

Policy Brief: Is walk-through energy auditing effective on micro and small enterprises? Evidence from a randomized experiment in Addis Ababa, Ethiopia

August, 2022

Are energy audit programs effective for micro and small enterprises in Ethiopia? Is it cost effective for these types of firms to voluntarily implement energy audit recommendations?

We provide insights from “Impacts and drivers of policies for electricity access: micro-and-macroeconomic evidence from Ethiopia” project

KEY MESSAGES

This study conducted an energy audit for 400 micro and small enterprises in Addis Ababa, Ethiopia with following findings:

- Energy audits increased use of energy efficient appliances by 14%, resulting in 10% reduction in electricity consumption.
- However, the cost saving was equivalent to about one dollar per month, and this may not be economically significant comparative to energy auditing and implementation of efficiency measures.
- Unless the auditing is subsidized or made compulsory such that firms must bear these costs as part of their licensing and other costs, it seems unlikely that firms will implement them voluntarily.

Background and Methodology

An energy audit program considers the energy consumption of firms, type of energy appliances used, and assesses whether energy losses due to use of particular appliances or production process can otherwise be reduced. It is regarded as one of the mechanisms for providing firms information on how energy efficiency can be improved, since lack of information is a major barrier to use of energy efficient appliances.

Although energy audit programs are now well established and commonplace in Europe and the US, they are still very new in many low-income countries. In Ethiopia, for example, the only institution that provides an auditing service is the government regulator – the Ethiopian Energy Authority (EEA), and this service is mainly provided to large manufacturing industries that consume very substantial amounts of electricity.

The EEA recently developed an Energy Efficiency Program and Activity Plan (EEA, 2020); energy auditing of industries and buildings are key components of this program. Participation by industries has thus far been voluntary. In addition, micro and small manufacturing enterprises have to date not been included, despite the fact that the micro and small enterprises constitute more than 50% of all firms in Ethiopia and consume about one third of its electricity (Hassen *et al.*, 2018).

Given the significance of these neglected firms in terms of electricity consumption, this study aimed to understand the impacts of a simple energy-auditing program on micro (having 5 or less employees) and small enterprises (having 6 to 30 employees) electricity consumption in Addis Ababa.

This study is based on baseline (2016) and follow up survey (2020) data of 1000 micro and small

enterprises. In cooperation with experts from the EEA, energy audits were conducted for 400 of the 1000 firms.

Both qualitative (descriptive) and quantitative data analysis methods were used to analyze the data.

Descriptive Result

Revenue and costs of firms

In the baseline and follow up survey, firms were asked about their production costs and revenues. As shown in Table-1, the sample firms were making about 17% profit (profit to cost ratio) in 2016 and only 4% in 2020. Labour and material cost constitutes of about 96% of the total cost in 2016 and about 78% in 2020. Electricity costs are less than 1% of the total cost of production of the firms. Such a low share implies firms have less incentive to implement energy efficiency programs voluntarily.

Table-1: Revenue and costs of firms

	2016	2020
Annual average Revenue in ETB	960783	946522
Annual Average Cost in ETB	819023	908232
Annual average Profit in ETB	141760	38290.2
Profit percent ((profit/cost) X100)	17%	4%
Share electricity in the total cost	0.3%	0.4%
Share other utilities in the total cost	0.8%	0.7%
Share of labour cost in the total	20.0%	22.1%
Share of material cost in the total	75.7%	57.6%

Electricity consumption

Figure-1 shows the average electricity consumption measured in KWh and electricity cost of the non-audited firms in 2016 and 2020, the latter measured in Ethiopian Birr (ETB). This graph shows that the average electricity consumption of the non-audited firms increased by about 10% over this period, while the electricity cost increased by more than 87%.

