Smart Grids
e Innovazione Tecnologica

Milano, Venerdì 18 dicembre 2009

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VIII GIORNATA DELLA RICERCA ANIE

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- Smart Grids Concept and benefits
- Enabling technology solutions for Smart Grids
- ST Technology Innovation and Future Evolution for Smart Grids

Smart Grid concept

The growing demand for improved energy efficiency and high value services to the end users will need Power Grids evolve into Smart Grids

What a Smart Grid can do ?

- Improve grid control and operational efficiency
- Anticipate and instantly respond to poor power quality and outages
- Increase security against terrorist attacks or natural disruptions
- Power congestion / collapse prevention and management
- Support widespread use of distributed generation
- Enable consumers to better manage energy use and reduce associated costs
- Optimize power flows and improve power quality and reliability
- Reduce power waste
- Better balance of distribution and local load
- Accurate infrastructure, equipments and protection devices dimensioning

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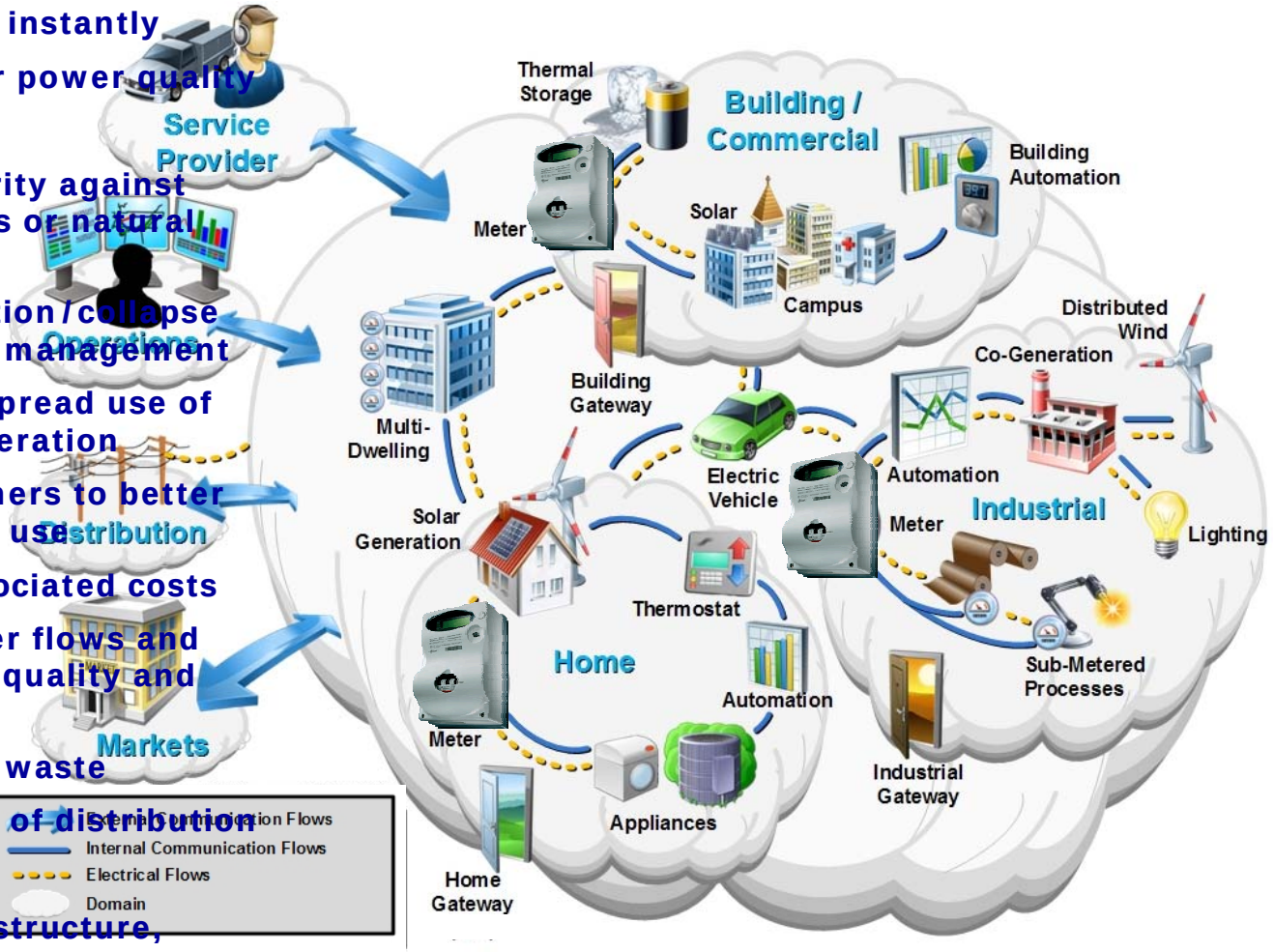


