HOW WIRELESS ELECTRICITY THEFT DETECTION CAN ASSIST IN REDUCING THE THEFT OR “STEALING” OF ELECTRICITY

9 October 2018
Presentation by Ms. Salome Tshikomboba (Colleen)
Introduction

• The presentation looks at the current technologies that will detect and minimize stealing of electricity.
• Municipalities are loosing electricity revenue due to electricity theft, inaccurate billing data, unbilled customers and non-cost reflective tariffs.
• The paper spotted transmission and distribution of electrical energy as the most affected areas in terms of losses.
POWER SYSTEM CONSIST OF:

ENERGY LOSSES
- \( E_{\text{Loss}} = E_{\text{Delivered}} - E_{\text{sold}} \)

TECHNICAL LOSSES
- \( C_{\text{Com Loss}} = U_{\text{Elec Cost}} \times E_{\text{Loss}} + M_{\text{Maintenance Cost}} \)

NON-TECHNICAL LOSSES
- \( C_{\text{NTL}} = C_{\text{Com Loss}} - C_{\text{Technical Losses}} \)
Non-Technical losses

- Non-payment of electricity bills
- Unauthorized line tapping and diversion
- Losses due to faulty meters and equipment
- Inadequate or faulty metering
- Poor revenue collection techniques
- Inadequate and inaccurate of meter reading
- Inaccurate customer electricity billing
- Loss/damage of equipment/hardware e.g. protective equipment, meters, cables/conductors and switchgear
- Inaccurate estimation of non-metered supplies, e.g. public lighting, agricultural consumption, rail traction
- Inefficiency of business and technology management systems
Techniques

Types of techniques available to deliver the information to the authorised Utilities to control the theft of the electricity.

Wired techniques
- Electrical cables
- Coaxial cable
- Optical fiber

Wireless technique
- ZIGBEE technology
- GSM technique
- WI-FI
- Infrared
- Wi-max
- Bluetooth
Wireless Sensor Network

What is wireless sensor network?

- WSN is a group of sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location.

Why wireless?

- To avoid lot of wiring
- Saves installation costs
- It can accommodate new device any time
- It is self organized network
- It is low power and low cost
Zigbee Technique

What is Zigbee?

Zigbee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless internet of things networks, it operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868MHz.
Zigbee Technique

What is Zigbee?
Zigbee Cont.

ZIBEE Function

- The flow chart shows how the system works to prevent the electricity theft that is firstly the microcontroller checks for the resistance and if there is change in the value of the resistance, the supply will cut off and the LCD will show that the meter is tempered. To operate the microcontroller via the relay there is a need for amplifier circuit because no direct access of the relay to the microcontroller. When the microcontroller switches off the load, the ZIGBBE
ZIGBEE Function cont.

Modem sends the results to the Utility’s authorised official. The system will not allow the consumer to reset, meaning it will only allow the person from authorised Utility to reset. The microcontroller will convey the information to the relay and switch from ON to OFF and the power supply to the meter will switch off by the system. Then the LDC will display the message “Meter tempered” and this message will reach the Utility’s official. The process flow is shown below.
Zigbee Process Flow

START

MICROCONTROLLER CHECKS THE RESISTANCE

IS THERE A CHANGE IN RESISTANCE?

YES

LCD DISPLAYS METER IS TAMPERED

NO

LCD DISPLAYS METER IS OK

RELAY WILL CUT THE SUPPLY TO THE METER

ZIGBEE MODEM SENDS A MESSAGE TO THE LAST DIALED NUMBER

FINISH
# Summary

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ZIGBEE</th>
<th>WIFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network type</td>
<td>WPAN (Wireless Personal Area Network)</td>
<td>WLAN (Wireless Local Area Network)</td>
</tr>
<tr>
<td>Network size</td>
<td>Up to 65536</td>
<td>32</td>
</tr>
<tr>
<td>Network Architecture</td>
<td>Star, Tree, Mesh</td>
<td>Star</td>
</tr>
<tr>
<td>Range (meters)</td>
<td>1 to 100+</td>
<td>1 to 100</td>
</tr>
<tr>
<td>Frequency Band</td>
<td>2.4 GHz and 868/915MHz</td>
<td>2.4 GHz and 5 GHz</td>
</tr>
<tr>
<td>Battery Life</td>
<td>Years</td>
<td>Hours</td>
</tr>
<tr>
<td>Application focus</td>
<td>Monitoring and Control</td>
<td>Web, Email, Video</td>
</tr>
<tr>
<td>Data rates (K bits/s)</td>
<td>250</td>
<td>11,000+</td>
</tr>
</tbody>
</table>
Conclusion

• The proposed technique is already on the market, but Researchers are still tying to find the loop holes around it, like network communication failure over a long distance and cyber attacks etc. Compared to other existing technologies is still the best, especially for its wireless properties and it does not require license like any other wireless techniques. Low cost, long battery life and limited staff.
THANK YOU

QUESTIONS?