AMI/AMR METERS: THE FUTURE OF METERING
HISTORY OF METERING IN NIGERIA

- Little / Lack of Customer Services
- Failed Reputation of the Power Utilities Companies
- Cases of Estimated Billing of customers
- Unreliability of Field Operators leading to loss of revenue by the power utility
Introduction to AMI

- **AMI** - Advanced Metering Infrastructure is a system designed for automated two-way communication between smart meter connected to a concentrator and interacts with the utility company through a GPRS network.
GOAL OF AMI: is to provide utility with real-time data about power consumption and allow customer to make informed choices about energy usage based on the price at the time of use (multi-tariff).
AMI gives consumers the information they need to make intelligent decisions, the ability to execute those decisions and a variety of choices leading to substantial benefits they do not currently enjoy.

In addition, system operators are able to greatly improve consumer service by refining utility operating and asset management processes based on AMI data.
AMI System Overview
Advantages of AMI

- Remotely access/collect meter data.
  - Establishes communications with the consumer
  - Provides time stamped system information

- Load control management for residential meter.
  - Load Shedding
  - Remote Switch ON & OFF

- Remote Vending/Local Vending.
AMI is not a single technology, but rather an integration of many technologies that provides an intelligent connection between consumers and Power Utilities.
AMI system is comprised of a number of technologies and applications that have been integrated to perform as one:

- SMART METERS
- COMMUNICATION INFRASTRUCTURE
- METER DATA MANAGEMENT SYSTEMS (MDMS)
SMART METERS

A smart meter is usually an electrical meter that records consumption of electric energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing purposes.
**Smart meters** are solid state programmable devices that perform many more functions, including most or all of the following:

- Time-based pricing (TOU)
- Consumption data for consumer and utility
- Net metering
- Loss of power (and restoration) notification (events)
- Remote turn on / turn off operations
- Load limiting for “bad pay” or demand response purposes
- Energy prepayment
- Power quality monitoring
- Tamper and energy theft detection
- Communications with other intelligent devices in the home
COMMUNICATION INFRASTRUCTURE

AMI employs open bi-directional communication standards, yet highly secure. It supports continuous and stable interaction between the utility, the consumer and the controllable electrical load.

- Power Line Carrier (PLC)
- Broadband over power lines (BPL)
- Copper or optical fiber
- Wireless (Radio frequency), either centralized or a distributed mesh
- Internet / GPRS / CDMA / 3G / 4G
- Combinations of the above
METER DATA MANAGEMENT SYSTEMS (MDMS)

- Electronics' AP (AMR & Prepayment system) Software
- Data Collection and Control Software
- Data Processing and Analysis Software
- Data Management Software
- Vending, Application & Analysis Software
- Database Development for AMR & Prepayment
FEATURES OF THE SMART PREPAYMENT METERS

- Integrated with PLC communication module.
- One extra relay output rated at 5A and is available for remote load-controlling in AMR system.
- Contains all critical metering, token decryption, and relay disconnection and reconnection functionality.
- It can be used in a wide range of application for all consumer types.

Applied Standard
SANS 62053-21 / IEC 62053-21
SANS 62053-23 / IEC 62053-23
SANS 62056-21 / IEC 62056-21
SANS 62055-41 / IEC 62055-41
SANS 62055-51 / IEC 62055-51
SANS 62052-11 / IEC 62052-11
SANS 474 / NRS 057
SABS (South African Bureau Of Standards)
MOJEC/CLOU Smart Prepayment Meter

CPU Card Prepayment Meter

Communication Support:
- RS485/PLC
- RF/ZIGBEE
- GPRS/CDMA/3G/4G

Main Function Includes:
- Measuring energy Class 0.5/1.0
- Multi-tariff
- Prepayment management
- Switch on/off (Contactor)
- Anti-tamper functions (Open meter cover, Bypass, Reverse etc)
- Event logging and auto report
- Multi-Meter Protocol to Meter: IEC62056-21, DLMS, IEC62055 etc

Keypad Prepayment Meter
Possible Solutions for Residential Clients

AMI Solution for Residential

Master Station

Public Transformer

Database Server

Application Server

Monitor/Maintenance/Report Workstation

Router/Adsl

Front-end Server

Switcher

Private Network

Billing and Other System

GPRS/CDMA/MODEM/LAN

Transformer Meter

Data Collector/Single/three Phase RS485 Meter

RS485 Solution

RS485

RS485/PLC/RF

PLC Solution

Single/three Phase PLC Meter

Zigbee/RF

Zigbee/RF Solution

Single/three Phase Zigbee/RF Meter

GPRS/CDMA/3G Meter

GPRS/CDMA/3G Solution

RS485 LINKUP
Solution for Residential (PLC)
PLC technology

PLC Communication Module

- Support Open international standard: ANSI/EIA/CEA-709.1
- Support OSI 7 layer Protocol (Application Layer)
- High communication speed: 5.5kbps.
- Support 2 way communication
- Support complex tree network topography

