



Promoting biomass power plants: A key to empowering rural women in Côte d'Ivoire

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Key messages

- Access to electricity enables the improvement of household living conditions through increased income generating opportunities and the empowerment of rural dwelling women.
- Decentralised electrification using biomass power plants is a practical, feasible, environmentally friendly and, above all, a cost-effective alternative for electrifying small, remote localities, given the high costs of connecting to the national grid.

75% of rural women live below the poverty line

Despite the strong performance of the domestic economy, with an average annual growth rate of 7% (Ministry of Planning and Development, 2019), **the level of poverty remains high in Côte d'Ivoire; particularly among women**, where the rate of poverty is 47.4% compared to 45.5% for men (NSI, 2015). The situation is even more alarming in rural areas, with about 75% of women living below the poverty line (NSI, 2015), even though they are heavily involved in the agricultural sector (Government, 2016). Rural women spend a large share of their income on the basic needs of their families, indicating that household living conditions are quite challenging (FAO, 2017).

Electrification programme to promote the empowerment and well-being of rural women

The National Rural Electrification Programme (PRONER), implemented by the Government as of 2013, **aims to electrify as many localities as possible and to provide the population with access to electricity in order to improve their living conditions through the empowerment of women** and the employment of young people. Aware of the importance of economic infrastructure for the benefit of the population, the Government has made PRONER a key element of its Social Programme (PSGouv). This is because the availability of electricity promotes the development of non-agricultural activities and improves welfare indicators - including those related to health, education, income and the environment (Kanagawa and Nakata, 2008).

Nevertheless, **the implementation of PRONER is costly**, and the authorities are struggling to mobilise funds to fully achieve the objectives.



Photo: GERES

About PRONER

Adopted by the Council of Ministers on the 2nd of July 2013 in Korhogo, the National Rural Electrification Programme (PRONER) seeks to electrify:

- 8518 communities with populations of at least 500 inhabitants by the end of 2020 - phase 1
- All communities, including those with less than 500 inhabitants (about 80,000), by the year 2025 - phase 2

It is essentially linked to **the national interconnected electricity grid** and requires increased mobilisation of financial and technical resources for the electrification of many remote rural localities, especially those situated more than 20 km away from the national grid.

At the end of 2020, about 80% of the targeted localities for phase 1 electrification has been covered.

PEP project

In 2019-2020, a team of Ivorian PEP researchers carried out a collaborative research project designed to provide support to government attempts to improve people's lives through access to electricity.

The project was composed of two parts:

1. **A scientific study** to evaluate the impact of the current version of the rural electrification programme (PRONER) on the empowerment of women.
2. **A comparative assessment of other alternative options**, less costly than PRONER, to extend the availability of electricity to all localities across the country.

Scientific study: The impact of access to electricity on the empowerment of rural Ivorian women

The scientific study undertaken by the Ivorian researchers sought to assess the impact of the PRONER programme on the economic empowerment of rural women.

The researchers used a quasi-experimental evaluation approach, applied to data from the Households Living Standard Survey conducted in 2015 (ENV 2015) - and therefore in a "post-PRONER" context - involving 12 900 households.

Using the selection criteria (a minimum of 500 inhabitants and within 20 km of the national grid), those communities identified were divided into two groups:

- The "treatment" group: Localities already electrified;
- The "control" (or comparison) group: Non-electrified localities



The results of the study show that PRONER has a significant impact on rural women in terms of "time allocation" and "quality of employment". This differs from the results obtained for men, for whom the study shows no significant impact on either of these dimensions.

Time allocation: Women with access to electricity, spend significantly

- less time (-13%) on household chores;
- more time (+23%) on non-agricultural activities;
- more time (+14%) on agricultural activities.

In other words, the reduction of chores brought about by electrification **allows women to save time and re-allocate this time to more diversified income-generating activities**. This increase in income is likely to increase their bargaining power within the household (World Bank, 2003).

Quality of employment: Being in an area with electricity increases:

- by 57 %, the probability of having a full-time job;
- by 4%, the probability of being in paid employment.

These quality employment opportunities (paid and full-time) would thus justify the strong reallocation of women's time to performing jobs in the non-agricultural sector.

The results of the study thus show that not only does **PRONER contribute to improving household welfare, but also to promoting gender equality** among the beneficiary populations.

To learn more about the objectives, methods and results of this research study, please consult the corresponding research paper from the [PEP working papers](#).



