SMART METERING
„OD EU LEGISLATIVY K REÁLNÝM APLIKACÍM VE SKČ“

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Špindlerův Mlýn, 13. březen, 2016
RECENT EU DEBATE ON SMART METERING SYSTEMS

Václav Janoušek
Business Strategy Department
ČEZ Distribuce
THE PERCEPTION OF THE EC

„Delivering a New Deal for Energy Consumers“

„The lack of appropriate information on costs and consumption“

„All consumers… should have easy access to their real- or near-time consumption data“

„…price signals that reward flexible consumption“

„Energy Union“

„the Commission will continue to push for standardization and to support the national roll-out of smart meters“
Commission Recommendation on preparations for the roll-out of smart metering systems

- readings directly to the customer
- update the readings frequently enough to use energy savings schemes
- remote reading of meters
- two-way communication for maintenance and control
- support advanced tariff systems
- remote on/off control of the supply and/or flow or power limitation
- secure data communications
- fraud prevention and detection
- provide import/export and reactive metering

Benchmarking the smart metering deployment in the eu-27 with a focus on electricity

- „only in few cases the data refresh rate / update to be offered with the smart metering systems comply with the recommended 15 minutes"
- „8 member states consider all recommended functionalities“ (Jan Panek; presentation „Delivering a new deal for energy consumers“ – October 2015)
The Future Role of DSOs (CEER paper)

„the need to differentiate between technical data and commercial data…the definition of commercial and technical data continues to remain problematic“

„CEER believes that DSOs should remain as neutral market facilitators but that this does not automatically confer the status of data management coordinator to a DSO“

Regulatory Recommendations for the Deployment of Flexibility (Smart Grid Task Force – EG3 report)

„where responsible for collecting data, grid operators should be enabled to act as a neutral market facilitator by providing relevant data to all relevant parties“
DEBATE ON NETWORK COSTS

Council conclusions on "Energy prices and costs, protection of vulnerable consumers and competitiveness"

„the continued rise of consumer prices in a number of Member States has been driven notably by increases in network costs and taxes/levies“

Energy Union

„The Commission will produce biennial reports on energy prices, analyse in depth the role of taxes, levies and subsidies and seek the phasing out of regulated prices below cost“

Study on tariff design for distribution systems (for DIRECTORATE-GENERAL FOR ENERGY)

„...attempts to compare certain aspects of performance may be compromised due to different countries’ interpretations of what exactly is to be measured“

„Moreover, it is also the case that significant variations exist in the architecture, size and conditions of countries’ distribution systems“
CYBER SECURITY

EG2
- Expert group of the Smart Grid Task Force

DPIA
- DSOs involved into DPIA testing and providing feedback to the EC

Regulation
- General Data Protection Regulation
- Network Information Security
THANK YOU FOR ATTENTION

TIME FOR NEXT SPEAKER
ADVANCED METER MANAGEMENT
„FROM EU LEGISLATION TO REAL APPLICATIONS IN CEZ“

Experience from foreign acquisitions
Jaroslav Macek – Foreign acquisitions manager

AMM IN FOREIGN ACQUISITIONS OF CEZ GROUP
BASIC OVERVIEW

CONTENT
1. Romania
2. Bulgaria
3. Turkey
## Smart metering implementation – current national plan

**2012 AT Kearney study for Romania prepared for ANRE showed benefits in 80% deployment**

<table>
<thead>
<tr>
<th>Financial input</th>
<th>ATK case</th>
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<tbody>
<tr>
<td>Equipment lifetime</td>
<td>20 years for technical</td>
</tr>
<tr>
<td></td>
<td>15 years for WiMAX, fiber optics</td>
</tr>
<tr>
<td></td>
<td>5 years for IT&amp;C</td>
</tr>
<tr>
<td>Comms. technology</td>
<td>PLC 99%, GPRS 1%</td>
</tr>
<tr>
<td>Inflation</td>
<td>Flat, at 4%</td>
</tr>
<tr>
<td>Discount rate</td>
<td>Flat, at 7.5%</td>
</tr>
<tr>
<td>CPT split</td>
<td>63% technical</td>
</tr>
<tr>
<td></td>
<td>37% non-technical</td>
</tr>
<tr>
<td>Decrease in non-technical CPT</td>
<td>60% reduction from current level</td>
</tr>
<tr>
<td>Decrease in OPEX</td>
<td>100% decrease in disconn/ reconn. (process automation)</td>
</tr>
<tr>
<td>Decrease in intervention time/cost</td>
<td>1% reduction of time to perform maintenance</td>
</tr>
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</table>

