



# “Analysis of the gap in enterprise access to renewable energy between rural and urban areas in Cameroon”

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<b>ARTICLE INFO</b>	Mathieu Juliot Mpabe Bodjongo, Guy Christol Ekane Ekome and Fanny Kabwe Omoyi epse Essomme (2021). Analysis of the gap in enterprise access to renewable energy between rural and urban areas in Cameroon. <i>Environmental Economics</i> , 12(1), 39-52. doi: <a href="https://doi.org/10.21511/ee.12(1).2021.04">10.21511/ee.12(1).2021.04</a>
<b>DOI</b>	<a href="http://dx.doi.org/10.21511/ee.12(1).2021.04">http://dx.doi.org/10.21511/ee.12(1).2021.04</a>
<b>RELEASED ON</b>	Tuesday, 27 April 2021
<b>RECEIVED ON</b>	Saturday, 27 February 2021
<b>ACCEPTED ON</b>	Tuesday, 20 April 2021
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<b>JOURNAL</b>	"Environmental Economics"
<b>ISSN PRINT</b>	1998-6041
<b>ISSN ONLINE</b>	1998-605X
<b>PUBLISHER</b>	LLC “Consulting Publishing Company “Business Perspectives”
<b>FOUNDER</b>	LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

50



NUMBER OF FIGURES

0



NUMBER OF TABLES

4

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## BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"  
Hryhorii Skovoroda lane, 10,  
Sumy, 40022, Ukraine  
[www.businessperspectives.org](http://www.businessperspectives.org)

**Received on:** 27<sup>th</sup> of February, 2021

**Accepted on:** 20<sup>th</sup> of April, 2021

**Published on:** 27<sup>th</sup> of April, 2021

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# ANALYSIS OF THE GAP IN ENTERPRISE ACCESS TO RENEWABLE ENERGY BETWEEN RURAL AND URBAN AREAS IN CAMEROON

## Abstract

Permanent access to energy is an essential pillar of economic development. However, there is a growing evidence that contemporary energy systems are not able to provide energy to the entire population on a sustainable basis and at affordable prices. In the face of these challenges, renewable energy can play an important role, especially in rural areas where access to centralized electricity grids is difficult. This paper aims to examine the access gaps of enterprises to renewable energy between rural and urban areas in Cameroon. The analysis is based on a sample of 209,482 enterprises, taken from the Second General Census of Enterprises in Cameroon (RGE-2) carried out by the National Institute of Statistics (NIS). The econometric estimations, obtained using the Blinder-Oaxaca decomposition, reveal that access rate to renewable energy for firms in rural areas is lower than that of firms located in urban areas. An increase in the level of education of the promoter of an enterprise, obtaining credit from banks, microfinance and savings, and the formalization of enterprises in rural areas can also contribute to reducing the gap in rural areas in terms of accessing to renewable energy. The discrimination suffered by rural enterprises related to the gender of entrepreneurs, the sector of activity, the business environment and professional experience tend to increase this gap. To reduce this gap, there is a need to promote access to finance for rural enterprises and their migration from the informal to the formal sector.

**Keywords** renewable energies access, firm, rural areas, urban areas

**JEL Classification** O13, O18, O55, Q40

## INTRODUCTION

Cameroon is a low emitter of greenhouse gases, but nevertheless aims to contribute to their reduction. That is why it signed the Paris Agreement on Climate Change. Many countries have opted for cleaner and environmentally friendly energy production technologies to cope with the horrors of climate change. Although they constitute only a small part of total global primary energy, renewable energy sources generate less CO<sub>2</sub> emissions than non-renewable sources, which constitute a significant share of total global primary energy (Zeng et al., 2019). In Cameroon, the consumption of renewable energies during the period 2000–2017 represents between 78% and 84.5% of global energy consumption (IEA et al., 2020).

One of the overall objectives pursued by Cameroon's National Development Strategy for the period 2021–2030 (NDS30) is to put in place conditions conducive to economic growth, the accumulation of national wealth and the structural changes indispensable for the industrialization of the country. To achieve this, Cameroon plans, in particular, to increase the installed capacity of electricity



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**Conflict of interest statement:**

Author(s) reported no conflict of interest

production to 5,000 megawatts by 2030, by pursuing its policy of developing a mix of energy based on hydroelectric power, photovoltaic energy, gas-based thermal energy and energy from biomass.

During the first phase of Vision 2035 (2010–2020), installed electrical power generation capacity increased from 933 megawatts to 1,650 megawatts, leaving a gap of 1,350 megawatts of generation capacity compared to the target of 3,000 megawatts envisaged in 2020 (MINEPAT, 2020). Cameroon has a 63% access rate to electricity in 2018 (IEA et al., 2020). This indicator is up by 53.65%, 18.66% and 6.77%, respectively, compared to the years 2000, 2010 and 2015. This performance is the result of a series of projects, including the construction of the Lom Pangar and Memvé'élé dams, the rehabilitation of the Limbé thermal power plant, and the installation of photovoltaic solar power plants. At the same time, the rate of access to electricity was 93% in urban areas and 23% in rural areas in 2018 (IEA et al., 2020). Thus, about 77% of rural areas do not have access to electricity in Cameroon. This shows that, despite its potential, Cameroon still has difficulty producing enough electricity to meet local demand (Ndouyou, 2019). There is a discontinuity in electricity service to subscribers due to numerous load shedding incidents, notably due to incidents on the transmission and distribution networks that result in losses of about 40% of the energy produced (MINEPAT, 2020). This inadequacy in power generation is a major obstacle to the development of economic activity and private investment.

