Smart Grid/Metering Solution

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Visit us on www.st.com\metering
Goals and pay off

- Purpose: review the smart grid / metering applications requirements and the ST solutions to answer them.

- At the end of this training, you will be able to describe the metering application and options of implementation. You will know how and why ST products fit in the application versus the different cases.
Agenda

1) Metering market overview and application technical requirements.

2) The Meter architecture: one or 2 microcontroller. Why?
   - The advantage of STM32 family.

3) Power and network quality measurement
   - (STPM01, 10 and C1 + S1)

4) The concentrator, MUC core: SPEAR310

5) Power Line Communication: the main communication medium for Smart Grid in EU.

6) ZigBee for HAN

6) Specific technical requirement for the SMPS in metering & the ST solutions
Warm up game

- What are the metering manufacturers and electricity utilities in your region/country?
  - France
  - Germany
  - Spain
  - Portugal
  - UK
  - Italy
  - Sweden
  - Finland
  - Norway
  - Poland
  - Slovenia
  - Cz
  - Slovakia
  - Lithuania
  - Belgium
  - Austria
  - Israel
  - Turkey
  - Republic of South Africa
  - Russia
What is Smart Grid?

- **Smart Grid** is the control of the Grid i.e.: the distribution network, its input (production of energy) and output (consumption) to guaranty its security and optimize the asset, the consumption and footprint. It has impact on:
  - **Smart Metering**: Control the meter infrastructure (change tariff, contract, reseller of electricity and distribute the information in the home)
  - **Grid control**: (pure **Smart Grid**), control of the Distribution network, load balance, outage discovery, quality of service control.
  - **Smart Building**: control the building resources (heating, air conditioning, lighting, Energy production...) according to the utility requirements thru tariffs of consumed and produced energy.
  - **Smart home**: control the home appliances, resources, e- Vehicle
  - **e-mobility**: Charge and discharge of electrical Vehicle to avoid pick of consumption or to sustain pick of consumption.
The applications in the smart grid

- Electricity meter
- Multi Utility controller
- Gas water heat meter
- Home Display
- Concentrator
- E vehicle Charge spot
- White goods and consumer electronic
- Air Conditioning
- P V Panel
- DC/DC, DC/AC Converter

STMicroelectronics motto: one-stop shop supplier for each Smart Grid applications
WW Market Overview

- Electricity Meter Market is rising fast driven by
  - Advanced (high-end) meters & Smart Grid deployments (*)
  - Regulation in EU, Stimulus packet in USA and Strong economic growth in Emerging market (i.e. Asia and India) and rising energy consumption - electricity crisis prevention...

- What is come first for biz
  - Smart Metering and AMI is NOW.
    - >300M in EMEA
  - Smart Grid: existing today, will grow
  - Smart Building. DIN meters, Smart Plug, central ctr system
  - Smart Home: pushed by Time of Used.

(**) it is needed to have local (direct) resource in the counties
Significant Electricity Meter Markets

6 Key players in EMEA – electricity meter manufactures: Landis & Gyr, ITRON, Elster, Sagem, ENEL (*), ISKRAEMECO

• In EMEA there is more than 80 meter manufacturers!
Why ST:

- **20+ years experience in Metering starting with ASIC and standard products**
- **A commitment from ST top management on metering**
  - => Focus on Market and Customer thru the Competence Centers.
  - => Product division are focus on delivering product for metering segment.
- **A wide product portfolio**
  - The right technologies for the metering market
  - A system solution provider
  - One stop shop supplier
  - Committed in long term product family
- **Research of long term partnership.**

[www.st.com/metering](http://www.st.com/metering)
Smart meter system and application architecture
Smart Metering application

Photovoltaic, and home + Building automation (load Management) are part of ST focus too. they are covered by dedicated Competence Center (CC) in synergy with the metering CC
OPTION 1: Energy meter is used as point of communication