*Romania study was conducted by AT Kearney consulting at regulatory request and DSOs were not involved in gathering data or preparing the outcome*
Current regulator requirement is smart metering implementation of 80% by 2020

<table>
<thead>
<tr>
<th>Yearly regulator provisions</th>
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<tbody>
<tr>
<td><strong>1st Pilot</strong> 2014</td>
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<tr>
<td>- Test both rural and urban areas</td>
</tr>
<tr>
<td>- Test both upgraded and old network</td>
</tr>
<tr>
<td>- Finish by year end</td>
</tr>
<tr>
<td>- 12 mandatory functionalities (remote disconn./reconn. readings, hourly profiles, etc.)</td>
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<tr>
<td>- Rollout decision postponed</td>
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<tr>
<td><strong>2nd Pilot 2015</strong></td>
</tr>
<tr>
<td>- Maximum investment 10% of total investment plan for 2015</td>
</tr>
<tr>
<td>- Test both rural and urban areas</td>
</tr>
<tr>
<td>- Test only new or modernized network</td>
</tr>
<tr>
<td>- Price limit: ± 20% of average price from all DSO’s (178€)</td>
</tr>
<tr>
<td>- Same mandatory functionalities</td>
</tr>
<tr>
<td>- Finish by November 1st</td>
</tr>
<tr>
<td>- Send rollout proposal by December 1st, rollout decision postponed</td>
</tr>
<tr>
<td><strong>3rd Pilot 2016</strong></td>
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<tr>
<td>- Maximum investment 10% of total investment plan for 2016 and requirement will stay also for 2017</td>
</tr>
<tr>
<td>- Test both rural and urban areas</td>
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<tr>
<td>- Test only old network</td>
</tr>
<tr>
<td>- Price limit: ± 20% of average price from all DSO’s</td>
</tr>
<tr>
<td>- Same mandatory functionalities</td>
</tr>
<tr>
<td>- Finish 50% by September 1st and all by November 1st</td>
</tr>
<tr>
<td>- Send rollout proposal (2017-2020) by January 10th</td>
</tr>
</tbody>
</table>

Romania DSOs have different approaches: ENEL target 80% by 2020, ELECTRICA and CEZ less then 50% while EON targets more then 50%
CEZ DISTRIBUTIE IMPLEMENTED SO FAR 34 THS. SMART METERS AND 10 THS. CONVERGE METERS FROM TOTAL 1,4 MIO ELECTROMETERS

65% of total consumption read remotely

Smart metering implementation

### 2012 CEZ Pilot
- Upgrade network and meters moved at property limit:
  - Urban area, block of flats
  - Urban area, houses
  - Rural area
  - Rural isolated area

### 2014 Pilot ANRE Order
- Urban area, old network
  - Urban area, modernized network
  - Rural area, old network
  - Rural area, modernized network

### 2015 Pilot ANRE Order
- Urban area, modernized network
  - Rural area, modernized network

### 2014 Pilot ANRE Order
- CEZ Distributie ~13 ths. meters:
  - Craiova, Carcea, Podari
  - Cost per client 122€
  - 19% loss reduction registered after implementation

### 2015 Pilot ANRE Order
- CEZ Distributie ~20 ths. meters:
  - Craiova
  - Carcea
  - Cost per client 178€
  - Loss reduction not yet evaluated, implementation finished in November

So far total costs are 6.9 mn. € while yearly benefits are 0.1 mn. € (mainly OPEX for reading and disconnection/reconnection and grid loss reduction – average 19% in LV)

Cost per client include all associated costs: equipment, software, hardware and implementation (mountings, configurations, etc)
SAME TECHNOLOGY WAS USED IN ALL 3 PILOT PROJECTS WITH CONTINUOUS UPGRADE OF ARGUS SYSTEM

AMM field equipment
CONTENT

1. Romania
2. Bulgaria
3. Turkey
STRUCTURE AND APPROXIMATE ESTIMATION OF COSTS OF FULFILLING THE EU DIRECTIVE ABOUT SM INSTALLATION AT 80% OF CUSTOMERS

Costs of initial investment:

