the workforce, and start businesses. Not only will this provide

opportunities for those often disenfranchised, but it will also help accelerate economic growth in developing countries and lay the foundation for an emerging middle class. If done thoughtfully, spurring access to energy could spur 50 percent of a labor force to be more productive and more engaged. A gender lens approach to energy access programs can be beneficial all the way around—for women, for local communities, and for emerging nations.

Appendix

Table 1. Employment profit analysis results

$\text{Prob}(Y = 1) = \Phi(\alpha + \beta_1x_1 + \beta_2x_2 + \dots + \epsilon)$, where $Y = \text{employed}$

| | Rural women | Rural men |
|---------------------------------|-------------|-----------|
| Prob > χ^2 | 0.000 | 0.000 |
| Sample size | 874,425 | 978,304 |
| Constant | -1.557 | -0.337 |
| Access to energy | 0.102 | 0.095 |
| Washer | 0.064 | -0.006 |
| Married | 0.450 | 0.751 |
| Ownership of dwelling | 0.017 | -0.344 |
| Household size | 0.003 | -0.021 |
| Education: Less than primary | 0.374 | 0.316 |
| Education: Primary completed | 0.537 | 0.627 |
| Education: Secondary completed | 1.104 | 1.092 |
| Education: University completed | 1.800 | 1.184 |

Note: Also controlled for state of residence in Brazil. All coefficients are statistically significant at the $p < 0.01$ level.

Graphic: Deloitte University Press | DUPress.com

Table 2. Income regression analysis results

$y_i = \alpha + \beta_1x_{i1} + \beta_2x_{i2} + \dots + \epsilon_i$, where $y = \text{income}$

| | Rural women | Rural men |
|---------------------------------|-------------|-----------|
| R-squared | 0.316 | 0.292 |
| Sample size | 335,970 | 613,641 |
| Constant | 411.998 | 480.606 |
| Access to energy | 38.298 | 54.510 |
| Washer | 120.738 | 191.202 |
| Married | 30.087 | 115.051 |
| Ownership of dwelling | 6.362 | -26.729 |
| Household size | -2.242 | -6.432 |
| Education: Less than primary | 42.648 | 71.201 |
| Education: Primary completed | 95.743 | 158.660 |
| Education: Secondary completed | 188.025 | 290.299 |
| Education: University completed | 616.576 | 856.586 |

Note: Also controlled for age, hours per week worked at main occupation, occupation, and state of residence in Brazil. All coefficients are statistically significant at the $p < 0.01$ level.

