Smart Energy - Honeywell HUG
Edge Intelligence (Gas) – The Future of Residential Gas Metering
Agenda

• What is driving the gas industry?

• Gas Residential Metering - today & outlook

• Next Generation Gas Meter

• Product Portfolio

• The Smart Factory
What is driving the Gas Industry?

Digitalisation
- Manage large scale roll outs
- No long term experience with Smart Meters
- New/ better communication technologies
- New risks to be taken care of…
- New opportunities…

Impact of new IT/ IoT trends

Increase focus on capital & operational costs
- Capital & Op. costs per unit rising quickly
- Systems Complex
  - Databases growing at astronomical rate
  - Real time performance
  - Pressure on Efficiency and Reliability

Pressure on efficiency & reliability

Renewables & Gas Quality
- Changing Energy mix supply & demand
- Biomethane injection
- Hydrogen injection
- CV measurement

Measurement technology need to deal with energy mix

Increasing government regulations
- Regulatory Pressures – governments respond to recent events & new technologies
  - Data Security
  - Data Privacy

Governments focussing:
Co2 emission cut, security, privacy
Gas Residential Metering | Today

- Smart Roll Outs are ongoing
- Customized solutions to meet local requirements

<table>
<thead>
<tr>
<th>Country</th>
<th>Specification</th>
<th>No. of gas endpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>2,4GHz ZigBee, SMETS2, Prepayment</td>
<td>22m</td>
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<tr>
<td>Italy</td>
<td>UNI-TS, GSM &amp; 169Mhz, wMBus, DLMS</td>
<td>20m</td>
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<td>France</td>
<td>169Mhz, wMBus, N-Mode</td>
<td>11m</td>
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<td>Netherlands</td>
<td>DSMR, ESMR 868Mhz, wMBus</td>
<td>7m</td>
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<td>Luxembourg</td>
<td>OMS, 868 wM-Bus &amp; hard wired M-Bus</td>
<td>85k</td>
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<td>Belgium</td>
<td>OMS, 868 wM-Bus</td>
<td>6m</td>
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<tr>
<td>Germany</td>
<td>OMS, 868 wM-Bus</td>
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</tbody>
</table>

- Focussed on
  - Battery lifetime & energy saving mechanism
  - Measurement & RF performance
  - Cost optimization
  - Production capacity & quality

European Commission: “According to our estimates, the roll-out commitments amount ... close to 200 million smart meters for electricity (representing approximately 72% of all European consumers) and 45 million meters (around 40% of consumers) for gas.”
Next Generation Gas Meter | Thoughts

• Challenging mechanical gas meters vs static measuring principles

• Mechanical diaphragm gas meter
  - Hard to beat or phase-out model?

• Some meter manufactures have recently introduced static meters
  - Opportunistic or forward-looking?

• Elster-Honeywell residential Ultrasonic gas meter has been developed in 1995
  - Market was not ready to accept the technology & price increase

• What will be the right measurement technology?
  - Ultrasonic, Thermal Mass Flow, any other alternative technology – not in scope yet
Gas Residential Metering | Outlook

• Is the next Generation Gas Meter about to come?
  - Smaller size
  - Multirange
  - Calorific Value & Energy Measurement (kwh)
  - Easy scalable to bigger meter sizes (C&I)
  - Diagnostics
  - Higher accuracy
  - Tamper proofed
  - Lower Cost
  - ...

• Still needs focus on
  – Battery lifetime & energy saving mechanism
  – Measurement & RF performance
  – Cost optimization
  – Production capacity & quality
Gas Metering | Alternative Technologies

• Residential static gas measurement technologies in use:

**Ultrasonic:**

Time of flight measurement of an accustical signal

**Thermal Mass Flow:**

Microthermal measurement of a temperature profile
Gas Metering | Alternative Technologies

- Alternative or potentially new gas measurement technologies
  - Time of Flight
    - Radioactive Time of Flight
    - Thermal Time of Flight
    - Corona Time of Flight
  - Vortex/ Coanda
  - Coriolis
Ultrasonic vs Thermal Mass | Comparison

- Ultrasonic measures 100% of gas flow whereas Mass Flow only measures a sample of approximately 1% (Bypass)
  - Utilities may consider bypass measurement as “trust issue”?
- Gas type dependency higher with Mass Flow
  - Gas types & gas composition will vary more in future
- Mass Flow easier scalable to bigger meter sizes
- Mass Flow has more potential to achieve lower cost
  - To be cost competitive to Diaphragm Meters
  - Ultrasonic expected to have higher costs as Diaphragm Meters
- Mass Flow obviously more sensitive against gas contamination
- Mass Flow – measures independent from temperature & pressure
  - Utilities may have an issue as today billing systems are calculating with high/pressure levels
Energy Measurement | kWh from Edge to Invoice