- Electrometers – 159,65 Mln. €
- Filters (5%) – 8,68 Mln. €
- Concentrators and commutation equipment – 11,96 Mln. €
- SW and HW – 6 Mln. €
- Implementation – 13,77 Mln. €

Total: 200,06 Mln. €
For 1 customer: 122 €

Costs of annual maintenance:

- Faulty equipment (2%) – 3,71 Mln. €
- SW and HW maintenance – 1,5 Mln. €
- Communication – 0,36 Mln. €

Total: 5,57 Mln. €
For 1 customer: 3,40 €

Based on the estimation of economical expedience of the implementation of smart metering the Bulgarian Regulator concluded in 2013 that the SM implementation is not financially justified.

Smart Metering would be implemented in such areas only, where the investment is economically efficient – for instance in areas with high technological losses.

The implementation of Smart Metering until 2020 at 80% of customers is not economically justified for „CEZ Distribution Bulgaria“ AD although EM are read once in a month. The expenses of the annual maintenance would be higher than reading on spot.
2,1M ELECTROMETERS ARE INSTALLED IN NETWORK, REMOTE READING ELECTROMETERS 35,100 OF IT

Corporate solution Converge

In 2009 a corporate CEZ Group solution was implemented in Bulgaria MDW Converge.

Converge reads 12,400 electrometers.

From 2013 all producers, consumers at MV and LV customers with capacity over 100 kW were included in Converge.

Local solution ADDAX

In 2009 started project of preparation of an unified system ADDAX of remote reading and management at LV.

ADDAX reads 22,700 electrometers:

System is installed in risk areas especially where the losses are high.

40% of total consumption read remotely.

CEZ Distribution Bulgaria AD is focusing on legal obligation and solution with economical benefit – positive business case.
Smart Metering will be implemented only in these regions where the investment is economically effective - regions with high distribution losses

Electrical Switchboard at height of 13m

LV Electrical Switchboard
AMM IN FOREIGN ACQUISITIONS OF CEZ GROUP
BASIC OVERVIEW

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EMRA (Electricity Market Regulation Authority) prepared «rules and principals «in regarding to define the scope of automatic meter reading systems and its practice in 2011.

Regulation enforced in 01.12.2011

AMR came into effect (infrastructure for data share) in 01.01.2016

Scope of AMR covers:
- Public Lightning (mandatory by EDC’s)
- Licensed Production Plants (mandatory)
- Unlicensed Production Plants (mandatory by EDC’s)
- Energy exchange points with EDC’s (mandatory by EDC’s)
- Other Customer with defined consumption limits (limits defined by 21 Distribution Companies (mandatory by EDC’s)

EDC’s are responsible to set the relevant infrastructure of AMR (modem and meter in case of the preference with modem embedded or otherwise communication port) for customers.
IMPLEMENTATION STARTED IN 2012 AND FINISHED IN 2015 FOR DEFINED GROUP OF CUSTOMERS

2012
Public lighting
Installation started

2013
Power plants
Exchange points
Customers
Installation started

2014 - 2015
Power plants
Exchange points
Customers
Installation continued

CURRENT STATUS
Installation completed in 2015
SEDAS remotely reads 23,118 EM
65% of total consumption read remotely

W1000

Abone.NET

PREDICTION

Market operator

Converge Meter Data Management system

Data Acquisition
Data Validation
Data Processing

Time Synchronization
Reporting

Read Values, alarms, events

Master Data, Readout requests, ad-hoc reading req.

ASOS solution for Public Lighting

Data Acquisition
Modem/meter parametrization

DISTRIBUCE
REMOTE METER READING VIA RF OPTIC READER DEVICE AS COMPLEMENTARY PART TO AMM

PURPOSE OF THE PROJECT

To include the meters which are not applicable to be read remotely, to the scope of AMR by montaging RF optic reader device (RF OOC) to those meters and besides that harmonizes

PROJECT ORGANIZATION AND SCOPE

- Project approved by EMRA in September 2015
- Period of the Project 1.9.2015 – 30.4.2017

SCOPE

Pilot project will start with 20 meters by defining from the following area
- Non read meters
- There are many block consumption points such as residences housings, multi storey business centers, industrial estates etc. which requires one to one reading, takes so much time to do it and some placed in rough/dangerous places
- Including the current standard meters in to AMR

EXPECTATIONS

- Lower investment amount and operational cost
- Fast, easy reliable meter reading
- Prevention of customer data loss and incorrect data registry
- Be able to read the unreadable meters
- Decrease the reading cost
- Be able to read the rural areas and shorter accrual process
- Decrease theft and loss with better reporting and analysis
THANK YOU FOR ATTENTION

TIME FOR NEXT SPEAKER
REAL ADVANCED APPLICATION RESULTS

Final results of LODIS project

František Müller - Business Strategy Department, ČEZ Distribuce
Field example showing situation where 80% of PV production flow to MV thru substation.

