Using Data to Improve Market Efficiency in Honduras' Power System

Summary

ENEE's[1] current liability levels are equivalent to 9.87% of Honduras's GDP and its balance sheets are constantly negative. This large deficit is a concern to the central government as a rise in debt levels is affecting the macroeconomic well-being of the country. Honduras' electricity sector has been facing key challenges: Electricity losses are high, and some sectors are not paying for their electricity consumption, as a result, ENEE is highly indebted.

We analyze previously unexplored sector data to obtain a better understanding of the sector. Based on our analysis, we recommend the following:

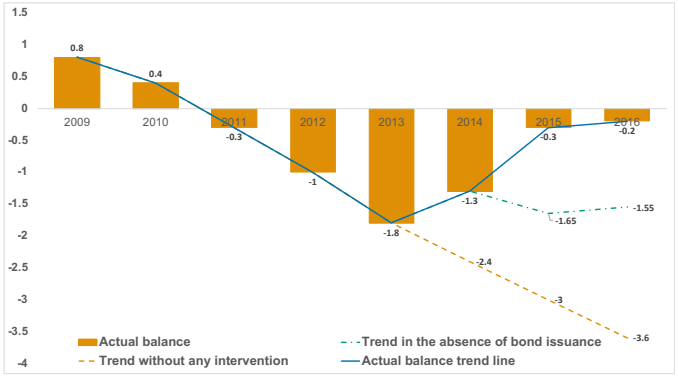
1. Collect on delinquent users in the commercial sector.
2. Address electricity losses through a smart-metering pilot program in the north-west region of the country focusing on the commercial sector.
3. Define a clear subsidy process, establishing how much should be given to each qualifying user.
4. Collect further data: data has been a barrier for further policy analysis. Our analysis raised new questions that could not be addressed with the current level of collected data.

Honduras' electricity sector has been facing key challenges: Electricity losses are high, and some sectors are not paying for consumption of electricity, as a result ENEE is highly indebted.

Problem Definition and Motivation

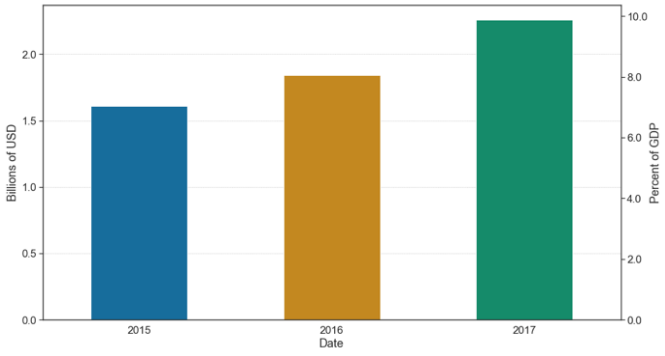
In 2013 and 2017, Honduras issued sovereign bonds to cover the financial losses of ENEE. Even with this intervention, ENEE's financial losses have continued to rise, its current liability levels are equivalent to 9.87% of Honduras's GDP and its balance sheets are constantly negative.

Figure 2: ENEE Global Balance as % of GDP (2009-2016)



ENEE's balances have normally been negative. The government issued sovereign bonds in order to curb ENEE's liabilities.

Figure 1: ENEE Liabilities as % of GDP (2015-2017)



ENEE liabilities were equivalent to 9.87% of GDP in 2017. ENEE's debt targets with the IMF were set to be zero by 2018.

In reference to the bonds, in 2016, the Commission of Public Credit of Honduras stated: "Given the strategic importance of ENEE to the government and its people, we have decided to take appropriate action to solve the situation, and with this mitigate any negative impacts the SOE could generate for the economy of the country." The bonds totaled $1.1 Billion.

In its 2014 Standby Agreement signed with the government, the International Monetary Fund (IMF) summarized the issues as such: "The deficit of ENEE (1.8 percent of GDP in 2013) derives mainly from below-cost electricity tariffs, high technical and non-technical losses, and operational inefficiencies."

[1] ENEE: Honduras' state-owned power company.