Graphic: Deloitte University Press | DUPress.com

Endnotes

1. *World energy outlook*, International Energy Agency, 2013, <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/>.
2. “Energy for All Initiative,” Asian Development Bank, 2014, <http://www.adb.org/sectors/energy/programs/energy-for-all-initiative>.
3. Dr. Nurzainah Ginting, interview conducted by Retno Soebagio of the USAID Indonesia Clean Energy Development project on behalf of Deloitte Consulting LLP, January 26, 2012.
4. “Energy services for the millennium development goals,” The UN Millennium Project, 2005, http://www.unmillenniumproject.org/documents/MP_Energy_Low_Res.pdf; Marcio Giannini Pereira et al., “Rural electrification and energy poverty: Empirical evidences from Brazil,” *Renewable and Sustainable Energy Reviews* 14, no. 4 (2010): pp. 1129-1240.
5. *World energy outlook*, International Energy Agency, 2013.
6. Salinee Tavaranan, interview conducted by Sophia Peters on behalf of Deloitte Consulting LLP, August 21, 2014.
7. Anne Marie Golla, Anju Malhotra, Priya Nanda, and Rekha Mehra, “Understanding and measuring women’s economic empowerment definition, framework and indicators,” International Center for Research on Women, 2011.
8. Note: We must also consider that empowerment may be represented by a woman choosing to work or not to work.
9. The Gender Inequality Index (GII) shows the loss to potential achievement in a country due to gender inequality across reproductive health, empowerment, and labor market participation. Additional information about the GI can be found at <http://hdr.undp.org/en/faq-page/gender-inequality-index-gii>.
10. Data on the Gender Inequality Index can be found at <http://hdr.undp.org/en/content/gender-inequality-index-gii>. Data on poverty headcount ratio can be found at <http://data.worldbank.org/indicator/SI.POV.DDAY> (the most recent year available was used). The regression yields an R-squared value of 0.46 and a poverty headcount ratio coefficient of 0.46 with statistical significance at the $p < 0.01$ level.
11. The regression of the Gender Inequality Index against both poverty headcount ratio and electrification rate yields a coefficient of -0.26 for electrification rate, which is statistically significant at the $p < 0.01$ level.
12. Soma Dutta, *Mainstreaming gender in energy planning and policies*, UNESCAP Project, 2003.
13. Daniele Coen-Pirani, Alexis Leon, and Steven Lugauer, “The effect of household appliances on female labor force participation: Evidence from micro data,” *Labour Economics* 17, no. 3 (2010): pp. 503-513.
14. Joshua Lewis, “Short-run and long-run effects of household electrification,” paper presented at Economic History Workshop, Queen’s University, Kingston, Ontario, Canada, April 25, 2014, http://www.econ.queensu.ca/files/other/Lewis%20electrification_SR_LR.pdf.
15. *Global tracking framework*, Sustainable Energy For All, 2013.
16. This analysis is based on a probit model with $\text{Prob} > \chi^2 = 0.000$ and the coefficient for access to energy is significant at the $p < 0.01$ level. Please see table 1 in the appendix.
17. This analysis uses the same probit model described above, where the coefficient for washer ownership is significant at the $p < 0.01$ level. Please see table 1 in the appendix.
18. *The welfare impact of rural electrification: A reassessment of the costs and benefits: An IEG impact evaluation*, World Bank Independent Evaluation Group Impact Evaluation, 2008, http://siteresources.worldbank.org/EXTRURELECT/Resources/full_doc.pdf.
19. *Rural electrification and development in the Philippines: Measuring the social and economic benefits*, World Bank, 2002.
20. Census data from Brazil was obtained through the Minnesota Population Center’s Integrated Public Use Microdata Series, International: Version 6.3. Data was originally produced by Brazil’s Institute of Geography and Statistics.
21. Ibid.
22. This analysis is based on a linear regression model with an R-squared of 0.316 for women and 0.292 for men. The coefficients for energy access and washer ownership

- are significant at the $p < 0.01$ level. Note that the sample is restricted to women and men with incomes under \$5,000 per year to avoid biasing the results with income outliers. Please see table 2 in the appendix.
23. Professor Roqia Motammhid, interview conducted by Hamid Massoudi on behalf of Deloitte Consulting LLP, January 23, 2012.
 24. Taryn Dinkleman, “The effects of rural electrification on employment: New evidence from South Africa,” *American Economic Review* 101, no. 7 (2011): pp. 3078–3108.
 25. Louise Grogan and Asha Sadanand, “Rural electrification and employment in poor countries: Evidence from Nicaragua,” *World Development* 43 (2013): pp. 252–265.
 26. Ruba Al-Zu’bi, interview conducted by Kathleen O’Dell on behalf of Deloitte Consulting LLP, December 3, 2011.
 27. April Allerdice and John H. Rogers, “Renewable energy for microenterprise,” National Renewable Energy Laboratory, November 2000.
 28. Ibid.
 29. Gunnar Kohlin et al. “Energy, gender, and development: What are the linkages? Where is the evidence?,” Policy Research Working Paper 5800, World Bank, 2011.
 30. Ibid.
 31. Tenezee Miatta Emeka, interview conducted by Rufus Emeka of the USAID Liberia Trade Policy and Customs project on behalf of Deloitte Consulting LLP, January 14, 2012.
 32. Note: This is the case when all other components are equal (i.e., *ceteris paribus*). Bert D’Espallier, Isabelle Guerin, and Roy Mersland, “Women and repayment in microfinance: A global analysis,” *World Development* 39, no. 5 (May 2011): pp. 758–772.
 33. “Female meter reader raises revenues: A team of USAID-supported meter readers improves water service delivery in Ghazni,” USAID, 2010, <http://www.usaid.gov/results-data/success-stories/female-meter-reader-raises-revenues>.
 34. Marika Taniashvili, interview conducted by Marina Kevanishvili of the USAID Hydro-power Investment Promotion Project on behalf of Deloitte Consulting LLP, January 10, 2012.
 35. “Lao PDR power to the people: Twenty years of national electrification,” The World Bank Group, 2012.
 36. “Female entrepreneurship resource point: Introduction and module 1: Why gender matters,” World Bank, 2014, <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTGENDER/0,,contentMDK:23392638~pagePK:210058~piPK:210062~theSitePK:336868,00.html>.