## 1. LITERATURE REVIEW

The seminal work of Sadorsky (2009) and Chang et al. (2009) laid the groundwork for the analysis of the determinants of renewable energy consumption. Over the last decade, the majority of studies considered income and prices as fundamental variables of renewable energy consumption. Li et al. (2020) show that rising GDP and energy prices are driving the growth of renewable energy consumption in OECD countries. On the other hand, Omri and Nguyen (2014) find that over the period 1990–2011, renewable energy consumption did not increase significantly with GDP growth in 64 countries. Nyiwul (2017) obtains a similar result in a panel of 27 Sub-Saharan African countries over the period 1980–2011.

By using the GMM<sup>1</sup> type model, Omri and Nguyen (2014) show that higher oil prices on the world market do not stimulate demand for renewable energy. Increasing consumption of non-renewable energy reduces the consumption of renewable energy (Salim et al., 2014). Apergis and Payne (2011) show that the increase in demand for non-renewable energy does not significantly in-

fluence the consumption of renewable energy in emerging countries.

Moreover, some authors have introduced environmental variables in the analysis of the determinants of renewable energy consumption. Apergis and Payne (2014) show, by using the VECM<sup>2</sup> model, that an increase in CO<sub>2</sub> emissions leads to an increase in renewable energy consumption in a sample of 7 Central American countries. On the other hand, Lucas et al. (2016) demonstrate, using PCSE<sup>3</sup> and FGLS<sup>4</sup> models, that the signature of the Kyoto Protocol did not significantly influence the consumption of renewable energy in the European Union. It should be remembered that the signatory countries of the Kyoto Protocol, which is an international treaty, had decided to reduce their greenhouse gas emissions by at least 5% over the period 2008–2012 compared to 1990 levels. Nyiwul (2017) portrays an ambiguous result. Indeed, using a DOLS<sup>5</sup> model, he shows that an increase in CO<sub>2</sub> emissions does not significantly stimulate the consumption of renewable energy in Africa. On the other hand, this effect is significant when he uses a FMOLS<sup>6</sup> model.

1 GMM: generalized method of moments.

2 VECM: vector error correction model.

3 PCSE: Partial Correlated Standard Errors.

4 FGLS: Feasible Generalized Least Squares.

5 DOLS: dynamic least squares.

6 FMOLS: fully modified least squares.

Romano and Scandurra (2016) show that rising CO<sub>2</sub> emissions stimulated investments in renewable energy during the period 1980–2008 in low-income countries, upper middle-income countries and high-income countries. For the period 2004–2011, Romano et al. (2017) examined the effect of pro-environmental measures on renewable energy investments using a PCSE<sup>7</sup> model. Their results reveal ambiguity. Indeed, contrary to regulatory measures, fiscal measures and public investment measures significantly favor renewable energy investments in developed countries. In developing countries, only fiscal measures have a positive and significant impact on the promotion of investments in developing countries. In a recent study conducted in OECD countries, Li et al. (2020) demonstrate, using a CS-ARDL<sup>8</sup> model, that eco-innovation promotes renewable energy consumption.

Continued investment in R&D and human capital development are likely to affect renewable energy consumption at the Micro and Macro levels. At the micro level, human capital development reinforces pro-environmental attitudes that may manifest themselves in the selection of energy efficient and, therefore, less energy consuming appliances (Broadstock et al., 2016). Human capital development can promote the adoption of modern technologies and contribute to a country's shift towards renewable or clean energy consumption (J.-W. Lee & H. Lee, 2016). According to the endogenous growth theory, the strengthening of human capital, considered as a factor of production, can boost agricultural or industrial production, with a corollary increase in energy consumption. Moreover, human capital has an effect on technological progress (Zhang et al., 2018), which is likely to influence energy demand. Yao et al. (2019) and Li et al. (2020) assert that the development of human capital promotes the consumption of renewable energy.

Other variables have been introduced to examine the determinants of renewable energy consumption, including trade openness and population. As concerns trade opening, Omri and Nguyen (2014) show that it has mixed effects on the consumption of renewable energy. Indeed, it significantly boosts renewable energy consumption in upper middle class and low-in-

come countries. This is not the case in high-income countries. With regard to population, Nyiwul (2017) argues that an increase in population favors the consumption of renewable energy.

