Clean Energy Can be a Win for Everybody

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Developing countries will play a major role in driving growth in energy consumption in the next several decades. A revealing new research by Imelda provides important insights for energy transition policies in these countries by investigating a successful energy transition program in Indonesia. The program increased access to clean energy from 40% to 80% in only 8 years. This study documents positive health and labor outcomes due to the transition to clean cooking. This transition provided health and indoor air quality benefits especially to women, as they are the ones responsible for cooking and likely to spend more time at home. Women also gained the opportunity to do more market work. Although men accrued smaller health benefits relative to women, they also increased their working hours, albeit by less than the increase in women's working hours. The study therefore shows that improving women's health and equality also improves the wellbeing of other family members. This study provides the first empirical evidence that clean energy can be a win for everybody. Ignoring these spillover effects underestimates the benefit of clean energy access.

According to the U.S. Energy Information Administration, nearly all of the growth in energy demand and its associated greenhouse gas emissions are forecasted to come from developing countries over the next three decades. Hence, an understanding of the drivers of clean energy transition in developing countries is central for policy debates regarding how to curb global emissions. What are the proper policy instruments that can promote a successful clean energy transition? A

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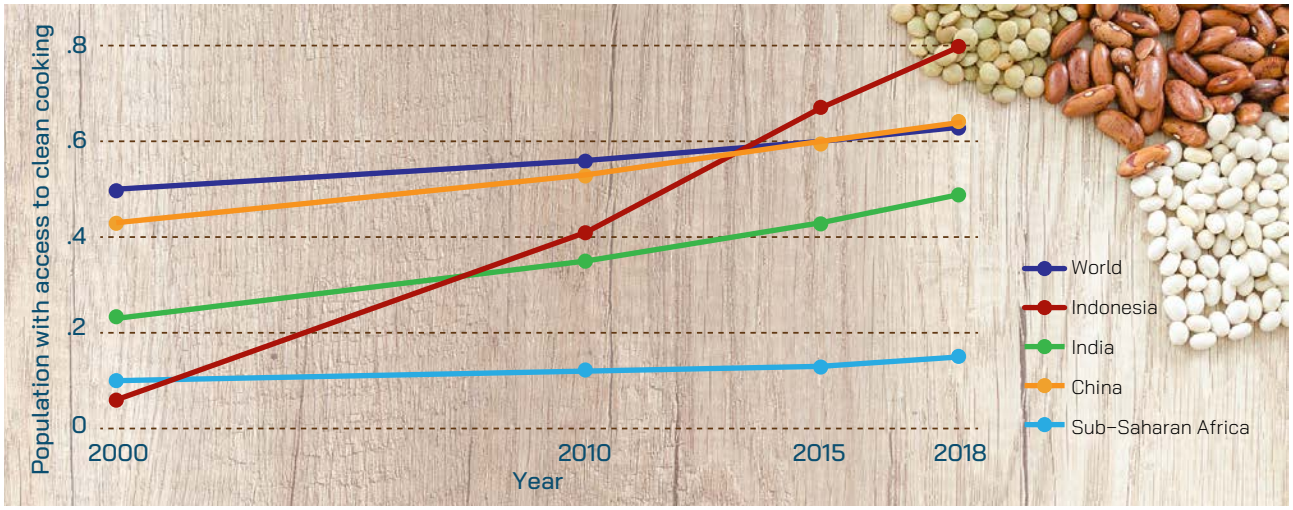
Figure 1. Progress on access to clean cooking



Source: WHO Household Energy Database. Geneva: World Health Organization; 2020.

Women may not be aware of its health consequences and thus have a low willingness to pay for clean energy

recent study provides a successful example of a government policy that works to promote clean energy transition, leading to quantifiable benefits.

Clean cooking adoption is integral to clean energy transition; however, progress towards achieving universal access to clean cooking—the UN's 7th Sustainable Development Goal—has been slow (Figure 1). Today, about 2.6 billion people worldwide still rely on dirty and polluting cooking technology.

Burning dirty fuels produces dangerous indoor pollutants, reaching up to 100 times the World Health Organization's (WHO) recommended safe levels. According to WHO estimates, indoor air pollution causes four million deaths annually, exceeding the death tolls of malaria, tuberculosis, and AIDS combined.

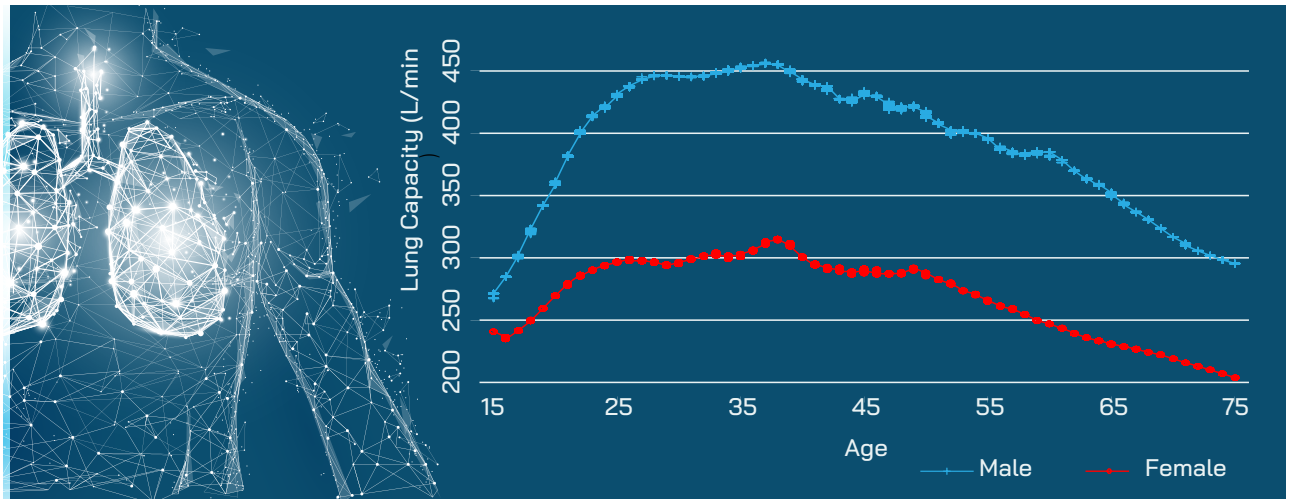
How to promote a clean energy transition at home? There are at least two major obstacles in developing countries. First, while being the most susceptible to the adverse health outcomes of unclean energy, women may not be aware of its health consequences and thus have a low willingness to pay for clean energy.