About the authors

Kathleen O'Dell, Association of Energy Engineers (AEE)-certified carbon reduction manager, is a senior manager with Deloitte Consulting LLP's Strategy & Operations supply chain practice. She has 16 years of international development experience in clean energy, energy efficiency, private sector development, and the gender-energy nexus. O'Dell has managed projects for various public sector entities and international donor organizations in Bangladesh, Ethiopia, Jordan, Kenya, Lesotho, Mongolia, Tanzania, Ukraine, Vietnam, and West Bank. She is currently managing a global USAID infrastructure & sustainability portfolio that includes the Catalyzing Clean Energy in Bangladesh project, which aims to scale up industrial energy efficiency and distribution of improved cookstoves, and the Jordan Energy Sector Capacity Building project, which is enabling utility-supported energy efficiency programs and strengthening key governmental institutions and energy service providers. In 2012, O'Dell completed a two-year assignment based in Amman, Jordan. She is currently a board member and international committee chair of AEE's Council on Women in Energy & Environmental Leadership.

Sophia Peters is a manager with Deloitte Consulting LLP's Strategy & Operations group. She has a background in economics and professional experience working in the energy sector and on community development projects. Currently, she supports a variety of projects for international energy clients in emerging markets focused on clean energy policy, access to finance, electricity markets, and power project development. Peters specializes in financial, economic, and policy analysis, with a specific interest in how consumers make decisions. Within this, she has worked on several projects at the intersection of gender, energy, and economic growth, with a perspective that women can be a catalyst for economic development goals. Peters has worked on long-term projects in Latin America, the Balkans, Southeast Asia, and East Africa, as well as on US domestic policy for the EPA and DOE. She recently supported the USG's Power Africa Initiative—a whole-of-government initiative to accelerate transactions in the power sector across key sub-Saharan African countries with a goal of creating 30,000 MW of new power for economic growth on the continent. She has published on energy issues in developing countries, including a Deloitte University Press report on stimulating demand for clean cookstoves in low-income markets. She holds a master's in public policy from Princeton University's Woodrow Wilson School and a bachelor's degree from Duke University. She is fluent in Spanish.

Kate Wharton is a consultant with Deloitte Consulting LLP's Strategy & Operations group, with a focus on emerging markets. She has a background in economics and expertise in data analysis and visualization, impact measurement, strategic planning, and innovation. Wharton supports the USAID Jordan Energy Sector Capacity Building project and World Bank Water and Sanitation Program's Domestic Private Sector Participation initiative. She co-founded and leads D2international, a Deloitte social impact fellowship, where she has led projects for non-profit and social enterprise clients internationally. Wharton has led teams to develop and deliver a monitoring and evaluation solution for a women's empowerment organization in the Highlands of Guatemala, as well as to develop strategic guidance around the rollout of a new social enterprise incubator for youth in Bosnia and Herzegovina. She holds a degree in economics and international affairs and a minor in Spanish from the Georgia Institute of Technology.

Acknowledgements

Special thanks to **Rebecca Ranich** for her original vision for this piece.

Contacts

Kathleen O'Dell
Senior manager
Deloitte Consulting LLP
+1 937 258 4354
kodell@deloitte.com

Sophia Peters
Manager
Deloitte Consulting LLP
+1 571 814 6400
sopeters@deloitte.com



Follow @DU_Press

Sign up for Deloitte University Press updates at DUPress.com.

About Deloitte University Press

Deloitte University Press publishes original articles, reports and periodicals that provide insights for businesses, the public sector and NGOs. Our goal is to draw upon research and experience from throughout our professional services organization, and that of coauthors in academia and business, to advance the conversation on a broad spectrum of topics of interest to executives and government leaders.

Deloitte University Press is an imprint of Deloitte Development LLC.

About this publication

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or its and their affiliates are, by means of this publication, rendering accounting, business, financial, investment, legal, tax, or other professional advice or services. This publication is not a substitute for such professional advice or services, nor should it be used as a basis for any decision or action that may affect your finances or your business. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser.

None of Deloitte Touche Tohmatsu Limited, its member firms, or its and their respective affiliates shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

About Deloitte

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee, and its network of member firms, each of which is a legally separate and independent entity. Please see www.deloitte.com/about for a detailed description of the legal structure of Deloitte Touche Tohmatsu Limited and its member firms. Please see www.deloitte.com/us/about for a detailed description of the legal structure of Deloitte LLP and its subsidiaries. Certain services may not be available to attest clients under the rules and regulations of public accounting.

Copyright © 2014 Deloitte Development LLC. All rights reserved.
Member of Deloitte Touche Tohmatsu Limited