In the economic literature, forecasting models are also often used to predict nuclear and hydroelectric energy consumption. Applying the CCRGM (1,1) model, Luo et al. (2020) predict that nuclear energy consumption will continue to increase over the decade 2019–2028 in North America, while hydroelectric energy consumption will peak and decline thereafter. Similarly, GRBM (1.1), Xiao et al. (2020) show that China's coefficient of preference for total energy consumption (0.7103) is lower than that of India (0.8799) and that China's coefficient of preference for clean energy consumption (0.9665) is higher than that of India (0.7155). This implies, according to these authors, that China has less interest in increasing total energy consumption but more interest in popularizing clean energy.

After reviewing the literature on the determinants of renewable energy consumption, a few observations emerge. Firstly, macroeconomic aspects have received considerable attention in the economic literature and experiments have been conducted mainly in developed and emerging countries. Microeconomic work on this topic have often ignored the behavior of production units, preferring to focus for the most part on the behavior of households or individuals. Based on survey data collected from 682 people in the Chinese city of Tianjin, Xie et al. (2019) find, by using the dichotomous dual-limit choice method, that 69.50% of individuals are willing to pay for clean energy. Estimated at USD 11.51 per month, the average willingness to pay is positively influenced by trust in the environmental management authority, knowledge about green electricity, education and income. By conducting a study in 4 Ghanaian regions, Twumasi et al. (2020) find, using a probit model with instrumental variables and a tobit model with instrumental variables, that access to credit from financial institutions promotes household consumption of clean energy. Moreover, this demand for clean energy increases with the level of education of the head of the household and his

7 PCSE: Panel-Corrected Standard Error.

8 CS-ARDL: Cross-Sectional Autoregressive Distributive Lag.

or her relationship with a city dweller. However, it decreases with the age of the head of the household and the size of the household.

Secondly, while most studies recognize the gap in terms of renewable energy consumption between urban and rural areas, the causes of this gap are not documented. Nevertheless, there are studies that have shown the effects of urbanization on the consumption of fossil or renewable energy (Wang et al., 2014) and the determinants of renewable energy consumption in rural areas (Twumasi et al., 2020). Fang (2011) shows, from Chinese data collected over the period 1978–2008, that a 1% increase in renewable energy consumption leads to an increase in real GDP by 0.120%, GDP per capita by 0.162%, annual per capita income of rural households by 0.444% and annual per capita income of urban households by 0.368%.

## 2. AIMS

This study aims to enrich the economic literature on the determinants of access to renewable energies. Specifically, it aims to (i) analyze the access gap of enterprises to renewable energy between rural and urban areas in Cameroon and (ii) propose instruments to reduce this gap.

## 3. METHOD

The above-mentioned studies have used several macroeconometric techniques to analyze the determinants of renewable energy consumption and energy consumption forecasting models<sup>9</sup>. In this study, a microeconomic approach was chosen. When attempting to examine the gaps of a dichotomous dependent variable between two groups, it is often recommended to use Fairlie's (2005) decomposition method or the Blinder-Oaxaca method for non-linear models developed by Bauer and Sinning (2008). The latter is based on the decomposition of the differences between two parts: an explained part (which presents the differences between the observed characteristics) and an unexplained part (which highlights the differences in the treatment received by individuals in the field).

9 Such as GM, NGM, DGM, ARGM, ENGM, CCRGM, GRBM and Verhulst's grey clean model.

### 3.1. Data source

The data used comes from the Second General Census of Enterprises in Cameroon (RGE-2) conducted by the NIS (2018). The geographical scope of this operation is the entire national territory. The sampling design is stratified at two levels. At the end of this RGE-2, the balance sheet shows 209,482 listed companies and establishments, geographically locatable and operating in a fixed business premises or a developed site. This value also corresponds to the size of the sample of this study, since all companies provided information on their location and the use of clean energy.

### 3.2. The econometric model specification and variables description

Considering the equation for the clean energy consumption of firms estimated by the logit method independently for urban and rural areas based on the literature presented in the previous section, let's consider the following equation:

- for enterprises in urban areas

$$ERN_{Ui} = X'_{Ai} \beta_{SF} + \varepsilon_{SFi}; \quad (1)$$

- for enterprises in rural areas

$$ERN_{Ri} = X'_{Si} \beta_{SI} + \varepsilon_{Sii}. \quad (2)$$

Based on the Oaxaca and Ramsom (1999) methodology, the access gap to renewable energy can be broken down as follows:

$$\begin{aligned} \overline{ERN}_U - \overline{ERN}_R &= \widehat{EP} + \widehat{UP} = \\ &= (\overline{X}_U - \overline{X}_R)' \widehat{\beta}_{1U} + \overline{X}'_R (\widehat{\beta}_U - \widehat{\beta}_R), \end{aligned} \quad (3)$$

where  $\overline{ERN}_U$  is the rate of access of enterprises to renewable energy in urban areas,  $\overline{ERN}_R$  is the rate of access of enterprises to renewable energy in rural areas, and  $\widehat{\beta}$  is the estimated values of the coefficient.

