Smart metering –
Why, What and How

Győző Kmesty
- President, DLMS User Association
- Secretary, IEC TC 13
- Convenor, CENELEC TC 13 WG02
Presentation program

- Drivers for multi-energy smart metering systems
- European projects and harmonisation efforts
- Requirements, Use cases, Architectures, Technologies
- Data models, Protocols, Data security
- The role of the DLMS User Association
Drivers for smart metering

**Political**
- energy efficiency
- energy saving
- supply security / sustainability
- EU energy market
- EU services market
- establish new technology culture
- economy stimulus

**Businesss**
- operation of the energy market
- customer choice
- efficient energy network operation
- defer capacity investments
- cost reduction
- market players need new revenue streams

**Technology**
- static meters
- ICT – Information and communication technologies grow together
Relevant European Directives

- **2004/22/EC, Measuring Instruments Directive (MID)**
  - Specifies essential requirements for metrology
  - Harmonised standards (OJ pub) give presumption of conformity
- **2006/32/EC, Energy end-use efficiency and energy services**
  - Article 13: Metering and informative billing of energy consumption
- **2009/72/EC, Common rules for the internal market in electricity**
  - Economic assessment of implementing smart metering by Sept 2012
  - Where positive, at least 80 % of consumers shall be equipped with intelligent metering systems by 2020
  - 200,000,000 metering points, 40,000,000,000 € market
- **2009/73/EC, Common rules for the internal market in natural gas**
  - Economic assessment of implementing smart metering by Sept 2012
  - Subject to that assessment, prepare a timetable for the implementation of intelligent metering systems
EU smart metering projects / 1

- **France, Linky project, E-metering**
  - Pilot of 300,000, S-FSK PLC / Euridis + DLMS/COSEM
  - Go / No Go mid 2011
  - 35 M rollout 2013-2017, OFDM PLC / Euridis + DLMS/COSEM
  - 4,000 M € investment 10 years return

- **Germany, difficult to make a business case**
  - „Mühleim zählt” pilot with 14,000 meters
  - Multi Utility Controller (MUC) concept, local standards
  - Open Metering System (OMS) specification, M-Bus based

- **Italy: Telegestore project, E-metering**
  - 35 M meters installed, FSK / BPSK PLC
  - 2,100 € investment, 5 years return
  - MORE specification is made public now
  - Gas metering is starting now
EU smart metering projects / 2

- The Netherlands: 7 M E-meters, 6,5 M Gas meters
  - NTA 8130, Dutch Smart Metering Req Spec 3.0 (Soon)
  - DLMS/COSEM on S-FSK PLC, GPRS, web services
  - Rollout held back due to security / privacy concerns
- Spain: Total market 26 M E-meters
  - IBERDROLA, 54%: Prime OFDM PLC with DLMS/COSEM
  - ENDESA / ENEL, 46 %: MORE (like in Italy)
- Scandinavia
  - Various technologies: DLMS/COSEM with S-FSK PLC, GPRS
  - Echelon, Zigbee (Gothenburg)
- UK: 47 M meters 2010 - 2020
  - Trials and technology evaluation
  - HAN: ZigBee, Z-Wave, proprietary Low Power radio
  - Backhaul: GSM / GPRS / ZigBee, TV transmitters...
European harmonisation efforts

- **OPEN meter collaborative research project**
  - FP7: Seventh Framework Programme for research and technological development
  - Objective: *specify a comprehensive set of open and public standards for AMI supporting multi commodities based on the agreement of the most relevant stakeholders*
- **M/441 smart metering standardization mandate**
  - Objective: *create European standards that will enable interoperability of utility meters (water, gas, electricity, heat)*
OPEN meter
Open Public Extended Network metering

**INDUSTRY**
- Smart Meter Manufacturers
- Telecommunication industry
- Silicon design & manufacturing

**USERS**
- Energy operators (retailers)
- Network operators
- Metering operators

**R&D, Technology centers**
- Comm. protocols, data formats
- Integrated systems
- Compliance tests

**POLICY MAKERS**
- Regulatory bodies
- Standardization bodies

**Consortium**

12th May 2010
Kuala Lumpur, 11-12 May 2010
Work packages

WP1: Functional Requirements & Regulatory Issues

WP2: Identification of Knowledge & Technology Gaps

WP3: Pre-Normative Research Activities

WP4: Testing

WP5: Specification & Proposal of a Standard
Deliverables to date

- D 1.1 Requirements, use cases
- D 1.2 Regulatory requirements
- D 2.1 State-of-the art of technologies and protocols
- D 2.2 Assessment of technologies
- D 2.3 Identification of gaps
- D 3.1. System architecture