Tree Structure: this picture 1, 2, 3 ... is subnet; in subnet red node is the repeat node. Black node is the common node; repeat number can support 9 level.
Solution for Residential (RS485)
Solution for Residential (CDMA/GPRS/3G)
## Meter Communication Contrast

<table>
<thead>
<tr>
<th>Meter Type</th>
<th>Applied Scene</th>
<th>Additional Communication Line</th>
<th>Successful Collection Every Time</th>
<th>Communication Protocol</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLC Meter</td>
<td>Disperse, but not too far</td>
<td>No</td>
<td>Medium</td>
<td>D/LT645-2007</td>
<td>medium</td>
</tr>
<tr>
<td>RS-485 Meter</td>
<td>Centralized</td>
<td>Yes</td>
<td>High</td>
<td>IEC62056-21 DLMS/COSM D/LT645-2007</td>
<td>Low</td>
</tr>
<tr>
<td>RF/ZIGBEE Meter</td>
<td>Disperse, but not too far</td>
<td>No</td>
<td>Medium</td>
<td>IEC62056-21 DLMS/COSM D/LT645-2007</td>
<td>Medium</td>
</tr>
<tr>
<td>GPRS Meter</td>
<td>Disperse and far</td>
<td>No</td>
<td>Medium</td>
<td>IEC62056-21 DLMS/COSM D/LT645-2007</td>
<td>High</td>
</tr>
<tr>
<td>Category</td>
<td>Count</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substation</td>
<td>&gt; 1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Users</td>
<td>&gt; 250,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Transformer</td>
<td>&gt; 200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrator</td>
<td>&gt; 300,000</td>
<td></td>
<td></td>
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</tr>
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Access users capacity ≥ 20,000,000 households
AMI Interface Demo

Advanced Metering Infrastructure

Real-time Work situation online rate bar charts

2011-03-15 Daily Each terminal type online rate bar charts

<table>
<thead>
<tr>
<th>Terminal type</th>
<th>Terminal num</th>
<th>Online num</th>
<th>Data receive num</th>
<th>Online rate (%)</th>
<th>Data receive rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load control terminals</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Electric energy terminal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Distribution transformer terminal</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Concentrator</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
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</tbody>
</table>
CLOU AMI Interface Demo

Advanced Metering Infrastructure

2011-03-16 Load curve

<table>
<thead>
<tr>
<th>Time</th>
<th>Maximum load(kW)</th>
<th>Maximum load happen time</th>
<th>Minimum load(kW)</th>
<th>Minimum load happen time</th>
<th>Average load(kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yesterday</td>
<td>68.84</td>
<td>10:00</td>
<td>36.02</td>
<td>21:30</td>
<td>51.21</td>
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<tr>
<td>Today</td>
<td>68.89</td>
<td>09:00</td>
<td>39.01</td>
<td>22:00</td>
<td>53.85</td>
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</table>
advanced metering infrastructure

2011-04-14 Line-loss curve

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Date</th>
<th>Input electricity</th>
<th>Output electricity</th>
<th>Loss electricity</th>
<th>Loss rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>500kV</td>
<td>2011-04-14</td>
<td>28735</td>
<td>28702</td>
<td>33</td>
<td>0.11</td>
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<tr>
<td>220kV</td>
<td>2011-04-14</td>
<td>16731</td>
<td>16542</td>
<td>189</td>
<td>1.13</td>
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<tr>
<td>110kV</td>
<td>2011-04-14</td>
<td>12583</td>
<td>12437</td>
<td>146</td>
<td>1.16</td>
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<tr>
<td>35kV</td>
<td>2011-04-14</td>
<td>6183</td>
<td>6094</td>
<td>89</td>
<td>1.44</td>
</tr>
<tr>
<td>10kV</td>
<td>2011-04-14</td>
<td>6254</td>
<td>6108</td>
<td>146</td>
<td>2.33</td>
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<tr>
<td>400V</td>
<td>2011-04-14</td>
<td>2802</td>
<td>2648</td>
<td>154</td>
<td>5.5</td>
</tr>
</tbody>
</table>
AMI Interface Demo
CLOU AMI Interface Demo
Mojec CLOU AMI System In Nigeria
Port Harcourt & Ibadan Zone

Our products have exported to more than 60 countries in the world!
The biggest Smart Meters suppliers of 2011 in China

- On-going installation of AMI system in the Zones
- Server Capacity is more than 1M set of meters
Thank You!
On Behalf of
Mojec & CLOU