**Displacement**

- **m^3**
- Forces gas through internal compartments to measure flow (multiple design variants)
- Measures in cubic meters
- Proven technology
- High accuracy
- Long term experience
- Robust

**Advantages**
- Pressure and temp compensation optional
- Wears out over time
- Form factor?

**Disadvantages**
- Pressure and temp compensation optional
- Higher power consumption

**Ultrasonic**

- **m^3**
- Measures the speed of gas movement via ultrasonic pulses inside a pipe
- Measures time of flight
- No moving parts
- Smaller form factor
- High accuracy
- Electronic meter – can combine with other tech

**Advantages**
- Pressure and temp compensation optional
- Higher power consumption

**Disadvantages**
- To be determined

**Thermal mass flow**

- **m^3**
- Uses a heating element and temp sensors to measure mass of gas in a pipe
- Measures mass flow
- No moving parts
- Smallest form factor
- Highest accuracy – measures mass, not volume

**Advantages**
- Uses thermal mass flow technology with additional measurements
- No moving parts
- Highest accuracy – measures mass, not volume
- Measures kilowatt hours
- Energy metering allows direct billing

**Energy Gas Meter**

- **kWh**
- Uses thermal mass flow technology with additional measurements
- Measures mass flow
- To be determined

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*Image source: Honeywell*
Volume vs Energy Measurement | Comparison

Pros:

• Energy measurement improves visibility for the consumer
  - (…what you see is what you pay for)

• After full implementation, energy measurement will reduce the cost of billing for utilities

Cons:

• Today’s billing systems are not prepared to receive gas consumption data in kWh

• There are no standards in place for gas kWh meters

• There are no metrological rules in place
  - E.g. no error limits
  - No approval procedures
  - National approvals most likely necessary for first few years (no MID)
• Voice Of Customer interviews conducted
  Major European customers have been visited & interviewed
  - Gas Meters will become SMART!
  - TCO, reliability and battery lifetime play a key role
  - Ratio of SMART static gas meters will increase in the next years
  - Slight advantageous position for Ultrasonic technology
  - Thermal Mass technology is not yet well known
  - Value of a true Energy Meter is unpredictable at the moment

• Voice Of Customer question:

  If you could source the three meter types (Ultrasonic, Thermal Mass and Diaphragm) at equal features & price. What would be your preference?

  Guess what the answer was…
Product Portfolio | Residential and C&I

- Indexes for Standard Meters & Smart Meters – G1,6 to G100
- Suitable for the whole range of Elster Meters

**Electronic Indexes**

- **themis\textsuperscript{alpha}**
  - Modular Electronic Index
  - G1,6 – G100
  - 868MHz wMBus/ 2.4 GHz ZigBee
  - Optional: Integrated Valve

- **themis\textsuperscript{evo}**
  - New integrated Electronic Index
  - G1,6 – G100
  - 868 MHz wMBus/ 2.4 GHz ZigBee
  - Optional: Integrated Valve

- **themis\textsuperscript{uno}**
  - Electronic Index
  - G1,6 – G100
  - GSM/GPRS & 169MHz
  - Optional: Integrated Valve

- **themis\textsuperscript{plus}**
  - Electronic Index for C&I Meters
  - Integrated Volume Corrector
  - Integrated Data Logger
  - G10 – G100
  - GSM/ GPRS

**Mechanical Indexes**

- **Z6**
  - Mechanical Index
  - For non smart meters
  - G1,6 – G100

- **Absolute Encoder - AE5**
  - Opto-electronic Index
  - G1,6 – G100
  - 868MHz wMBus
  - MBus wireless/ hard wired
Low Power Wide Area (LPWA) radio standards

...will dominate next generation meter communication

- NBloT – Narrow Band Internet of Things
- LoRa WAN – Long Range Wide Area Network
Smart Metering Gas | SMART Factory

- Smart Metering cannot happen without innovation in meter production
- Smart Meter Production cannot be managed without Industry 4.0 practices
- Industry 4.0 in Smart Meter manufacturing stands for:
  - High degree of automation, dynamic processes, connected equipment, data security, comprehensive QA parameter, lowest failure rate