The first term, denoted  $\widehat{EP} = (\overline{X}_U - \overline{X}_R)' \widehat{\beta}_{1U}$ , represents the gap in enterprises' access to renew-

able energy due to differences in average characteristics between urban and rural areas, derived using coefficients estimated for all enterprises in the study sample. For example, if the promoters of rural enterprises have a higher level of education than urban enterprises, this contributes positively to their increased access to renewable energy compared to urban enterprises. This first term is the “explained” part of the differences in access to renewable energy.

The second term in this equation,  $\widehat{UP} = X'_R(\widehat{\beta}_U - \widehat{\beta}_R)$ , is the difference in valuation between the characteristics of firms in urban and rural areas. This second term is the “unexplained” part of the gap in access to renewable energy.

Specifically, equation (3) of the model can be rewritten as follows:

$$\overline{ERN}_U - \overline{ERN}_R = \widehat{EP} + \widehat{UP}, \tag{4}$$

with

$$\begin{aligned} \widehat{EP} = & (\overline{AEA}_U - \overline{AEA}_R)\widehat{\beta}_{1U} + (\overline{SF}_U - \overline{SF}_R)\widehat{\beta}_{2U} + \\ & + (\overline{SA}_U - \overline{SA}_R)\widehat{\beta}_{3U} + (\overline{EXP}_U - \overline{EXP}_R)\widehat{\beta}_{4U} + \\ & + (\overline{LOC}_U - \overline{LOC}_R)\widehat{\beta}_{5U} + (\overline{BAN}_U - \overline{BAN}_R)\widehat{\beta}_{6U} + \\ & + (\overline{EMF}_U - \overline{EMF}_R)\widehat{\beta}_{7U} + (\overline{SAV}_U - \overline{SAV}_R)\widehat{\beta}_{8U} + \\ & + (\overline{MOM}_U - \overline{MOM}_R)\widehat{\beta}_{9U} + (\overline{INT}_U - \overline{INT}_R)\widehat{\beta}_{10U} + \\ & + (\overline{ORD}_U - \overline{ORD}_R)\widehat{\beta}_{11U} + (\overline{SEX}_U - \overline{SEX}_R)\widehat{\beta}_{12U} + \\ & + (\overline{EDU}_U - \overline{EDU}_R)\widehat{\beta}_{13U} + (\overline{MS}_U - \overline{MS}_R)\widehat{\beta}_{14U}, \end{aligned} \tag{5}$$

and

$$\begin{aligned} \widehat{UP} = & \overline{AEA}_R(\widehat{\beta}_{1U} - \widehat{\beta}_{1R}) + \overline{SF}_R(\widehat{\beta}_{2U} - \widehat{\beta}_{2R}) + \\ & + \overline{SA}_R(\widehat{\beta}_{3U} - \widehat{\beta}_{3R}) + \overline{EXP}_R(\widehat{\beta}_{4U} - \widehat{\beta}_{4R}) + \\ & + \overline{LOC}_R(\widehat{\beta}_{5U} - \widehat{\beta}_{5R}) + \overline{BAN}_R(\widehat{\beta}_{6U} - \widehat{\beta}_{6R}) + \\ & + \overline{EMF}_R(\widehat{\beta}_{7U} - \widehat{\beta}_{7R}) + \overline{SAV}_R(\widehat{\beta}_{8U} - \widehat{\beta}_{8R}) + \\ & + \overline{MOM}_R(\widehat{\beta}_{9U} - \widehat{\beta}_{9R}) + \overline{INT}_R(\widehat{\beta}_{10U} - \widehat{\beta}_{10R}) + \\ & + \overline{ORD}_R(\widehat{\beta}_{11U} - \widehat{\beta}_{11R}) + \overline{SEX}_R(\widehat{\beta}_{12U} - \widehat{\beta}_{12R}) + \\ & + \overline{EDU}_R(\widehat{\beta}_{13U} - \widehat{\beta}_{13R}) + \overline{MS}_R(\widehat{\beta}_{14U} - \widehat{\beta}_{14R}). \end{aligned} \tag{6}$$

*ERN* is the qualitative variable that provides information on the enterprise’s use of clean energy. It takes the value 1 if it uses clean energy and 0 otherwise. Renewable energy is defined as the use of hydroelectric power, solar energy, geothermal energy, biomass and natural gas.

*EDU* measures the education level of the promoter of the enterprise. This qualitative variable has two modalities: 0 if he or she has a primary education diploma at most, and 1 if he or she has a secondary or higher education diploma.

*SEX* is the qualitative variable capturing the respondent’s sex. It has two modalities: 0 if female, and 1 if male.

*MS* is the qualitative variable that measures the marital status of the promoter of the business. It takes the value 1 if he or she is married, and 0 if not.

*BAN* is the qualitative variable that captures the enterprise’s access to bank financing. It admits two modalities: 1 if the enterprise has already obtained bank financing, and 0 if not. Using a panel data model, Al-Mulali and Lee (2013) show that financial development has favored the increase in renewable energy consumption in the Gulf Cooperation Council over the period 1980–2009.

*EMF* is the variable that measures the enterprise’s access to microfinance financing. It takes the value 1 if the enterprise has already obtained financing from microfinance institutions, and 0 if not.

