Impact of Meter Replacements and Borehole Solarization on Water Service Provision in Kenya

USAID's Water, Sanitation, and Hygiene Finance (WASH-FIN) 2
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Photo Credit: David Favazza

WASH-FIN 2 Project Summary

- U.S. Government's 2021 **PREPARE** initiative aims to mobilize **$1 billion** in financing for climate-resilient water and sanitation services by 2030.

- USAID's WASH-FIN 2 activity aims to mobilize **$375 million by 2027** for climate-resilient water and sanitation services and **strengthen the performance of 165+** sector institutions and service providers.

- Operates in 10 countries (including India, Kenya, and Ghana)

PROBLEM CONTEXT

- Water service providers often fail to collect revenues on water provided to consumers due to under-measurement from faulty meters

- Failure to collect sufficient revenue to cover operating costs can create numerous disruptions to service provision, including:

  - Infrastructure maintenance
  - Water quality monitoring
  - Complaint resolution
  - Service expansion to low-income/rural areas
  - Hours of service per day

- USAID partnered with four county water service providers in Kenya to replace 5,100 faulty meters with automatic meter reading-enabled meters in Aug – Sep 2022.

RESEARCH QUESTION

Did the meter replacements increase the revenue collected from the customer accounts? (Did meter replacements increase the proportion of water provided that was *actually billed for?*)

Key Outcome of Interest:
- Revenue Collection

METHODOLOGY

Proposed Analysis: Differences in Differences

- *Goal:* Isolate metering impact from seasonal variation in consumption

$$B_i = \beta Metered_i + \lambda Post_i + \omega(Metered_i \times Post_i) + \gamma X_a + \epsilon_i \quad (1)$$

- B_i = Monthly bill amount
- $Metered_i = 1$ if account had a meter replacement
- $Post_i = 1$ for October 2022
- ω : DiD term to capture treatment effect
- X_a : vector of controls (Zone, Usage Clusters, etc.)

Current Data Availability:
- Utility D provided administrative and billing data for domestic accounts from May 2022 → Oct 2022
- Pilot DID approach using this county, prior to additional data requests from the other utilities

DATA

- Datasets submitted from each service provider for each customer account contain:
  - Monthly Billing (May – Oct 2022)
  - Water Consumption*
  - Customer Category (Domestic, Industrial, School, etc.)*
  - Zone*
  - Usage Cluster*

* for some counties

Limitations:

- Counties vary in data management capacity – not all variables are present across all datasets
- Data is politically sensitive for utilities and very difficult to acquire
- Short time frame

Utility	% Change: May→ Oct
A	9.0%
B	22.5%
C	10.9%
D	7.3%
OVERALL	**10.4%**
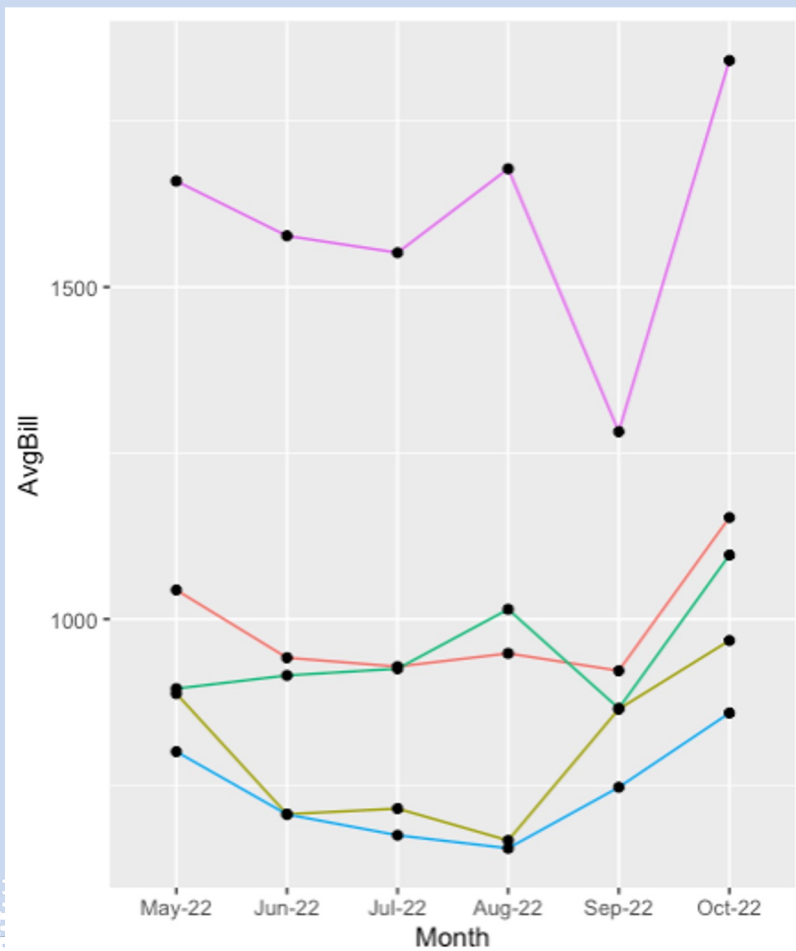
PILOT RESULTS

