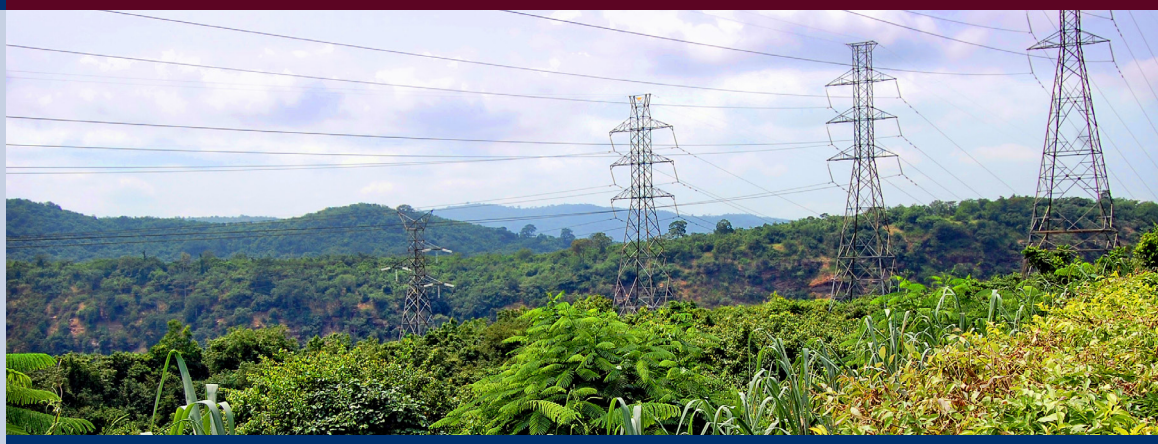
This project was implemented by ICF under the USAID Energy Efficiency for Clean Development Program (EECDP) Leader Award



ENERGY TARIFFS IN GHANA

March 2017

Time of Use (TOU) Tariff Objective

TOU tariffs are the most common dynamic pricing program in use today, and are used in developed economies around the world. The objective of the TOU tariff for the electric utility is to reduce peak loads and/or shift load from peak to off-peak periods.

The Electric Company of Ghana (ECG) collects energy consumption data from 1,700 industrial customers using smart meters.

INTRODUCTION

Time of Use (TOU) tariffs are a mechanism used to lower peak electricity demand with the goal of reducing load-shedding and/or the need for new power generation. By lowering prices during non-peak demand periods, TOU tariffs incentivize customers to shift their energy consumption away from peak periods to non-peak periods. If a significant amount of demand is shifted, it reduces the maximum amount of electricity needed at any given time, reliving pressure on existing power plants to increase capacity and produce more power. These tariffs incentivize customers to lower peak loads to reduce their electricity bills

In 2014, USAID EECDP conducted a TOU tariff analysis and program design with the Electric Company of Ghana (ECG). The analysis focused on the industrial sector as it is the largest electricity consumer at ECG and uses the greatest share of peak load. The presence of smart meters at customer sites enabled ECG and ICF to collect data to identify peak load periods and develop a model to determine tariff pricing calculations. A two-tier TOU tariff rate program for industrial customers was developed. If implemented in 2015, by 2019 the recommended tariff could achieve total demand savings of 56 MW, equivalent to around 5% of the industrial load and 2% of the system load.

Framework Overview

1. Conduct analysis of demand side energy use

Ghana is undergoing an electricity and power crisis due to chronic capacity and energy shortages. While all sectors are impacted, the industrial sector is particularly hard hit by the lack of reliable power. Understanding when and how energy is currently used within a utility's service territory is the first step to developing TOU tariffs. The project:

- Conducted a literature review of the Ghanaian power sector
  - Collected data from one of the main power suppliers, ECG related to: operations, business and cost structure, customer base, load, and technical challenges.
  - Collected additional information on the political, economic, and historical contexts of the power sector in Ghana from additional sources.

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TOU Tariff Program for Utilities serving Industrial Customers

Ghana's industrial sector is hard hit by the lack of reliable power supply and forced load shedding. A recent tariff increase to about U.S. $0.20/kWh (about twice the average U.S. retail price) fueled customer dissatisfaction with the utility and could negatively impact the competitiveness of Ghanaian industries.

- Analyzed ECG's electric meter data, demand factor and power factor data
  - ECG collects 15-minute interval smart meter data on around 1,700 industrial rate customers.
  - Detailed analyses of these data allowed for the development of hourly load shapes.