*SAV* is the variable that measures the enterprise’s access to credit from savings. It takes the value 1 if the company has already obtained financing from savings, and 0 otherwise.

*SF* is the variable that provides information on the formal or informal nature of the enterprise. It admits two values: 1 if the enterprise belongs to the formal sector, and 0 if it operates in the informal sector. In this study, an enterprise is considered to belong to the informal sector when it does not keep accounts in accordance with OHADA standards and does not complete a fiscal and statistical declaration (FSD).

**ORD** is the dummy variable that provides information on computer use within the enterprise and takes the value 1 if the enterprise uses at least one computer, and 0 otherwise.

**INT** is the dichotomous variable that informs about the connection of the company to the internet network and takes the value 1 if the company is connected to the internet network, and 0 otherwise.

**MOM** is the dummy variable used to assess the adoption of mobile money by the enterprise and which takes the value of 1 if the enterprise carries out financial transactions via mobile telephony, and 0 otherwise.

**AEA** is the qualitative variable used to assess the business environment in Cameroon. It takes the value 1 if the enterprise does not recriminate against the business environment, and 0 otherwise.

**LOC** is the qualitative variable that provides information on the occupancy status of a professional premises to carry out activities. It admits two modalities: 1 if the enterprise is a tenant, and 0 if not.

**EXP** is the dichotomous variable that allows us to appreciate the IPU experience. It takes the value 1 if the IUP has more than 4 years of activity, and 0 otherwise.

**SA** is the qualitative variable that captures the IPU's sector of activity. This variable admits two modalities:

1 if the IPU carries out activities in the "trade" sector, and 0 if it carries out activities in the production sectors, in this case "industry" and "agriculture".

**ZON** is the qualitative variable that provides information on the location of the IPU. It admits two modalities: 0 if the IPU is located in an urban area, and 1 if it is located in a rural area.

## 4. RESULTS

Table 1 shows that the observation rate of the variables varies between 65% and 100%. The proportion of enterprises using renewable energy is slightly above average (52.9%). Furthermore, it can be observed that 18% of the enterprises in the sample are located in rural areas.

According to Table 2, the consumption of renewable energy by enterprises located in urban areas is higher than that of enterprises operating in rural areas. There appears a difference of 0.031 points, significant at the 1% threshold.

In addition, it is seen that in urban areas about 54.3% of business promoters have at least secondary education compared to 35.3% in rural areas. This suggests that the level of school dropout or discontinuation in rural areas is very high. In the same vein, it can be observed that in both urban and rural areas, there is a predominance of men at the head of enterprises. However, it seems to be more pronounced in rural areas.

**Table 1.** Elements of descriptive statistics

Source: Authors.

Variables	Observation	Observation, rate	Average	Std. dev	Minimum	Maximum
ERN	209,482	100%	0.529	0.499	0	1
AEA	136,936	65.369%	0.473	0.499	0	1
SF	149,264	71.254%	0.036	0.186	0	1
SA	209,482	100%	0.844	0.363	0	1
EXP	146,498	69.933%	0.537	0.499	0	1
LOC	152,893	72.986%	0.850	0.357	0	1
BAN	145,043	69.239%	0.037	0.189	0	1
EMF	145,025	69.230%	0.027	0.163	0	1
SAV	145,187	69.307%	0.150	0.357	0	1
MOM	145,093	69.263%	0.229	0.420	0	1
INT	145,684	69.545%	0.056	0.230	0	1
ORD	147,503	70.413%	0.131	0.337	0	1
SEX	146,552	69.959%	0.628	0.483	0	1
EDU	136,173	65.005%	0.503	0.500	0	1
MS	140,418	67.031%	0.647	0.478	0	1
ZON	209,482	100%	0.180	0.384	0	1

**Table 2.** Tests for comparison of means

Source: Authors.

Variables	Description	Urban areas	Rural areas	Difference	t-student
ERN	Average	0.554	0.523	0.031	10.961***
	Std. dev	0.002	0.001	0.002	–
AEA	Average	0.458	0.528	–0.0069	–21.125***
	Std. dev	0.001	0.002	0.003	–
SF	Average	0.040	0.017	0.023	19.298***
	Std. dev	0.0005	0.0007	0.001	–
SA	Average	0.847	0.827	0.020	9.724***
	Std. dev	0.0008	0.001	0.002	–
EXP	Average	0.523	0.590	–0.067	–20.754***
	Std. dev	0.001	0.002	0.003	–
LOC	Average	0.854	0.830	0.023	10.545***
	Std. dev	0.001	0.002	0.002	–
BAN	Average	0.039	0.027	0.012	10.325***
	Std. dev	0.0005	0.0009	0.001	–
EMF	Average	0.028	0.022	0.006	6.094***
	Std. dev	0.0004	0.0008	0.001	–
SAV	Average	0.156	0.127	0.029	12.667***
	Std. dev	0.001	0.001	0.002	–
MOM	Moyenne	0.220	0.259	–0.038	–14.254***
	Std. dev	0.001	0.002	0.002	–
INT	Average	0.062	0.030	0.032	21.736***
	Std. dev	0.0007	0.0009	0.001	–
ORD	Average	0.142	0.087	0.054	25.402***
	Std. dev	0.001	0.001	0.002	–
SEX	Average	0.610	0.697	–0.087	–27.951***
	Std. dev	0.001	0.002	0.003	–
EDU	Average	0.543	0.353	0.189	57.798***
	Std. dev	0.001	0.002	0.003	–
MS	Average	0.630	0.707	–0.076	–24.408***
	Std. dev	0.001	0.002	0.003	–

Note: \*\*\* represents significance at 1%.