- Deliverables available at www.openmeter.com
System components and interfaces

- **Local O&M device**
  - MUMI 2
- **Multi-utility meter**
  - MUMI 1
- **End Customer devices**
  - MI5
- **Electricity Meter / Communication hub**
  - MI1
  - MI2
  - MI3
  - MI4
- **Concentrator**
  - CI1
  - CI2
  - CI3
  - CI4
- **External devices**
- **Local O&M device**
  - MI1
- **Central System**
  - SI1
  - SI2
  - SI3
- **Legacy systems (Supplier / Grid Company)**

Multi-utility meter

- OPEN meter
- Open Public Extended Network metering

12th May 2010

Metering Asia
Kuala Lumpur, 11-12 May 2010
<table>
<thead>
<tr>
<th>OM-SR1</th>
<th>Meter registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM-SR2</td>
<td>Remote tariff programming</td>
</tr>
<tr>
<td>OM-SR3</td>
<td>Meter reading – on demand</td>
</tr>
<tr>
<td>OM-SR4</td>
<td>Meter reading – for billing</td>
</tr>
<tr>
<td>OM-SR5</td>
<td>Remote disconnection and reconnection</td>
</tr>
<tr>
<td>OM-SR6</td>
<td>Power control</td>
</tr>
<tr>
<td>OM-SR7</td>
<td>Clock synchronization</td>
</tr>
<tr>
<td>OM-SR8</td>
<td>Remote firmware update</td>
</tr>
<tr>
<td>OM-SR9</td>
<td>Alarm and event management</td>
</tr>
<tr>
<td>OM-SR10</td>
<td>Interruption information</td>
</tr>
<tr>
<td>OM-SR11</td>
<td>Fraud detection</td>
</tr>
<tr>
<td>OM-SR12</td>
<td>Remote concentrator access</td>
</tr>
<tr>
<td>OM-SR13</td>
<td>Load profile management</td>
</tr>
<tr>
<td>System requirements / Processes (Advanced)</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>OM-SR14 Automatic adaptation to grid changes</td>
<td></td>
</tr>
<tr>
<td>OM-SR15 Meter availability control</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System requirements / Processes (Optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OM-SR16 Energy balances</td>
</tr>
<tr>
<td>OM-SR17 Load management</td>
</tr>
<tr>
<td>OM-SR18 Customer device management</td>
</tr>
<tr>
<td>OM-SR19 Power quality management</td>
</tr>
<tr>
<td>OM-SR20 Prepayment</td>
</tr>
</tbody>
</table>
Selected technologies

System components and interfaces

- DLMS/COSEM over local ports
  - Electricity Meter / Communication hub
  - Local O&M device
  - Multi-utility meter
  - End Customer devices

- DLMS/COSEM over GPRS
  - Central System
  - Local O&M device
  - Concentrator

- COSEM over web technologies
  - Concentrator
  - External devices
  - Legacy systems (Supplier / Grid Company)

- DLMS/COSEM over M-Bus, Euridis
  - End Customer devices
  - Multi-utility meter

- DLMS/COSEM over S-FSK / OFDM PLC
  - External devices

IEC 62056 DLMS/COSEM selected as data model and application layer protocol

Media: S-FSK PLC, OFDM PLC, M-Bus, Euridis, GPRS / UMTS...
M/441 Mandate: Overview

- In view of the various Smart Metering projects there is an urgent need for harmonisation to avoid uncontrolled growth of specifications

- Mandate M/441 of the EC from 12th March 2009:
  - Draft standardisation mandate to CEN, CENELEC and ETSI in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability

- Objectives:
  - to create European standards that will enable interoperability of utility meters (water, gas, electricity, heat), providing a meanse to raise customers' awareness of actual consumption in order to allow timely adaptation to their demands (commonly referred to as “smart metering”)
M/441 Mandate: Tasks

- **Communication: 9 months**
  - Develop European standards for an open software und hardware architecture for utility meters that:
    - Support secure bi-directional communication
    - Allow advanced information, management and control systems
    - Scalable and adaptable for future needs
    - Provide secure interface to protected metrology block

- **Harmonised solutions for additional functions: 30 months**
  - Develop European standards for additional functions within an interoperable environment

- Permit innovation
- Permit fully integrated modular and multi-part solutions
- Consider existing international, EN and national standards
M/441 mandate org and responsibilities

European Commission
DG Enterprise and Industry
Mandate issued 3/09

Smart Metering standards
2011-2012

Mandate accepted 6/09
Approve reports
Publish standards

Smart Meter Coord. Group
CEN
CENELEC
ETSI
WELMEC
CEER / ERGEG
OPEN meter
EURELECTRIC
MARCOGAZ
ESMIG
FACOGAZ
Consumers Assn.
Installers Assn.