The government has made attempts to resolve the issues in the electricity sector by:

1. Providing financial support to the national power company.
2. Incentivizing renewables.
3. Changing legislation to further open the electricity market.
4. Hiring a private distribution agent.

Methodology

We question why these attempts have not fully addressed the persistent issues in the sector. After conducting a thorough review of the literature on Honduras' electricity sector, we conclude that clean and reliable data is a principal barrier for further analysis and subsequent policy recommendations. We take on the challenge of collecting and cleaning data that is dispersed throughout various institutions in the country.

The data collected covers the time period between January 2012 to October 2018. There is a total of 82 months' worth of data coming from various public sources. In some instances, the datasets used for analysis contain up to 6,938 unique observations.

This policy paper, through the use of data analysis, dives deep into exploring the issues being confronted by the power company and the government in order to:

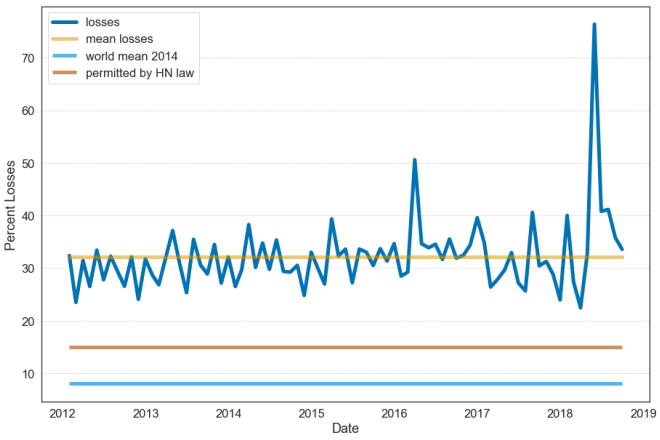
1. Shed light on what are the underlying causes of the sector's inefficiencies.
2. Learn what the analysis of large datasets can do for a power sector.

In the past, clean and reliable data has been a principal barrier for sector analysis and subsequent policy recommendations.

Data Analysis and Principal Results

Losses: Electricity losses average 32.14%, far above the 8% world average. Honduran law allows for 15% of losses to be transferred to consumers' electricity bill. In early 2016, the government contracted a private distributor with the purpose to reduce losses, but the data does not show improvement (see Figure 1).

Figure 1: Transmission and distribution losses



Consumption behavior: The four main consumers are the residential, commercial, high consumers and the industrial sector (Figure 2). Thus, any policy intervention in these sectors would have significant financial impacts.

There are some noteworthy patterns among some sectors and regions. As highlighted with the red rectangles in Figure 3, there are some periods during 2012-2016 in which the commercial sector payment per subscribers has been decreasing while their energy consumption increased. There are

Figure 2: Distribution of energy consumed by sector

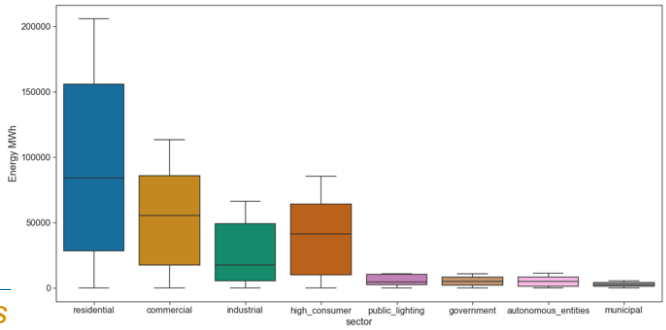
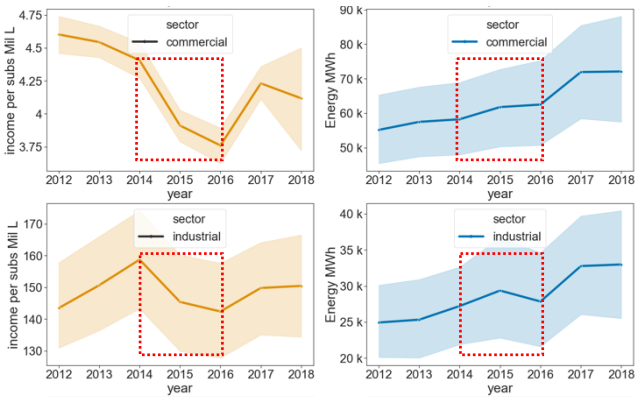


