EUCL AMI Project Experience Share

James Musoni--Project Manager of Revenue Protection Program (RPP)
EUCL
COMPANY’S STRUCTURE

Board of Directors

Holding company

Rwanda Energy Group

Energy Development Corporation Ltd

Energy Utility Corporation Ltd

- General power system planning
- Energy infrastructure projects development
- Electricity roll-out program
- Primary energies (Oil, biomass)
- Social energies (Off-grid systems, biogas…)

- Power generation and bulk purchase from IPPs
- Bulk power transmission
- Power distribution
- Network maintenance
- Retail of electricity
- Consumer relation & demand side management
Rwanda Grid Overview

**Installed Capacity:** 218 MW

<table>
<thead>
<tr>
<th>Installed Capacity by category (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro: 98</td>
</tr>
<tr>
<td>Diesel: 58</td>
</tr>
<tr>
<td>Solar: 6</td>
</tr>
<tr>
<td>Methane gas: 30</td>
</tr>
<tr>
<td>Peat: 15</td>
</tr>
</tbody>
</table>

**Connections**

- **Current Access Rate:** 47%
  - Rural: 9%
  - Urban: 72%
- **People without Power:** 8 million
- **Target:** Universal access by 2024 (52% on-grid, 48% off-grid)
- **PA New Off-Grid Connections:** 210,670

**INVESTMENT AND ENABLING ENVIRONMENT**

**Biggest Issues and Bottlenecks**

1. Long-term misalignment of power supply and demand
2. Grid condition prevents efficient utilization of power
3. Limited financing for off-grid companies

**Power Africa Interventions**

1. Support in on and off-grid energy policy development and implementation
2. Transaction advisory services
3. Technical assistance and capacity building for energy sector institutions
4. Financing mobilization

**Population:** 11.92 million

**GDP Growth:** 2.4%

**GDP/Cap (PPP):** $743
EUCL’s Path to Smart Metering Solutions

REG had both prepaid and postpaid mechanical meters before, where it was not possible to determine line loss and tampering, by 2016, EUCL estimated 23% loss and extra cost per year. EUCL has tried in 2015 to seek for a solution for real line loss monitoring, thus the EUCL indented to adopt the AMI solutions 2016

Rwanda lunches smart meters request on July 2015 initially for 6000 grid meters. Meters were commissioned in 2017.

Future plans to have smart meters installed from feeder to DT with AMI technology
And achieve 100% within next 2 years

Rwanda launched the 2nd phase of smart metering in September 2017 with 2000 meters

Initiative

1st Step

2nd Step

3rd Step

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Before EUCL could not know the line losses as there was no meter on transformers.

Meters after installation on the transformer.

PLC Meters At customer premises
<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
</table>
| • Line loss: **23%** (estimated)  
• Tampering: **based on physical inspection**  
• Way of Collection: **Manual**  
• Period of Collection: **3 Days 33 staff (2400 meters)**  
• Transport Cost: **33 vehicles**  
| • Line loss: **4.3%**  
• Tampering: **automatically/instantly detected**  
• Way of Collection: **AMI System**  
• Period of Collection: **2 hours one staff**  
• Transport Cost: **None**  

**Other Benefits**

- Monitoring the loading of distribution transformers
- Monitoring the real time Distributed energy to our clients
- Monitoring real time billed consumptions of our clients
- Comparison of Billed energy with distributed Energy to check for the Transformer line losses.
- Monitoring the Consumption of Prepaid Customers
- Identification of any meter tampering in the Network
- Identify Line loss of distribution transformer as well as a feeder.
- Remote meter management including fault meter identification.

**Future Planning**

- The AMI platform shall be unified to connect with Smart meters of A B and C
- AMI platform will be integrated with IBMS and CMS
EUCL target on AMI---

Critical Communication

- Interference from nearby DT will not influence communication

- High speed real-time communication:
  - One cycle only need 2min (for 300 meters)
  - Automatically reporting abnormal events to master station

- Remote upgrade of all terminals
- Cover total AMI system

- Real response to remote operation
- Real time online control

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EUCL target on AMI---

Why we need an Open Platform

**Lower Cost**
- Different vendors for competition
- Easy to introduce new vendors in the system
- Low cost for integrating with new meters

**Easy Operation**
- Unified platform for easy operation
- Low cost for maintenance

**Easy Innovation**
- Easy to develop new service for Smart Grid
- Easy to integrate with new Application software
End to End Openness from Meter to System

- Openness of communication module: provide open API in PLC module for integration with other smart meter (based on vendor, not on technology)
- Openness of HES: provide open API in MDCS for integration with other concentrators or GPRS meters.
- Openness of MDMS: provide open API in MDMS for integration with other MDCS and other Application software
EUCL target on AMI---
Revenue Protection: Abnormal Data Monitor Locates Electricity Theft
Case: Analysis of Power Supply Ability

<table>
<thead>
<tr>
<th>Transformer Load Analysis</th>
<th>Tampering Prevention</th>
<th>Line Loss Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of DT</td>
<td>No. of Tampering Event</td>
<td>Input Consumption</td>
</tr>
<tr>
<td></td>
<td>No. of Overload DT</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>No. of Underload DT</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>No. of Normal DT</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>No. of Abrupt Increase</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>No. of Abrupt Decrease</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>No. of Suspected Tampering</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Line Loss Rate 10.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feeder Quantity 25</td>
</tr>
</tbody>
</table>

Visualization Monitor and Alarm

Be attention Data

Meter Exception Event Data
Line Loss Abnormal Data
Consumption Abnormal Data
Power supply, energy consumption, energy loss quantity and energy loss rate will be counted by calculating frequency of statistics check unit.

System supports various types of line loss:

- Substation Loss
- Substation Transformer Loss
- Bus bar Loss
- Feeder Loss
- Transformer Area Loss
- Transformer Area Transformer Loss
EUCL target on AMI---
Big Data Analysis and report

Power Operating Status

Collection Success Rate
Line Loss Rate
Tamper

Customers Volume
Consumption Volume
Line Loss Rate

Overall Statistics

Peak load demand 389,900 KWh
Reduced peak load demand 173,720 KWh

Supply & Demand Control

Before
Under control

TD Detail Information

Peak load: 389,900 KWh
Reduced peak load: 173,720 KWh

Consumption Volume
Line Loss

Month

0%
20%
40%
60%
80%
100%

0
2
4
6
8
10
12
14
16
Daily Consumption for Prepaid Customers
Line loss for one of the transformer with SMART Meter
THANK YOU