Prepares reports
Assigns responsibilities / Coordinates work programs
Develops Glossary
Develops Use cases
Develops architecture

CEN TC 294
CLC TC 13
CLC TC 205
ETSI M2M
M/441 Mandate: Application

- Only MID has essential requirements
  - Smart metering standards will not be „harmonised” by publishing them in the OJ – no presumption of conformity
- Solutions of member states may differ
  - Standardization in the context of the mandate does not necessarily mean completely identical solutions in the member states
- Standards must cover all solutions
  - As a target smart meter solutions of the member states must be covered by suitable standards
- Country solutions to be standards based
  - The member states can set their own priorities and treat the various consumption types differently, but the selected solution must be taken from the one and only smart meter standard pool
- Back office systems and industrial metering are out of scope
  - Industry solutions or back office solutions will not be regulated by the mandate, knowing that there will be a significant impact on these areas
M/441 mandate: ESO TC responsibilities
M/441 Mandate: High level additional functions

Additional function is what goes beyond the MID

- F1. Meter reading for billing, export / import
- F.2 Two-way comms for PQ, tamper, firmware update, customer info
- F.3 Prepayment, TOU
- F.4 Remote disablement / enablement / limitation of supply
- F.5 Communication with in-home devices: load control, customer info, HA
- F.6 Provide info via web portal / gateway
### CLC TC 13 WG02 Road map

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 1: Use cases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 2: Func. architectures and service requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 3: Interfaces and protocols</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 4: Legal metro requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 5: Security requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 6: Map additional functions to object models</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 7: Multi-part installations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 8: Further communication technologies (Pass 2 of Task 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 9: Interoperability requirements and test processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**12th May 2010**

**Metering Asia**

**Kuala Lumpur, 11-12 May 2010**
IEC – CLC TC 13 co-operation

• CLC TC 13 develops technical reports, describing how to use existing standards for smart metering
• Identifies need for new standards – these will be developed by IEC TC 13
• IEC standards become EN standards through parallel voting
A few words on data security

- Data security and privacy are major concerns
  - May fail a project
- DLMS/COSEM provides tools for:
  - role based access
  - peer authentication
  - message confidentiality
  - message integrity /authenticity
- It is up to the project to use them properly
- Guidance:
  - Customer should own data and
  - Make available for the purposes of the services required
DLMS User Association Update

- Formed in 1997
- 171 members (May 2010)
- 5 continents - 40 countries
- from all branches of the industry
- 142 Product Certificates
DLMS UA in smart metering standardization

M / 441
EC Smart Metering Standardization Mandate

TC 57, Power systems management
• IEC 61334 PLC

TC 13, Metering
• WG 14 - IEC 62056

TC 13, Metering
• WG02, Smart metering

TC 294, Communication systems for meters – EN 13757-1

ETSI
• TC M2M

Open Public Extended Network Metering (OPENmeter)

DLMS UA

IEC

ETSI

CENELEC
## Status of the DLMS/COSEM specification

<table>
<thead>
<tr>
<th>Blue Book Ed. 10</th>
<th>Green Book Ed. 7</th>
<th>Yellow Book Edition 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>• energy&amp;demand</td>
<td>• 3-layer HDLC</td>
<td>• All objects</td>
</tr>
<tr>
<td>• gas volume conversion</td>
<td>• TCP-UDP/IP</td>
<td>• 3-layer HDLC</td>
</tr>
<tr>
<td>• load profiles</td>
<td>• S-FSK PLC</td>
<td>• TCP-UDP/IP</td>
</tr>
<tr>
<td>• billing profiles</td>
<td>• Euridis</td>
<td></td>
</tr>
<tr>
<td>• instantaneous, PQ</td>
<td>and in the near future</td>
<td></td>
</tr>
<tr>
<td>• value monitoring</td>
<td>• OFDM PLC</td>
<td></td>
</tr>
<tr>
<td>• load management</td>
<td>• M-Bus</td>
<td></td>
</tr>
<tr>
<td>• connect / disconnect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• events and tamper mgmt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• firmware upgrade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• comm. channel setup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• data security</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary

• Many national smart metering projects
• Standards are seen as key to interoperability
• EU pushes for harmonised standards
  – OPEN meter project
  – M/441 standardisation mandate
• IEC 62056 / EN 13757-1 DLMS/COSEM is core standard
  – Data model for all energies
  – Advanced security
  – GPRS, Internet, PLC ... Media
• DLMS UA works with all TCs involved

*Smart meters have new talents: how do we benefit?*
Many thanks for your kind attention!

gyozo.kmethy@dlms.com