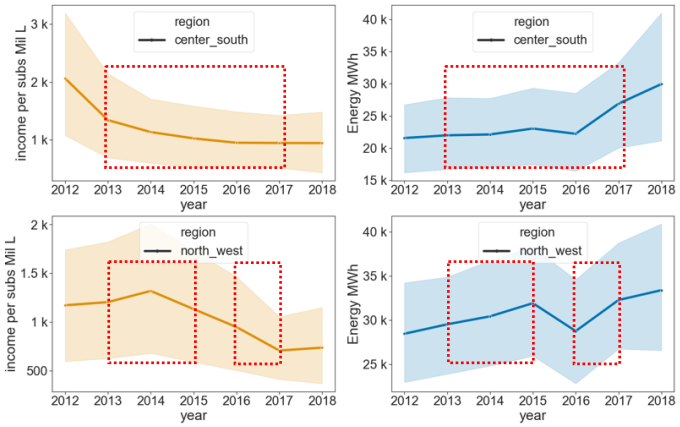
Figure 3: Trends of "total energy consumption" vs "income per subscriber" for commercial and industrial sectors



similar behaviors in other large electricity consumers such as in the industrial sector and high consumers. Possible explanations of these trends are subsidies or non-technical losses.

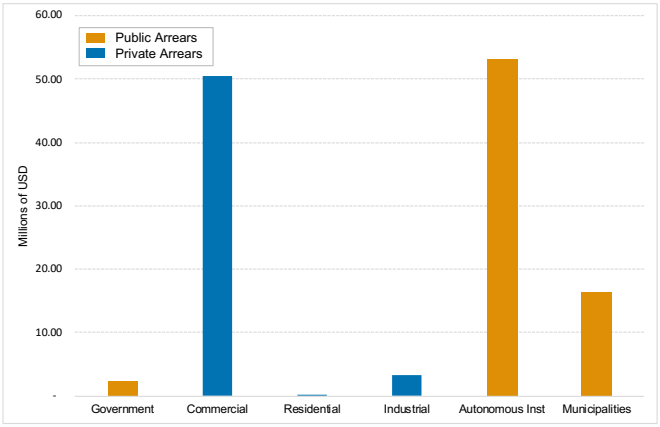
Another informative comparison of payment per subscriber behavior with their consumption pattern by region (Figure 4). As highlighted with a red square, there is a similar pattern of decreasing payment per subscriber while increasing consumption in the center south and north west regions.

Figure 4: Trends of "total energy consumption" vs "income per subscriber" for northwest and center-south regions



Delinquency on electricity bills: By the end of December 2018, the total debt owed to ENEE was approximately $155.81 Million, equivalent to 0.7% of GDP. Figure 5 shows that the public sector owes the most money to ENEE (65% of the debt), while the commercial represents 32.4% of the total debt owed to ENEE.

Figure 5: Total debt owed to ENEE by sector (Dec. 2018)



Principal Recommendations

As a result of the exploratory data analysis, important question relating to generation, consumption, payment, and ENEE's financial liabilities became sufficiently clear to be able to recommend specific policy interventions. In this section we present our policy recommendations along with an estimate of the impact each option could have. We first address what it would mean if the government decides to take no action. We then present the recommended policies which were chosen based on their: i) potential impacts, ii) technical correctness, iii) political and administrative feasibility.

Policy option 1: keeping status quo

Addressing the status quo is important in order to place our policy recommendations in perspective. Keeping the status quo implies:

1. Electricity losses will remain high at around the average 32.14 %.
2. ENEE Liabilities will keep growing.
3. A significant fraction of consumers will not pay their electricity bill.
4. Subsidies in the sector will remain unclear.
5. Incentives to renewables will remain high.

