Power IoT applications in Advanced Metering Infrastructure

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Overview of Power IoT a Cornerstone of Smart Grid
# New ICT is the Key to Unlock the Potential of Power IoT

## Challenges of Legacy ICT

<table>
<thead>
<tr>
<th>Technology</th>
<th>Platform</th>
<th>Ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;85% IoT communication success rate in challenging conditions;</td>
<td>How to consolidate platform architecture?</td>
<td>How to ensure service evolution with solution partners?</td>
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## New ICT Solution

<table>
<thead>
<tr>
<th>100% E2E Service Insurance</th>
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<tbody>
<tr>
<td>eLTE - IoT RF Mesh</td>
</tr>
<tr>
<td>PLC-IoT xPON Smart Gateway</td>
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<thead>
<tr>
<th>E2E Open Architecture with Unified APIs</th>
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<tbody>
<tr>
<td>Comm. Module + IOT OS + Open Platform</td>
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<table>
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<tr>
<th>Business Driven ICT</th>
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<tbody>
<tr>
<td>Business driven ICT with mature and open ecosystem</td>
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</table>
AMI Solution Application for Utilities (Electricity, Water, Natural Gas)

Traditional Metering
- Manual meter reading and fault diagnosis

Advanced Metering Infrastructure
- Automatic Readings
- Remote connection disconnection
- Line loss analysis
- Theft location
- Load control
- Time of Use
- Customer Service
- Multi way payment

Network
- Advanced Communication Network and Data Management System

Management
- Dispatching Center
- Web/app

Customer
Huawei AMI End-to-End Solution

Application
- Outage Management
- Grid Operation & Optimization
- Real-time Application
- Advanced Analyses
- CRM/Billing
- Meter Data Management
- Asset Management
- Energy Capital Management

Platform
- HES & IoT platform

Network
- WAN & FAN Network
- Wired/Wireless: PON/eLTE

NAN Meter
- Concentrator (DCU)
  - PON/ETH/3G
  - PLC-IoT module
  - PLC-IoT/RS485
  - IEC&ANSI Meter
  - RF Module

Huawei AMI End-to-End Solution

Server & Storage
- eLTE-IoT Air Node
- eLTE / eLTE-IoT
- Module
- Cabinet Meter

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AMI MDM System Improve Power Utilities Management Efficiency

Power Operating Status

- Collection Success Rate: 100%
- Line Loss Rate: <10%
- Tamper: 1%

Overall Statistics

- Residential
  - Customers Volume
  - Consumption Volume
  - Line Loss Rate
- Commercial
  - Customers Volume
  - Consumption Volume
  - Line Loss Rate
- Industry
  - Customers Volume
  - Consumption Volume
  - Line Loss Rate

Supply & Demand Control

- Peak load demand: 389,900 KWh
- Reduced peak load demand: 173,720 KWh
- Before
- Under control
**Head End System**: Core Component for Metering Collection

### Basic Metering Business
Support remote control and parameters dispatched, including data collection management, prepayment management, power usage control and outage management, help reasonably use power.

### Archives and Operation Management
Provide archives synchronization with MDM, Billing, CRM, etc. Basic system operation management.
**Head End System:** Massive Devices Unified Management

**Data Collection**
- DCUs collect and store meters' data.
- Polling meter data.
- Generate collection task.
- Collect data from DCU.
- WAN

**Unified Management**
- Unified Topology Mgmt
- Unified Remote Diagnose
- Smart Alarm Mgmt
- Visible management

DCUs collect and store meters' data.
PON-based Smart Grids Supports Smooth Evolution to Smart Cities

**Highlights**

**High bandwidth:**
- GPON: 1.25G / 2.5Gbps
- 10GPON: 10G / 10G bps

**High Reliability:**
- 1+1 Equipment protection
- 1+1 Fiber link protection
- ...

**Multi-service access:**
- Smart Meters,
- Video, Data, Voice,
- IoT Devices
LTE Technology Application in Power IoT

**eLTE**

- Higher Capacity Uplink **50Mbps**, Downlink **100M bps**
- High mobility, >400 km/h
- High reliability

**Licensed Frequency**
From 700MHz to 3.7GHz

**Unlicensed Frequency**
ISM Bands: 400Mhz, 800Mhz, 900Mhz

- Massive connections, Wide coverage **10KM**
- Low power consumption, **10** years battery life.
- High reliability High Anti-interference performance.

