



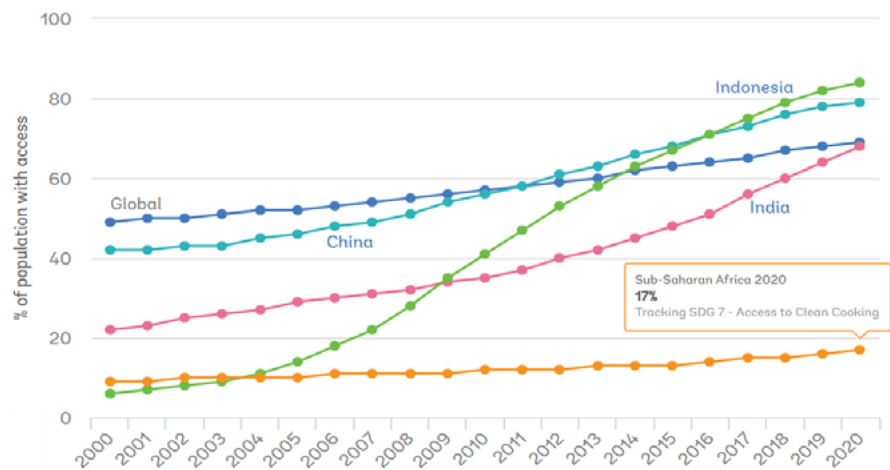
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Clean Energy Access, Health, and Gender: Evidence from Indonesia

Imelda, Assistant Professor of International Economics, The Geneva Graduate Institute
Anjali P. Verma, Economist, Amazon

Women bear a disproportionate share of the health and time burden associated with a lack of access to modern energy. We show that a proper intervention that improves access to clean cooking improves adult health and labor supply outcomes. In particular, when a cleaner cooking alternative was used sustainably, women's health improved. As a result, work hours increased not only for women's but also for men's. The increase in the labor supply by men may be driven by the potential positive spillover effects of clean energy access within households.

Figure 1. Progress on access to clean cooking.



Source: [WHO Household Energy Database](#).
[Geneva: World Health Organization; 2020.](#)

Worldwide, about 1.2 billion people may lack access to electricity, but there are more than [2.5 billion people globally](#) who do not have access to modern cooking technology (IEA, 2020) ---more than double the number of people who lack access to electricity. Burning dirty fuels produces dangerous pollutants, reaching 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. Importantly, 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.

It is often difficult to encourage people to switch to new and cleaner technology. Many countries---such as China and India---have attempted to implement large fuel transition programs. Existing studies point out that behavioral aspects, such as low willingness to pay for clean fuels and a lack of understanding of the proper use of clean technology can hinder household adoption of clean energy.

Relationship between clean energy, gender, health, and labor outcomes

Existing studies argue that there is a link between access to clean energy and female labor force participation. But econo-

mic development presents confounding effects, and disentangling these effects is challenging because of the voluntary nature of cleaner cooking technology adoption.

Moreover, households sort to places with better infrastructure, so it is not clear from earlier studies how female labor force participation depends on clean energy access.

[Verma and Imelda \(2022\)](#) use 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 pr-

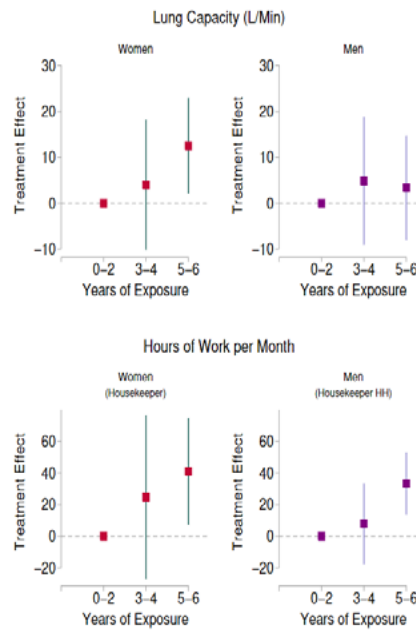
ogram was a great success in promoting adoption to clean cooking and likely improved households' indoor air concentration.

We exploit 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. 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.

Figure 2 summarizes two main findings. Foremost, the program led to a sizable increase in lung capacity in women due to the program. 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 are impacted the most by the program. 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.

Furthermore, 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's and women's labor. As their health improves, women have the opportunity to

Figure 2. Health and labor impact of the access to clean cooking.



dedicate more time to market work. Additionally, we find an increase in the labor supply by men, which suggests the existence of positive spillover effects of the policy.

There are at least two potential mechanisms: (1) It is likely that 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. (2) It is likely easier for women to pick up the slack or act as a complement for men when they have similar skills. Indeed, we find that men's labor supply increases when both genders are within the same sector. We also find 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.

Policy Implications

We can draw two policy implications. First, a combination of some policy instruments can lead to a high adoption rate with attendant improvements in health. A single policy instrument alone may not be sufficient to address the existing lack of access to clean cooking. Second, some of the gender disparity in health can be explained by the lack of access to clean energy. When women become healthier from an improvement in indoor air quality due to the switch to clean cooking, both men and women 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.

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 leads to improved health and labor outcomes, an often overlooked positive spillover effect from clean energy access.

References

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CENTRE FOR INTERNATIONAL ENVIRONMENTAL STUDIES
 GRADUATE INSTITUTE OF INTERNATIONAL AND
 DEVELOPMENT STUDIES
 Case postale 1672, 1211 Genève 1
 T +41 22 908 44 61
cies@graduateinstitute.ch
www.graduateinstitute.ch/cies