Photo: Fiston Wasanga/CIFOR

Analysis of alternative policy options for cost-effective rural electrification

In light of the results of this study conducted by the Ivorian researchers, it is clear that PRONER is an effective tool in the fight against poverty through its positive impact on household welfare and women's empowerment.

However, its implementation, which requires the interconnection of communities to the national grid, **involves high costs for the connection of remote communities**, especially those with less than 500 inhabitants (i.e. about 80,000 communities).

The authors therefore propose to take into account, **alternative, off-grid electrification modes** such as:

- biomass power plants;
- solar power stations; and
- small-scale hydropower.

Although offering the same benefits as on-grid electrification for the beneficiary populations, the off-grid alternatives also have a significant cost advantage, or cost effectiveness, over PRONER.

Indeed, according to the results of the cost-benefit analysis carried out by the authors (see Table 1), **the biomass plant is by far the most cost-effective option** from an economic point of view. In addition, it offers the following advantages:

- 1. It uses a renewable and infinite resource**
 - Biomass comes from waste, residues and other biodegradable materials, which are available everywhere in unlimited quantities;
 - The country's agricultural sector produces more than 15 million tons of residues (by-products), of which 12 million tons are recyclable. Nevertheless, the use of this waste (crop residues) should be rationalised as it also contributes to improving soil fertility.
- As well as producing cheaper energy, **the use of waste and residues helps to clean up the environment** and people's living environments;
- 4. Giving priority to developing biomass power generation would also contribute to further "greening" Côte d'Ivoire's energy mix** and help meet the country's commitment to increasing the share of renewable energy to 42% by the year 2030 - including a 10% biomass share.

Cost-benefit analysis

Policy option	PRONER	Small-scale hydropower	Solar power plant	Biomass power plants
Average cost of intervention (CFA francs)	2 655 775	1 087 300	856 975	496 491
Average net benefit (CFA francs)	0	+1 568 475	+1 798 800	+2 159 284,1
Cost-Benefit Ratio (CBR)	1 : 1	1 : 1,4	1 : 2,1	1 : 4,3

Source: Authors' calculations from PDER-CI (2015) and ADB (2018). Note: The advantages of an option here, represent the cost savings relative to PRONER. They are obtained by calculating the difference between the average cost of the option and that of the PRONER. The ratio between the benefits and the average cost of the option constitutes the CBR.

Recommendations and perspectives

Given the results of the scientific study - that electrification significantly improves the empowerment of rural women - the researchers recommend extending **electrification to cover all communities in the country, including the most remote ones with less than 500 inhabitants.**

Furthermore, to achieve the objective of providing universal access to electricity, they recommend privileging **decentralised electrification through the use of biomass**, principally for the following reasons:

- **Cost-effectiveness:** This option is cheaper and more cost-effective with a much higher Cost Benefit Ratio (CBR) (4.3) than PRONER (1) and the other 'off-grid' options (2.1 for the solar power and 1.4 for the small scale-hydro plant).
 - The CBR means that for every CFA franc invested in a biomass power plant, a 4.3 CFA franc saving is made in comparison with being connected to the national grid;
- **The energy potential of biomass** is 15 terawatt hours (TWh) for an available resource of more than 3.6 million tons. The primary sources are cocoa, rubber, palm oil and cotton. Other significant sources of these residues are from agricultural and industrial activities and urban waste.

In addition to being efficient, the nature and diversity of biomass inputs make it a **longer term, cheaper, and more environmentally friendly fuel alternative to PRONER**, which produces about 70% of its energy from fossil-based sources (natural gas).

Roadmap

- **Increase awareness among all stakeholders** (ministries and technical structures of the State, financial and technical partners, private sector, beneficiary communities) regarding the need to take on board the study and to facilitate the implementation of the recommendations.
- **Conduct an inventory and assessment of the potential for fuel** from available biomass resources across the country to better understand the value-added potential and its availability over time, in terms of by-products per region, municipal solid waste, commercial waste and other feedstocks of potential interest for bioenergy projects;
- **Accelerate the contract negotiation process** between the State, the energy sector and the promoters of biomass energy projects;
- **Carry out technical studies** to enable the Ivorian government to launch calls for tender for the selection of independent producers of biomass electricity;
- **Facilitate the development of small capacity pilot units** that will be scaled up in the future.



This brief summarises outcomes from the project **PMMA-20454**, conducted 2019-20.

To find out more about the research methods and findings, read the full paper, published as part of the [PEP working paper series](#).

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