- P1: ZigBee (in UK), M-Bus Wireless or proprietary (EU), Euridis in F.
- P2: M-BUS Wired (UK, Ger.), and Wireless. Ethernet with Energy meter (in Germany only)
- P3: PLM S-FSK, OFDM (F, Sp, Ger), PSK (Sp); GPRS w/o concentrator (No), Wireless (USA, Australia...)
- P4: GPRS and ADSL
P1: ZigBee (in UK), M-Bus Wireless or proprietary (EU), Euridis in F.
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P3: PLM S-FSK, OFDM (F, Sp, Ger), PSK (Sp) ; GPRS w/o concentrator (No), Wireless (USA, Australia… )
P4: GPRS and ADSL
E-meter Functional blocks

- Power Supply Battery Charger
- Voltage Sensing
- Current Sensing
- Energy Metering IC
- Stepper Motor Display
- Battery Switchover
- Anti Tampering
- RTC
- Control Unit
- Reset Circuit
- LCD Control
- EEPROM
- Breaker
- X-axis accelerator
- Communication Signal Processing for AMR and domestic automation
  - RF
  - Ethernet
  - PLM
  - GSM
  - RS-485 RS-232
  - Smart Card Reader
  - IR Remote

Legend:
- Power Management and Power Related
- Data Storage
- Data Processing
- Interfacing Related
- Peripheral
- Standard Products Devices
- 3rd Party/Partner Components
- Not Supported Components
ST Kit for E-Meter

**Microcontroller**
- STM32

**Microporessor**
- SPEAr

**Power Line modem**
- ST7540/70/80/90

**ZigBee**
- Module or STM32W

**Sub Ghz**
- Spirit 1

**GSM Chip Set**
- ST Ericsson solution

**Power Measurement**
- STPM01
- STPM10
- STPMC1
- STPMS1

**Digital Memory**
- EEPROM
- Dual IF EEPROM (I2C + RFID)

**RTC**
- M41T6x
- M41T87L

**Power Supply**
- Viperxx
- ALTair04-900

1st metering dedicated IC

1st in cortex M3 family offer & Market Share

Unique kit approach to 3 phase

STMicroelectronics
Energy meter with Communication

Extension for AMM meter

STM32F100/1/3
>256 K flash
32 RAM

UART
SPI
UART

ZigBee

P1

MBUS

P2

Basic meter

STM8L or STM32L or F
>32 Flash
TQFP48

SPI

UART

3 I/Os

2 buttons + relay

Super cap or battery

RTC

SPI

2 I/Os

Anti tamper system w/ or W/O memory

Sensor (s)

STPM01/10 or STPMC1 + 3 S1

UART

ST7590

ST7570

Serial 1 MB (8 Mb) Flash

STMicroelectronics
Commodities Kit for Electricity Meter

**POWER**

**POWER SUPPLY**
- Turbo II diodes:
  - STTH8R06D/STTH8L06D
  - STTH5R06D/STTH5L06D
  - STTH110
- 150V Schottky:
  - STPS1150
  - STPS2150
- Linear regulator
  - L78xx

**PROTECTION / VOLTAGE REFERENCE**
- Transils:
  - P6KExx, SM6Txx, SMBJxx
  - SM15Txx, SMCMJxx
  - BZW06xx, BZW50xx

**ESD PROTECTION**
- RS232 / 422
  - ESDA25B1+ESDA25SC6

**I/Os**

**REVERSE BATTERY**
- Schottky diodes:
  - STPS1L60 / STPS0560Z

**ESD for display**
- ESDA6V1-5W6
Concentrator and MUC Functional blocks
ST Kit for Concentrator and MUC

**Power Line modem:**
- ST7540/70/80/90

**ZigBee**
- Module or STM32W

**Sub Ghz**
- Spirit 1

**GSM Chip Set**
- ST Ericsson solution

**Ethernet Phy**
- ST802RT

**Mciprocessor**
- SPEAr

**Microcontroller**
- STM32F2xx

**RTC**
- M41T6x
- M41T87L

**Memory**
- EEPROM

**POWER SUPPLY**
- Viperxx
- ALtair04-900

* Picture of a MUC from DNT
In case the utility delivers multi energy: Electricity and water in Germany (or Elec and Gas in UK) it is sometime chipper to have a deported concentrator or communication unit called MUC: Multi Utility Controller.