Besides, the rate of access of enterprises to credit from banks and microfinance is too low in both urban and rural areas. However, the constraints on access to financing are more acute in rural areas.

It would appear that enterprises located in urban areas have a higher level of ICT connectivity than their rural counterparts. As an illustration, 6.2% of enterprises have access to the Internet in urban areas compared to 3% in rural areas. In the same vein, 14.2% of enterprises have at least one computer in urban areas against 8.7% in rural areas. However, this level of connectivity of enterprises to ICTs appears low.

The results recorded in Table 3 reveal that improving the business climate (AEA), belonging to the formal sector (SF), professional experience (EXP),

professional premises occupancy status (LOC), access to credit from a bank (BAN), microfinance (EMF) or savings (SAV) have a positive and significant influence on access to renewable energy. In the same vein, increasing the education level of business promoters (EDU), their gender (SEX) and marital status (MS) also contribute to increasing access to renewable energy.

On the other hand, enterprises operating in the “commercial” sector have relatively more difficulty in gaining access to renewable energy. The same is true for enterprises connected to the Internet network, as well as those living in rural areas.

Table 4 presents the results of the Oaxaca-Blinder decomposition of the renewable energy consumption differential by enterprises. The estimated average rate of renewable energy consumption



**Table 3.** Estimates of simple logit of the determinants of access to renewable energies

Source: Authors.

Variables	Model 1		Model 2	
	Coefficient	Std. dev	Coefficient	Std. dev
AEA	0.05122***	0.01391	0.02362*	0.01382
SF	0.21433***	0.06674	0.25786***	0.06653
SA	-0.01706	0.01604	-0.03835**	0.01601
EXP	0.73308***	0.01430	0.70061***	0.01418
LOC	0.49624***	0.01544	0.47369***	0.01542
BAN	0.29445***	0.04511	0.31338***	0.04497
EMF	0.29787***	0.04922	0.31512***	0.04908
SAV	0.19278***	0.02039	0.19951***	0.02032
MOM	0.28371***	0.01813	0.24209***	0.01798
INT	-0.15160***	0.05658	-0.12615**	0.05637
ORD	0.51034***	0.03633	0.51907***	0.03621
EDU	0.39102***	0.01448	0.42958***	0.01436
MS	0.09737***	0.01428	0.06073***	0.01418
SEX	0.13687***	0.01428	0.09847***	0.01416
ZON	-0.44083***	0.01689	-	-

Note: \*, \*\* and \*\*\* represent significance at 10%, 5% and 1%, respectively.

by businesses in rural areas is lower than that of businesses located in urban areas. In fact, the estimated average consumption rate of renewable energy by enterprises in rural areas is approximately 69.22%, while that of enterprises located in urban areas is approximately 77.9%. This corresponds to a difference of about 8.71 points.

The gap linked to the explained share equation reflects the increase in the rate of access to renewable energy by enterprises in rural areas, if they had the same characteristics as those located in urban areas. This is the gap that would remain in the absence of the disparities between rural and urban areas, i.e. the characteristics of enterprises in the two above-mentioned areas are identical. The results show that the explained part related to the differences recorded in terms of individual characteristics represents about 1.29% of the total gap.

The explained share of the gap in enterprises' access to renewable energy between urban and rural areas is significantly and positively influenced by the variables representing membership in the formal sector (SF), occupation status of a business premises (LOC), access to financing from a bank (BAN), microfinance (EMF) and savings (SAV), computer ownership (ORD) and level of educa-

tion (EDU). On the other hand, it is significantly and negatively influenced by the assessment of the business environment in Cameroon (AEA), the professional experience of the enterprise (EXP), the use of internet (INT), the use of mobile money during financial transactions (MOM) and the marital status of the enterprise promoter (MS).

In addition, the second gap related to the unexplained (see equation (3)) part equation represents 98.71% of the total gap. This result reveals that the discrimination suffered by enterprises located in rural areas in Cameroon in terms of access to renewable energy predominates when trying to explain the gaps between urban and rural areas. In principle, the delay of realization of Low Voltage connection by ENEO is 5 working days in urban areas against 15 days in rural areas<sup>10</sup>. According to the facts on the ground, these delays are still very long in rural areas.

This discrimination is significantly and positively influenced by the assessment of the business environment in Cameroon (AEA), sector of activity (SA), professional experience (EXP), status of occupation of a business premises (LOC) and the gender of the company promoter. On the other hand, it is significantly and negatively influenced

10 <https://eneocameroon.cm/index.php/fr/clients-industriels-vos-preoccupations/clients-industriels-vos-preoccupations-je-m-abonne>.

by access to financing from banks (BAN) and savings (SAV), use of a computer (ORD) and the level of education of the company promoter (EDU).