Fig-1: Average electricity consumption (in KWh) and cost of non-audited firms

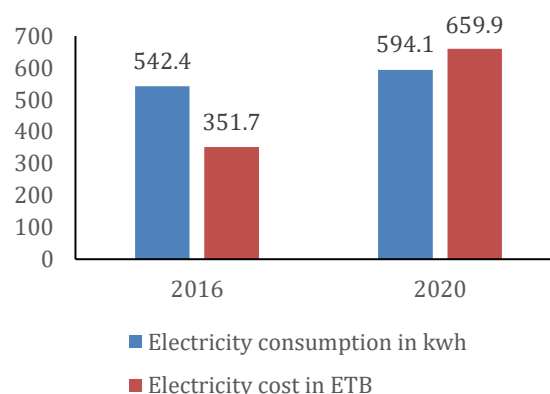
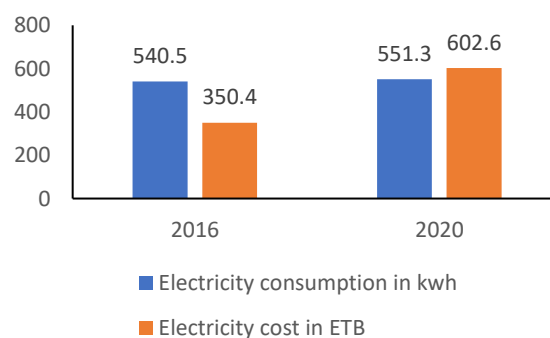


Figure-2 depicts the electricity consumption and expenditure of the audited firms. The graph shows that electricity consumption of the audited firms also increased in 2020, but only by about 2%, and that the electricity cost similarly increased by more than 72%.

The large increase in electricity costs for both audited and non-audited firms was due to a tariff reform implemented starting in 2018, that substantially increased tariffs in an attempt to improve cost recovery.

Fig-2: Average electricity consumption (in KWh) and cost of audited firms



Electricity consumption of both groups of firms increased in 2020, perhaps due to increased economic activity. At baseline, both audited and non-audited firms had nearly identical electricity consumption and costs. By 2020, however, the electricity consumption of non-audited firms was about 7% higher than that of the audited firms.

Quantitative Analytical Result

The above result is based on a descriptive graphical or tabular presentation of results which does not distinguish whether the decreased in electricity

consumption was due to energy audit or other factors. Further quantitative analytical was used (a regression model) to disentangle the effect of energy audit. Using this method, the study found that that the audits reduced electricity consumption by about 10% and increased the use of efficient appliances by 14% among audited firms.

Although audits reduce electricity consumption significantly, the savings do not appear to be economically significant from the firm perspective – equating to approximately one US dollar per month. Such savings are unlikely to exceed the cost of auditing and the implementation of efficiency measures.

Policy implications

The policy implication of the study is that auditing does reduce energy consumption and use of energy efficient appliances for micro and small enterprises, but that the savings from their implementation appears small, though they may provide benefits to the grid system as a whole.

Unless the auditing is subsidized, perhaps justified on the basis of system-wide utility benefits – or made compulsory such that firms must bear these costs as part of their licensing and other costs – it seems unlikely that firms will implement them voluntarily.

About the authors

Sied Hassen was a senior research fellow at Environment and Climate Research Centre (ECRC) based at the Policy Studies Institute (PSI) in Ethiopia until almost a year before the end of project period. Currently he is a consultant at the World Bank.

Abebe D. Beyene is a senior research fellow at ECRC, PSI, Ethiopia.

Marc Jeuland is an Associate Professor in the Sanford School of Public Policy, with a joint appointment in the Duke Global Health Institute.

Alemu Mekonnen is a professor of economics at the department of Economics of Addis Ababa University and Dean of the College of Business and Economics.

Tensay Hadush Meles is a postdoctoral researcher at the UCD School of Economics and UCD Energy Institute.

Samuel Sebsibie is a researcher at ECRC, PSI, Ethiopia.

Thomas Klug is research associate and program coordinator at Duke University.

Subhrendu K. Pattanayak is the Oak Professor of Environmental and Energy Policy at Duke University.

Michael A. Toman is currently a Senior Fellow at Resources for the Future (RFF). Mike served as a lead economist and research team manager in the World Bank Development Research Group.

The views expressed in this Policy Brief do not necessarily reflect the UK government's official policies.