AMI in Smart Substation Pilot Project

Knathip Spuntupong
Metropolitan Electricity Authority
Presentation Outline

- Introduction to MEA
- MEA Smart Grid Concept & Roadmap
- AMI in Smart Substation Pilot Project
- Conclusion
- Question & Answer
Metropolitan Electricity Authority – MEA

<table>
<thead>
<tr>
<th>Description</th>
<th>MEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services Area (km²)</td>
<td>3,192</td>
</tr>
<tr>
<td>Customer (no.)</td>
<td>3,194,167</td>
</tr>
<tr>
<td>Energy Sale (GWh)</td>
<td>47,885</td>
</tr>
</tbody>
</table>

Thailand Area: 514,000 km²
Vision

“Moving towards a high performance organization and becoming a leader in the power distribution business with service excellence, while simultaneously enhancing the strength of related business and the responsibility for the society and environment.”

Mission

- To develop towards a high performance organization with an efficient management system based on the participation of all stakeholders and taking responsibility for the society and environment.

- To run business with a strong commitment to the Principles of GRC (Good Corporate Governance, Risk Management and Compliance) along with the integration of ICT.

- To conduct business in pursuit of sustainable growth with qualified, reliable and safe power distribution system as well as excellent service.

- To increase competitive advantage in related business.
10-12% Higher demand in April – May
Risk of Overload, Outages!!!
MEA – Reliability Index

SAIFI

Interruptions/customer/year

Year

2007 | 2.388
2008 | 2.229
2009 | 1.865
2010 | 1.715
2011 | 1.837
2012 | 1.831
MEA – Reliability Index

SAIDI

minutes/customer/year

Year

2007: 59.662
2008: 50.645
2009: 47.056
2010: 46.919
2011: 58.798
2012: 49.448
MEA Smart Grid Objective

“An electrical system that is reliable, guarantees satisfaction and is socially concerned”

<table>
<thead>
<tr>
<th>Theme</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power System</td>
<td>Service Reliability</td>
</tr>
<tr>
<td></td>
<td>Operating Efficiencies and Economics</td>
</tr>
<tr>
<td></td>
<td>Security</td>
</tr>
<tr>
<td>Services</td>
<td>More Services Opportunity</td>
</tr>
<tr>
<td></td>
<td>More Interaction between MEA and Customers</td>
</tr>
<tr>
<td>Energy Saving and Renewable Energy</td>
<td>Provide infrastructure to integrate renewable resources</td>
</tr>
<tr>
<td></td>
<td>Promote Energy Efficiency</td>
</tr>
<tr>
<td></td>
<td>Research and Support the integration of EV</td>
</tr>
<tr>
<td></td>
<td>Research and Support the integration of Energy Storage</td>
</tr>
</tbody>
</table>
In October 2010, MEA and Precise signed an MoU to setup a Smart Substation project. This project was aimed to be a learning and testing site for advance smart grid infrastructure system

- **Location**: Bangpla Substation, Bangplee, Samutprakarn
- **Substation**: 115kV AIS Switchyard & 24kV Switchgear
- **Distribution**: Overhead Line
- **Validity**: April 20, 2014
Combination of 4 sub-system

1. Substation Automation
   - IEC61850 Architecture down to Process Level
   - Multi-Vendor Integration

2. Feeder Automation
   - IEC61850 Architecture
   - Integrated to the Substation Automation, directly to Station Bus

3. Advanced Metering Infrastructure
   - DLMS/COSEM standard for meters communication
   - PLC
Combination of 4 sub-system

4. Smart Substation Management
   • CIM Integration Bus System
     • IEC 61968
     • IEC 61970
   • Smart Substation Application
     • Quality monitoring
     • Analytic functions (Performance & Lose)
     • Web SCADA Application
Objective of Pilot Project

To study the technical features of the Smart Substation.

To design of the Smart Substation to communicate with the existing system of MEA.

To install and test commissioning Smart Substation that can be integrated into the current system of MEA.

To analysis the performance of the systems. To serve as the basis for applying the system in the future.
AMI : Analysis of the result

| AMI systems design for MEA’s application |
| Necessary functions for the implementation of the MEA’s Smart Meter |
| Reading performance. |
| Effective in preventing the abuse and theft of electricity. |
| Low voltage distribution system energy losses |
| Load Research to Support the MEA |
AMI: Architecture of AMI Solution
AMI : System Configuration
AMI: Necessary Function

- TOU Billing
- Load Profile 15min
- Remote Connect/Disconnect
- Anti-Tampering
- DLMS/COSEM Communication Protocol
- PLC Communication
AMI: Expect Benefit

**UTILITY**
- Low cost & improved service
- Operating efficiency, flexibility
- Decrease of technical losses and of power theft
- Grid stability

**CUSTOMER**
- Satisfied electricity demands
- Reduced bills
- Improved service
AMI : DCU

**Feature**
- Full 2-way communication
- GSM/GPRS modem
- LV PLC modem (S-FSK modulation)
- Ethernet communication channel
- Two USB interfaces: USB-A (host) & USB-B (device)
- Automatic detection, registration and support of end-point devices of the ADDAX metering system
- Built-in real time clock
- Scheduled data collection.
- Support of on-line requests
- Long term data storage in non-volatile memory
- Backup power supply
- Secure data transmission (IPSec)
- Protection level
- Optical port
- LED indicators
AMI : Smart Meter

Feature

- Active energy, reactive energy, import/export
- Measured quantities (V, I)
- 6 tariff registers
- Built-in clock
- Event Log
- Load profile
- Differential current detection
- Protection level IP54
- Standard data model, Open protocols (DLMS/COSEM)
- Optical port
- Basic and extra relays
- Sensor of meter case opening
- Sensor of terminal box cover opening
- Magnetic field sensor
- Built-in PLC module
AMI : Factory Acceptance Test
AMI: Public relations before installation
AMI : Installation
• MEA have Smart Grid Roadmap to Implement AMI System in future
• Some observation from Pilot Project
  – Installation condition for MEA
  – Interoperability by use DLMS/COSEM standard Protocol
  – Interface with SAP by MDMS