**Table 4.** Blinder-Oaxaca decomposition results

Source: Authors.

Variables	Model 3		Model 4	
	Coefficient	Std. dev	Coefficient	Std. dev
Urban areas	0.77938***	0.00137	0.77843***	0.00137
Rural areas	0.69226***	0.00291	0.69195***	0.00290
Difference	0.08711***	0.00321	0.08649***	0.00321
Explained variance	0.00111*	0.00065	0.00307***	0.00087
Unexplained variance	0.08600***	0.00319	0.08342***	0.00317
<b>Explained part equation</b>				
AEA	-0.00023**	0.00011	-0.00048***	0.00011
SF	0.00024*	0.00013	0.00040***	0.00013
SA	-0.00002	0.00002	0.00003	0.00003
EXP	-0.00410**	0.00175	-0.00698***	0.00048
LOC	0.00076**	0.00038	0.00133***	0.00023
BAN	0.00022**	0.00011	0.00037***	0.00008
EMF	0.00013*	0.00007	0.00022***	0.00006
SAV	0.00040**	0.00019	0.00061***	0.00011
MOM	-0.00123**	0.00053	-0.00206***	0.00020
INT	-0.00024*	0.00014	-0.00039**	0.00015
ORD	0.00133**	0.00063	0.00228***	0.00029
EDU	0.00528**	0.00251	0.00880***	0.00097
MS	-0.00056**	0.00025	-0.00107***	0.00014
SEX	-0.00086**	0.00038	-	-
<b>Unexplained part equation</b>				
AEA	0.01037***	0.00301	0.01140***	0.00297
SF	0.00065	0.00044	0.00064	0.00044
SA	0.03684***	0.00580	0.04042***	0.00558
EXP	0.01983***	0.00343	0.02188***	0.00339
LOC	0.02786***	0.00551	0.03229***	0.00539
BAN	-0.00286***	0.00068	-0.00280***	0.00068
EMF	-0.00088	0.00056	-0.00086	0.00056
SAV	-0.00548***	0.00132	-0.00565***	0.00132
MOM	-0.00271	0.00193	-0.00221	0.00193
INT	0.00030	0.00071	0.00023	0.00071
ORD	-0.00295**	0.00126	-0.00258**	0.00126
EDU	-0.01287***	0.00260	-0.01279***	0.00260
MS	0.00224	0.00436	0.00345	0.00430
SEX	0.01566***	0.00426	-	-

Note: \*, \*\* and \*\*\* represent significance at 10%, 5% and 1%, respectively.

## 5. DISCUSSION

Table 4 shows that increasing the number of formal sector firms in rural areas can help close the gap in renewable energy consumption between

urban and rural areas. Informal sector enterprises are often at a disadvantage in terms of access to renewable energy. For a connection to the ENEO electricity grid, companies are required to be registered in the Trade and Personal Property Credit Register. This requirement is prohibitive for informal sector enterprises. Enterprises in the formal sector generally benefit from easier access to standard utility connections such as electricity, water and telephone (Ingram et al., 2007). In addition, these enterprises are more inclined to invest in renewable energy because they have easier access to bank financing and land. Based on a representative sample of informal enterprises in seven West African cities, Grimm et al. (2013) find no evidence of a systematic and significant contribution of access to electricity to business performance. However, focusing on a more homogeneous sample of tailors in the city of Ouagadougou, Burkina-Faso, these authors find that electricity increases firm performance by stimulating the adoption of modern machinery and extending working hours.

Improving rural enterprises' access to credit from banks, MFEs, and tontines can help reduce the gap in renewable energy consumption between urban and rural areas. As an emerging industry, renewable energy can be very risky, and different sources of investment are needed to finance different projects. Venture capital and equity financing may be more appropriate for small projects with new technologies, while bank or debt financing is needed for larger projects (Ji & Zhang, 2019). Al-Mulali et al. (2015) show that credits to the economy have mixed effects on renewable energy sources in Europe over the period 1990–2013. Indeed, an increase in credits stimulates the production of five renewable energy sources that are renewable energy fuels or waste production, hydroelectric production, nuclear production, solar production and wind production. But this impact is only significant for wind generation. Anton and Afloarei Nucu (2019) find that the financial development favors the consumption of renewable energy in the European Union over the period 1990–2015. Ji and Zhang (2019) obtain a similar result in the case of China. He et al. (2019) have highlighted the role of green credit on the development of the renewable energy sector in China. On the other hand, Khan et al. (2020) show that financial development has reduced renewable energy consumption in G7 countries over the period 1995–2017.