Can it be managed by on demand switching of boilers by PV production prediction? Optimization of energy flow?
What does it mean optimization in dynamic Grid world?

Flexible adaptation to actual grid situation!

Common grid situations:
1. Stable grid = target is optimize to lowest losses in a SG cell
2. Overloaded grid = lowest total consumption/manage supply sources
3. Oversupplied grid = maximize consumption/manage supply sources
4. Under/over voltage

Each SG cell getting own targets for a time period and optimize own behavior in defined limits (tariffs, fuses, transformers, etc.)

Lot of flexible SG cells = Flexibility of whole grid
POSSIBLE ARCHITECTURE OF SG CELL
BEHAVIOR MODEL:
DETECTION AND PREDICTION OF CONTROLLED LOAD -

**Response rate calculation for each consumption point**
EXAMPLE OF DAILY SUBSTATION BALANCES WITH LOCAL PRODUCTION DURING WINTER
**Algorithm goal:**
find optimal tariff switching plans for tomorrow for each consumption point according to expected production and consumption at given location

**Optimality:**
- To consume production from renewables as close to production points as possible
- To minimize technical losses

- **Weather prediction**
- **Production prediction**
- **Consumption prediction**
- **Prediction of customer reaction to tariff switch**
- **Compute optimal switching plans in a form of TOU tables**
- **Distribute TOU tables to consumption points**
LOCAL DEMAND MANAGEMENT EFFECT EXAMPLE

24h DTS load (green - local load mgmt., black - as is (HDO))

24 production

Calculated optimal unblocked boilers (low tariff) time periods (green)
RESULT ANALYSIS FROM 14.8. PLZEŇ - LO DIS
RESULT ANALYSIS FROM 24.8. PLZEŇ WITHOUT LO DIS
LODIS NEXT RESULTS

- **Balance smoothness (algorithm target: minimum from \( \sum 15\text{min} \ LP \ A^2 \))**
  - around 10%

- **Counts of 15min periods where the regulated consumption was against to renewable production (PVs)**

<table>
<thead>
<tr>
<th>Locality</th>
<th>LODIS</th>
<th>Before</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hradec Králové</td>
<td>29%</td>
<td>19%</td>
</tr>
<tr>
<td>Lázně Bohdaneč</td>
<td>51%</td>
<td>36%</td>
</tr>
<tr>
<td>Plzeň</td>
<td>51%</td>
<td>31%</td>
</tr>
</tbody>
</table>
CONCLUSIONS

- We are using flexibility in consumption to achieve flexible grid
  - We are now using accumulation in hot water boilers, the solution is open for other types of flexible consumption (heating, air conditioning, charging stations, ...)
- It is automated service for customers
- It is example of application based on smart meter data and infrastructure which shows
  - 15m consumption profiles are useful and they can be base for prediction models
  - Targeted ad-hoc readings during day are useful for intra day optimization

LODIS project tested hypothesis, that we can utilize data from Smart metering for Smart grid world with real actions and real benefits.
THANK YOU FOR ATTENTION

TIME FOR QUESTIONS
František Müller has been working in the sector of information technologies for the power industry since 1994.

Until 2005 he was with Východočeská energetika, a.s. (East-Bohemian Power Distribution Co.) in the position of the Senior Manager of GIS.

At present he works as an expert in ČEZ Distribuce

He was, among others, responsible for the following projects:

- Geographic information system of Východočeská energetika (VČE),
- Data acquisition from the distribution system of VČE,
- Automatic system of technical and economic management of power distribution,
- Project: Migration of customer service system of VČE into SAP/R3
- Project: Management of output at ČEZ Měření
- Pilot project: Automated Meter Management in the Group ČEZ
- Wide pilot project WPP AMM
- LODIS project – smart local optimization in distribution grid
- New technology strategy

He is a representative of CEZ in the PRIME Alliance