2. Determine utility costing periods and develop TOU tariff strategies

Key elements of a TOU program include specifying on-peak and off-peak time periods and setting appropriate prices for each. To determine these elements, the project:

- Analyzed load data to determine peak time periods for the entire system and specific customers
  - Reviewed the load data to determine peak energy use time periods for the entire ECG system and for 36 individual high voltage industrial customers.
  - Comparison of the two data categories indicated that industrial customers do not always follow the same hourly profiles as the overall system load.
- Developed a model to test the price elasticity impacts of multiple TOU rate structures
  - Conducted a literature review to determine estimates for price elasticity and ratio of on-peak to off-peak prices. Also added realistic revenue impact and rate structure constraints to the model to ensure financial and political acceptability.
  - Used the model to analyze three conservative ratios (2, 4 and 8) for effects of on-peak to off-peak rates.
  - Model indicated an average system peak load reduction of 8% with a peak price ratio of 2.
- Proposed a two-tier TOU tariff rate for industrial customers
  - The recommended on-peak energy charge (19 hours a day from 11 PM to 6 PM) is higher than the existing flat tariff charge. The off-peak energy charge (5 hours a day from 6 PM to 11 PM) is lower than the existing flat tariff charge.
  - The on-peak energy charge is at a price point designed to motivate industrial customers to shift a modest amount of their load from on-peak to off-peak.

3. Estimate impacts and costs of TOU tariff strategy

Customers and power companies are only likely to implement and utilize TOU tariff programs if they are financially beneficial to both. The project determined that:

- Between 2015 and 2019, customers on the TOU tariff could achieve total demand savings of 56 MW (over 2% of current ECG system peak load).
- Weighted against the large avoided capacity savings, this program is very cost-effective. The Utility Cost Test* indicated that for every Ghanaian Cedi (GHc) invested by ECG in the program, ECG customers would save 4.7 GHc in the long run.

4. Create a three-step marketing plan for pilot rollout support

Successful implementation of this program requires educating customers on the concept of TOU rates. TOU programs can reduce electricity rate increases, keeping production costs down. The following steps were recommended to successfully implement the plan:

1. Create marketing brochures to clearly communicate the program details. Implement a voluntary pilot with a small set of industrial customers.
2. Revise the program based on the findings of the pilot and launch 'opt-in' TOU program to build momentum. (3-6 months from program start date).

*Utility Cost Test (UCT) measures cost-effectiveness from the viewpoint of the sponsoring utility. It compares the avoided supply costs to the cost of the DSM program. UCT costs include DSM program costs, including incentive costs and non-incentive program delivery costs.

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Determine On-Peak and Off-Peak Time Periods

As with all USAID projects, ICF encourages the development of local expertise. The analysis conducted to determine the on-peak and off-peak time periods included a review of the system load for the entire ECG system and a selective review of a set of industrial customers' load.

3. Conduct evaluation, measurement and verification (EM&V) activities. Revise the program requirements and launch a mandatory program with exemptions for certain industries e.g. continuous process petrochemicals. (12-18 months from program start date).

Project Accomplishments

- Determined peak time periods for the entire ECG system and 36 high voltage industrial customers using ECG's smart meter data on around 1,700 industrial rate customers.
- Proposed TOU tariff strategy and estimated costs that show total program demand savings, between 2015 and 2019, of 56 MW (over 2% of current ECG system peak load).
- Developed a three-step marketing plan for pilot rollout support, including immediate, short term (3-6 months) and longer term (12-18 months) recommendations for how to scale up the project

Recommendations for Replication and Scaling-up

- Develop training and outreach programs industrial customers to implement recommended TOU tariff programs.
  - Industrial customers may not currently understand the concept of TOU rates and that TOU programs can reduce electricity rate increases thus avoiding increases in production costs.
  - Industrial customers may need additional assistance in implementing effective ways to shift their energy use profiles.
- Public recognition can expand outreach and accelerate TOU tariff program use
  - Development of government standards, regulations and "peak load reduction" awards can foster other power distribution companies to implement TOU tariffs.
  - Public support of TOU tariff programs can increase awareness to all customers and encourage other customer categories to participate.
- Establish pathways to address barriers that prevent implementation of TOU tariff programs
  - Working with government agencies can improve laws, rules, guidelines and regulation of initiatives to improve use of TOU tariff programs.
  - Collaborating with major stakeholders can improve stability and sustainability of interest and support implementation of TOU tariff programs.