Increasing the number of rural business developers with at least a high school diploma can help narrow the gap in renewable energy consumption between urban and rural areas. Khan et al. (2020) show that human capital is conducive to renewable energy consumption. Similarly, Zafar et al. (2020) and Ponce et al. (2020) show that education contributes to the improvement of renewable energy consumption. Mahalick et al. (2021) show that increasing the proportion of individuals with secondary education in BRICS<sup>11</sup> countries contributes to the improvement of environmental quality. Noting that public awareness alone is not enough to facilitate the transition to renewable energy consumption in the European Union, Marra and Colantonio (2020) recommend the national governments to strengthen education by working on schools, training institutions and universities. Specifically, they should take action to develop and assess knowledge, skills and attitudes towards climate change and sustainable development, providing support materials and facilitating the exchange of good practices in networks of teachers' training programs.

Improving rural businesses' access to NICTs (internet, computers and mobile money) would have mixed effects on reducing the gap in access to renewable energy between rural and urban areas. Indeed, unlike network connection and the use of mobile money, the use of computers by rural businesses can enable them to reduce the gap in access to renewable energy compared to urban businesses. Econometric results from some studies conducted in South Asia (Murshed, 2020) show that ICT trade directly increases the consumption of renewable energy, improves renewable energy shares, reduces energy consumption intensity, facilitates the adoption of cleaner cooking fuels and reduces carbon dioxide emissions. In addition, ICT trade indirectly mitigates carbon dioxide emissions by increasing levels of renewable energy consumption, improving energy efficiency and increasing access to cleaner cooking fuels. Sectors driven by ICTs offer opportunities for renewable energy consumption and environmental protection, including telecommuting, video conferencing, optimizing transportation and travel, e-commerce, dematerializa-

tion of administrative procedures and minimizing energy consumption in buildings. The use of ICTs contributes notably to the improvement of agricultural, industrial and commercial practices, air and water pollution control, the efficiency of both the energy and transportation sectors and the goods and services sector.

The quality of the business climate can reinforce the discrimination faced by rural enterprises in terms of access to renewable energy. Gennaioli and Tavoni (2016) show that low quality institutions (under the influence of corruption) do not favor the wind energy production sector. Cadoret and Padovano (2016) show that the quality of governance to the development of the renewable energy sector in the European Union. Kaller et al. (2018) prove that improved regulatory quality and reduced corruption lead to lower electricity prices in 22 European countries over the period 2005–2013. Lower hydropower prices stimulate the consumption of renewable energy. Saidi et al. (2020) find that the establishment of an attractive institutional framework (including low levels of corruption, low bureaucracy, law and order, and democracy) is important to stimulate the development of renewable energy in MENA countries<sup>12</sup>.

The least experienced enterprises are also discriminated against in terms of access to renewable energy. This result suggests that in order to ensure the connection of an enterprise to its electricity grid, it would seem that ENEO takes into account the experience of the enterprise itself.

Women entrepreneurs seem to be discriminated against in terms of access to renewable energy. This result reinforces the World Bank's 2019 result, which shows that Cameroon is ranked 159th in the world in terms of gender equality in employment and entrepreneurship. Specifically, this discrimination, according to the World Bank, is perceptible at the level of:

- “travel”, there are still impediments to women's freedom of movement, since there are still cases where women cannot freely decide where to go, travel and live;

11 These are Brazil, Russia, India, China, and South Africa.

12 Middle East and North Africa.

- “access to employment”, women still face barriers to getting a job or practicing a trade or profession without authorization;
- “marriage”, since some women are not protected by law when they are subjected to domestic violence;
- “business management”, since there are some women who encounter obstacles to starting and running a business, particularly when registering businesses, opening bank accounts and signing contracts;
- “asset management”, there are gender differences in ownership and succession.

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## CONCLUSION

The potential positive impact of renewable energies on sustainable development seems to be the subject of consensus in the economic literature. Reducing the gap in access to renewable energy between rural and urban enterprises is of paramount importance for rural productivity, poverty alleviation, unemployment and rural-urban migration. This study highlights the factors likely to influence the gap in enterprises' access to renewable energy between rural and urban areas in Cameroon. At the methodological level, the paper used descriptive statistical techniques and the Oaxaca-Blinder decomposition using the database resulting from the 2nd general census of enterprises.

Statistical and econometric results reveal that enterprises' access to renewable energy in rural areas is lower than in urban areas. Moreover, there is a predominance of unexplained gap, which suggests that there is discrimination against enterprises in rural areas. Also, they show that in rural areas, improving the level of education of the business promoter, access to computers, obtaining credit from banks, micro-finance and savings, and formalizing businesses can also help reduce the gap in access to renewable energy. Discrimination against rural enterprises based on the gender of the entrepreneurs, the sector of activity, the occupation status of the business premises, the business environment and professional experience tend to increase this gap.

Therefore, to reduce the access gap to renewable energy between urban and rural areas, it might be advisable in rural areas to strengthen the capacities and skills of entrepreneurs, promote access to credit from banks, micro-finance and tontines, promote the migration of enterprises from the informal to the formal sector, and encourage the use of computers. In the same vein, measures should be taken to reduce the discrimination suffered by rural enterprises in terms of access to renewable energies by focusing on the gender of entrepreneurs, the business climate, the sector of activity, professional experience and the occupation status of business premises.

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