This situation is costly for ENEE and to the government. ENEE's finances have not improved over the past 7 years and the policy of keeping the status quo will result in continued poor financial performance of the sector.

Additionally, under the IMF Standby Agreement signed in 2014, Honduras committed to restoring "positive operating margins and [eliminating] ENEE's overall deficit progressively by 2018." This is a condition that is not being met. Not upkeeping the standby agreement with the IMF could have macro-financial implications as the country's access to better credit options could be limited. Keeping the status quo is not a technically correct option and not recommended.

Policy option 2:

We recommend a package including collecting on delinquent users, addressing

electricity losses, identifying subsidies and clarifying its process and collecting additional data.

Collecting on delinquent users is important. The commercial sector and public entities are not paying for electricity. Together, these two sectors represent a debt to ENEE of $155.81 Million. We suggest the Ministry of Finance to define a mechanism that enforces electricity consumption payment from public institutions.

Collecting on the commercial sector must be enforced. Capacity to collect exists as it is happening in both the industrial and residential sectors. This could begin immediately. Additionally, note that the commercial sector is the second largest consumer of electricity in the country, hence it is important to collect on their electricity bills.

Electricity losses between 2012 and 2018 have been 32.14% on average, this has represented a financial loss equivalent to 6.4% of 2017 GDP. In an unconstrained environment, the reduction of losses should happen at the country level in all regions and in all sectors. Unfortunately, this is expensive, and the government attempted to do this by hiring a private distribution company which has produced little results. Our analysis found strange consumption patterns of behavior in the commercial sector for both the northwest and central-south regions of the country (see Figure 3 and Figure 4). Given the limitations of the data used for this analysis, we cannot further distinguish whether these patterns of behavior are due to theft, subsidies, or some other factor. Therefore, ENEE needs to start metering and gathering metering data in a proper and formal manner. It is our recommendation that the government aids ENEE in implementing a rigorous remote metering program in the commercial sectors in the northwest and center-south regions of the country as a starting point.

Identify indirect subsidies: There are direct and indirect subsidies given in the sector, yet there is no clear data on how subsidies are structured. We recommend this process is made clear. If ENEE were to reduce non-technical losses to zero, then any indirect subsidies given through improper metering would disappear. In order to determine the size of this indirect subsidy proper metering must happen (as addressed in the previous recommendation). Once this indirect subsidy is identified, and assumed eliminated through the reduction of electricity losses, the government must define a subsidy process if it so wishes to provide one.

Collect additional data: Our analysis raised new questions that could not be addressed with the level of data collected. It is important to investigate such topics in future studies in order to design additional policy interventions. Of relevance are the following questions:

- What is the composition of ENEE's finances? Its costs and income.
- What are the costs of generation by power plant?
- What is the subsidy process? Who benefits from indirect subsidies?
- What is the Investment plan for generation expansion?
- How is priority dispatch for renewables distorting the market?

Why not Tariff Adjustments or Renegotiating Power Purchasing Agreements?

The IMF, and other studies, have suggested tariff adjustments. We suggest that this policy should happen but at a later stage. There are important reasons for this suggestion. ENEE first has to have proper metering in place before adjusting tariffs as an increase could induce an increase in non-technical losses (such as theft). Additionally, adjusting tariffs is politically difficult, even more-so when there is a sense that there are large inefficiencies in the sector that can be addressed prior to adjusting tariff. Finally, it seems that there are considerable amounts of direct and indirect subsidies given by the government, hence adjusting tariffs before having a clear vision of who is paying how much would yield unclear results.

Another government priority area is to renegotiate the contracts with private generators. We do not recommend that priority is placed on this unless the government has a clear understanding of ENEE's cost and income structure. As we presented in Figure 12, debt to private generators represent at most 11% of ENEE's total liabilities. This implies that there are other factors significantly more important within ENEE's liabilities that need to be understood before being fully addressed. This, therefore, is why we recommend the government to first understand and investigate ENEE's debt.