* MUC: Multi Utility Controller
Home display and gateway functional blocks

- Real time clock
- Reset circuit
- Anti tamper
- MEMs
- Security & cryptography
- Control unit
- User interface
- Display interface
- Display
- RF
- GSM
- RS 232
- RS 485
- Power line modem
- Ethernet
- Battery charger
- DC-DC converter

Legend:
- Power management
- Data storage
- Data processing
- Interface
- Peripherals
- 3rd party/partner components
- Non-supported components
ST Kit for Home display \ gateway

**Microprocessor**
- SPEAr

**RTC**
- M41T6x
- M41T87L

**Memory**
- EEPROM

**POWER SUPPLY**
- DC/DC converter

**Microcontroller**
- STM32F2xx

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**Sub Ghz**
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**GSM Chip Set**
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**Ethernet Phy**
- ST802RT

- Picture of Cisco Energy Display
- Picture Of L+G Eco meter
Home Display

- **LCD**
- **EEPROM or Flash**
- **Battery Charger**
- **Battery**
- **STM32F100/1/3**
  - 64 K flash
  - 16 RAM
- **SPEAR 300 and 310**
- **Possible complete integration**
- **ZigBee Module or STM32W**

Possible complete integration
Gas meter functional blocks
ST Kit for water and Gas Meter

**Ultra low power Microcontroller**
STM8L and STM32L

**Micro controller and Porcessor for Hubs**
STM32F and SPEAr

**ZigBee**
Module or STM32W

**Sub GHz**
SPIRIT 1

**GSM Chip Set**
ST Ericsson solution

**POWER SUPPLY**
LDO

**COM.**

**POWER**

**DIGITAL**

**Memory**
EEPROM
Dual interface EEPROM

**RTC**
M41T6x
M41T87L
Why ST product for Smart Grid apps.

- Measurement AFE for Electrical meter. Advanced and disruptive single phase and 3 phase solutions with a clear leadership reference.
- Microcontroller: STM32: The most advanced and wider Cortex M3 Micro Portfolio WW. Ultra low power sub families taking leadership position.
- Power Line Communication: ST is the number 1 in Metering PLC WW
- Microprocessor Unit (MPU): tuned family for metering concentrator, MUC and high-end home display.
- EEPROM: WW number 1
- ZigBee: State of the art Modules and integrated solutions
- Aux. Power supply: Best in class product offer with unique dedicated integrated solution with 900V break down voltage
- Commodities: Reference wide range supplier
ST technology and qualifying factors in Smart Metering

ST offers a unique mix of qualifying factors:

- Reliable and independent Semiconductor vendor
- World wide support and supply chain to any subcontractor
- Wide electronic meter system coverage with a complete kit of advanced semiconductor devices
- Ability to identify, support and adapt to market evolution trends and changes
- ST approach is to promote open standards and provide cost effective royalty-free solutions
- Long term presence in the smart Grid market and strong field based system know-How
Too answer your MCU needs

- Would you like an effective Hot line?
  - Provide technical product and tools support to selected CTM projects.
  - Our Engagement
    - An E-Mail Acknowledge time of 1 hour (>95%)
    - A solution in one workday, if the problem is known (>95%)
    - A follow up for new issues, status of issue will be reported via Email.

- Deep Technical Trainings on:
  - STM32 (3 days)
  - STM8S (3 days)
  - Advanced C (2 days)
  - Extensive Hands-on exercises included

- Do you need extra resources: Application SW Development
  - Partial or complete SW development for selected Customer.
  - SW conversion / porting from competitor’s micros to ours
  - Application SW validation has to be done with or by Customer.
Metering and SMPS support: IMMCC

- Smart Grid CC
  - Metering AFE, PLC and Smart Grid System questions
- Connectivity CC
  - ZigBee: module SN250 260 and STM32W, Dual Interface EEPROM
- Power Management CC
  - SMPS: viper, Altair04-900, L65xx...
Main point of reference for info

- [www.st.com/metering](http://www.st.com/metering)

- Block diagram, datasheet, User manual, demo board, reference SW, flyer and brochure…