Second, even if women are aware of the benefits of clean cooking and prefer using clean energy, their choice often depends on men's preferences because they often have low bargaining power in making key household decisions. As a result, clean energy take-ups are often low, making it even harder to measure clean energy's benefits.

Energy-health-gender nexus

Knowing the gains from using cleaner energy is crucial for public policy design because it is the basis on which to evaluate and weigh policy alternatives. Existing studies have pointed to the interlinkage between clean energy access, health, and gender. Clean energy

Figure 2. Lung capacity by gender



Source: author's calculation

access positively affects health because reliance by households on dirty fuel for cooking —such as firewood or kerosene— can lead to adverse health effects from air pollution exposure.

Moreover, this health effect is also gendered because women spend a considerably higher amount of time on housework than men due to traditional gender norms. This leads to disproportionate health and time burden on women. For instance, Figure 2 shows a large gap in the lung capacity between men and women. While some of these results can be explained by biological factors, a revealing new study by our team member, Imelda, uncovers the extent to which some of these gaps can be explained by the lack of access to clean energy.

An even less discussed aspect is that clean energy access can also indirectly increase men's productivity through shifts in the intrahousehold division of labor. This is true whenever there is substitutability or complementarity between men and women's labor inputs in both market work and household work.

Existing studies argue that there exists a link between access to clean energy and female labor force participation. But correlation is not causation: economic development presents confounding effects, and disentangling these effects is challenging because of the voluntary nature of cleaner cooking technology adoption. Households that voluntarily adopt cleaner cooking technology tend to also be in places with better infrastructure, so it's not clear from earlier studies how female labor force participation depends on clean energy access.

Methodology

In her new paper, Imelda hypothesizes that the lack of access to clean cooking imposes a disproportionately higher health and productivity cost on women than men. Furthermore, she also argues that the health-burden associated with unclean cooking fuel can influence the labor supply of both genders.

To test these hypotheses, Imelda uses a case study in Indonesia. Figure 1 shows a remarkable increase in the population share with access to clean energy from 40% to 80% in only 8 years. The reason for this increase is that the Indonesian government started a cooking fuel conversion program in 2007 that replaced kerosene with liquid petroleum gas (LPG) at a national scale. This program was a great success in promoting adoption to clean cooking.

There exists a link between access to clean energy and female labor force participation

A recently published study suggests that fine particulates emitted from burning LPG are about 46-76% lower than particulates emitted from burning kerosene. Replacing kerosene with LPG lowers indoor fine particulates by about 50-140 μg/m^3, a concentration that is 2-6 times the safe levels recommended by the WHO.

Imelda's paper exploits exogenous variation in the timing of the program to estimate a causal relationship between clean energy access, health, and labor supply. Specifically, it compares the health and labor supply outcomes of individuals living in districts with a *longer* exposure duration to the program with the health and labor supply outcomes of individuals living in districts with a *shorter* exposure duration to the program.

The clean energy program led to a 2-6% increase in eligible women's lung capacity

Since the outcomes between the two groups were trending similarly before the program, the difference in the outcomes between the two groups after the program can be interpreted as a causal effect of the differential access to clean cooking.

Main results: Health improvements among women & spillover effects on men

This paper finds that **the clean energy program led to a 2-6% increase in eligible women's lung capacity**. A back of the envelope calculation shows that this increase is similar to the lung capacity improvement of a smoker who had consumed 20 cigarettes per day for 10 years before quitting, a sizable improvement. For men, the program led to small and statistically insignificant changes in their lung capacity. As women are the primary users of cooking fuel and spend more time doing household chores, they benefited the most from the program.

Improvement in the health of women can lead to changes in labor supply for both women and men depending on the elasticity of substitution between men and women's labor. As women's health improves, they have the opportunity to dedicate more time to market work. Indeed, the study finds an increase in working hours among women, in-line with the hypothesis.

The paper also documents an increase in the labor supply by men, which suggests the existence of positive spillover effects of the policy. The empirical analysis suggests the relevance of the substitution and complementarity effects in explaining the spillover effects.

First, the program reduces the need for men to help with unpaid work at home, suggesting that women can be a substitute for men's 'housekeeping' efforts. As a result, the program increases the men's propensity to work a second job.

Second, the paper finds that men's labor supply increased when both genders are within the same sector. In this case, it is easier for women to act as a complement for men due to their similar skills. For example, in agriculture—the major sector in the sample—results suggest an increase in the area of cultivation and in the crop varieties planted, which is to be expected as both men and women increase their work hours.

It is often challenging to study the impact of technology adoption when the take-up rate is low and the adoption is not sustained for a longer-term. However, this study provides an example of how a clean energy intervention can lead to a massive and fast transition and subsequently lead to improved health and labor outcomes. This example serves as a lesson for many other countries that attempt to move towards clean energy ·

Further reading

Imelda and A. Verma (2020) "Clean Energy Access: Gender Disparity, Health, and Labor Supply" available here.