**Internet Access & Mobile Office**
**Video Surveillance & Radio Trunking**

**AMI Sensors monitoring**
**IoT applications**

**CPE**
**Radio**

**Module**
**Smart Meter**

**eLTE - IoT**

**From 700MHz to 3.7GHz**

**OPEX**
Building 100% Connected Smart Meters

**PLC-IoT**

- High density area scenario
- Master Station
- eLTE-IoT
- GPRS
- xPON Ethernet
- 220Vac
- PLC-IoT
- Transformer
- Bandwidth: 2Mbps

**RF-Mesh**

- Low density area scenario
- Master Station
- eLTE-IoT
- GPRS
- xPON Ethernet
- DCU Concentrator
- Transformer
- RF-Mesh
- Bandwidth: 800Kbps
- RF-Mesh

PLC-IoT support up to 1000 smart meters
PLC-IoT support 100% reading success rate

RF-Mesh support up to 500 Smart meters, 1km
Free frequency: 433MHz/915MHz
**IoT Platform:** Accelerating Digital Transformation Across Consumer

- **Smart Power Plant**
- **DA & Smart Substation**
- **AMI Smart Metering**
- **Smart Lighting**
- **Smart Home**
- **Environment**

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**IoT Connection Management Platform**

- Application Enablement
- Connectivity Management

**Communication Technologies**

- LTE/NB-IoT
- Wifi
- Eth
- RF
- PLC/G.hn

**IoT Agent Inside IoT LiteOS**

- DLMS
- MODBUS
- Multi Profile

**Interoperability Plug-in**

- Zigbee
- 3rd party

**Rule Engine**

**Service Orchestration**

**Big Data**

**Security & Identity**

**IT Cloud Server Storage**
Building Open Ecosystem across IoT devices

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<tr>
<th>Device Provider</th>
<th>Application provider</th>
<th>Alliance and standard</th>
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<tbody>
<tr>
<td>Honeywell</td>
<td><strong>ORACLE</strong></td>
<td><strong>ALLSEEN ALLIANCE</strong></td>
</tr>
<tr>
<td>WASON</td>
<td><strong>LongShine</strong></td>
<td><strong>AliJoyn</strong></td>
</tr>
<tr>
<td>Haier</td>
<td><strong>SAP</strong></td>
<td><strong>HIGHSILICON</strong></td>
</tr>
<tr>
<td>尚吉电子</td>
<td><strong>iSOFTSTONE</strong></td>
<td><strong>oneM2M</strong></td>
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<tr>
<td>BroadLink</td>
<td><strong>东风汽车</strong></td>
<td><strong>OSGi Alliance</strong></td>
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<tr>
<td>Wulian</td>
<td><strong>赛迪网</strong></td>
<td><strong>HGI</strong></td>
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<td></td>
<td><strong>CCIDnet</strong></td>
<td><strong>ZigBee Alliance</strong></td>
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Successful Cases

Thailand
Joint Innovation

Laos

Indonesia

Nigeria

Mexico

Colombia
Best Practice of Leading New ICT for Power Industry in Thailand

2016
- Smart Lighting
- Transmission Backbone

2017
- DA
- AMI

2018
- PV Plant
- Power Cloud
- Electric cars

Joint Innovation Center

Strategy
- Trends
- Challenges

New ICT
- Open Interfaces
- Open Labs
AMI Project in Nigeria Ikeja

1.2M consumers, only 35% with meters. The line loss in Ikeja power company is US$7.5 million every month.

Total 297K Smart meters in this case.

PLC - IoT as last mile and GPRS as backhaul network.

Customer Benefit:

1. Reduce line lose 45% → 14%
2. Cash Cycle 3 Months → 45 Days
3. Payment Success 60% → 100%
4. Increase Metering Customer 23%
AMI Project in Nigeria Ikeja

Application
- Billing
- CRM
- Vending

Platform
- Head-end system
- UMS (Unified Mgmt System)
- EDM (Energy Data Mgmt)

WAN/FAN
- GPRS/3G

Telco network
- GPRS

NAN (Neighbor Area Network)
- CL730D21H CT&VT Meter HV
- CL730D21L CT Meter LV
- CL730D21H CT&VT Meter MD
- CL730S11, 3-Phase STS
- CL710K11 Single Phase STS Meter
AMI Project in Colombia Emcali

Project scope

Customer benefits

End-to-End Integration (smart meters, GPON, Head-End etc)
Restrain power theft
Reduce line loss
Improve operation efficiency

Huawei Values

Innovative Customized Solution (DCU support 2G/3G/4G/FE)
Comply International Standard (IEC, DLMS)

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Pole: 15,210
Concentrator: 1,521
Head-End
Substation
OLT
ONU
GPON
Substation
SDH

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Cabinet Meter

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AMI Project in Colombia Emcali

Main Station

WAN/FAN

NAN

Cabinet Meter

3-rd party main station

Plug and play without wiring

MCU (Main Control Unit)

Multiple payment methods
AMI Project in Mexico CFE

CFE, Electricity Federal Commission, power supply to 122M people

Driving force of AMI is to reduce loss, which is 15% in average, 30%+ in some area

CFE didn’t trust public network e.g. GPRS/3G and decided to build dedicated network for AMI

Customer Benefit

1. Reduce line lose 15.8% → 7.6%
2. Save OPEX (i.e. cost for network renting in 10 years) by 50%
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