Metering Effect on Revenues = 49.27 KES (~$0.35)

- Significant at 5% level
- ~6% of the average May bill at Utility D
- Utility D replaced 1,693 meters ⇒ potential ~$350K increase in annual revenues

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Call:
lm(formula = bill ~ did + Treatment + post + zn_name + usageclusters,
    data = df[df$newcustcode == "Domestic", ])

Residuals:
   Min    1Q Median    3Q    Max
 -9266  -103    -39    26  46586

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)      59.0942    14.1920   4.164 3.14e-05 ***
did              49.2702    23.4920   2.097 0.035973 *
Treatment        -9.6442    17.3718  -0.555 0.578784
post            -19.7791     7.2673  -2.722 0.006499 **
```
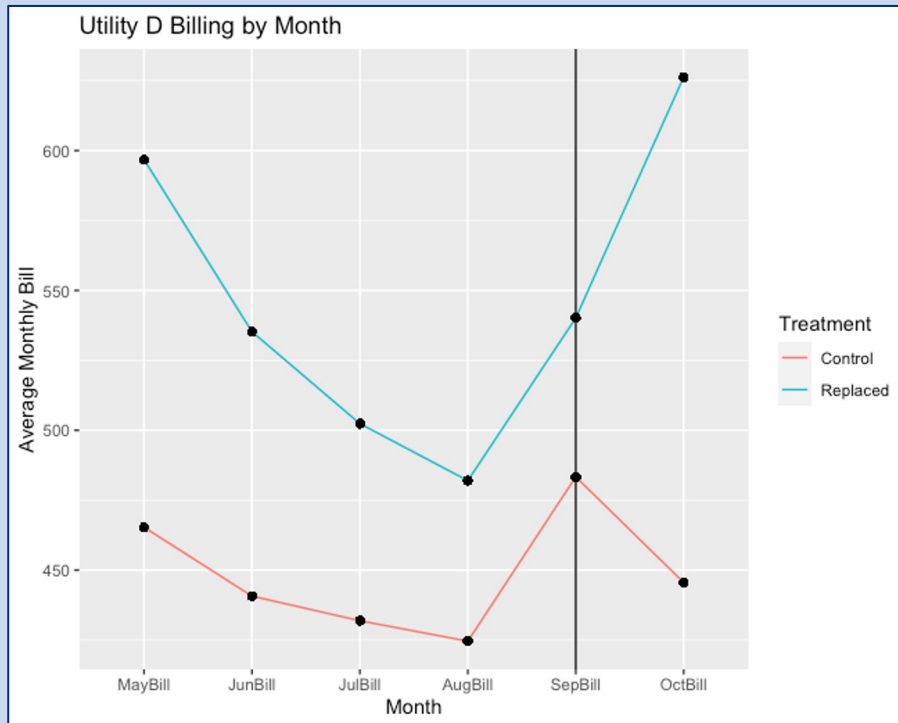

Utility D Billing by Month

NEXT STEPS

Data Collection:

- Additional funding was provided to utilities to conduct an additional round of meter replacements in mid-2023, with installations on going
- We are requesting data from utilities to use these second-round meters as a credible counterfactual group for the May → October 2022 DiD
- Already identified as in need of replacement in 2022, but did not actually receive a meter replacement during the first round of installations

Deliverables:

- Utilities want to take out commercial loans to finance the acquisition of more meters, but are struggling to get lender interest

- Estimated revenue increase from meter installations will be used to develop a financial model for the proposed meter investments to demonstrate financial viability to lenders

Photo Credit US Embassy Nairobi