CO_2 reduction

Ambitious Smart Grids initiatives are booming, but...

EUROPE commitments on energy efficiency with 20% targets by 2020

USA Stimulus Package allocating more than 4$ Billion for Smart Grids

CHINA State Power Grid Corp new plans to build a "Strong & Smart Grid" by 2020

… but….

Obama putting $3.4B toward a 'smart grid'

President promotes moving America's power system into the digital age

Associated Press

updated 7:22 a.m. PT, Tues., Oct. 27, 2009

WASHINGTON – The Obama administration is giving a jolt to the futuristic "smart" electric grid, hoping to more quickly bring America's power transmission system into the digital age.

President Barack Obama, during a visit to a solar energy facility in Arcadia, Fla., is announcing Tuesday that he is making available $3.4 billion in government support for 100 projects aimed at modernizing the power grid.

The projects include installing "smart" electric meters in homes, automating utility substations, and installing thousands of new digital transformers and grid sensors.

Story continues below ↓

- **Real deployments** may require **different smart grid technologies** depending on local regulations and specific application needs and strategies
- **Long term investments** are required to build large scale Smart Grids

… so….

Flexible, reliable, field-proven, cost-effective *and* ***future-proof*** *technology solutions are mandatory for Smart Grids success*

ITALY pioneering Smart Grids World Wide providing enabler technology

- Started in 2001, **ENEL Telegestore** is today the largest ever AMM (Automated Metering Infrastructure) deployment worldwide involving more than **30 Million customers in Italy** with 2.1B€ investment recovered in 4.5 years payback.
- The meter for "Telegestore Project" today embeds a complete set of semiconductor components from STMicroelectronics **(Power Line Modem, Microprocessor, HV protections, memories, power management, …)**
- The key element of the smart Metering evolution, in the heart of Automatic Meter Reading (AMR) project , is the Power Line Communication Modem technology able to transmit data through he Power Line network
- The ST7538 Power Line Communication Transceiver IC is totally designed, developed and produced in Italy by STMicroelectronics

Today Italian Utilities as **ENEL, A2A, AEM, ACEA** have deployed AMR/AMM systems **based on ST Power Line Communication technologies**

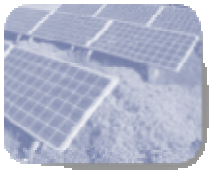
- A complete kit of semiconductor components and new **28 kbit/s** technology generation Modem, ***STarGRID*** by **STMicroelectronics**, developed, designed and produced in Italy, has been chosen by **ENEL group** to provide the new Advanced Meter Management system
- It will be used by **ENDESA** in 2010 to install more than 13 Million smart electronic meters in Spain with improved robustness and security
- This new solution will use the ENEL Power Line Communication protocol stack, named SITRED, which is going to be open to the market, so making it available for all the stakeholders who want to adopt a reliable and proven system on **more than 50 million meters worldwide.**

ST solutions for Smart Grids

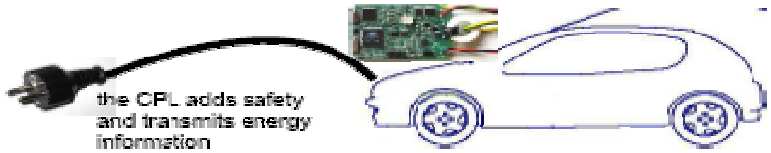
- Energy Meters

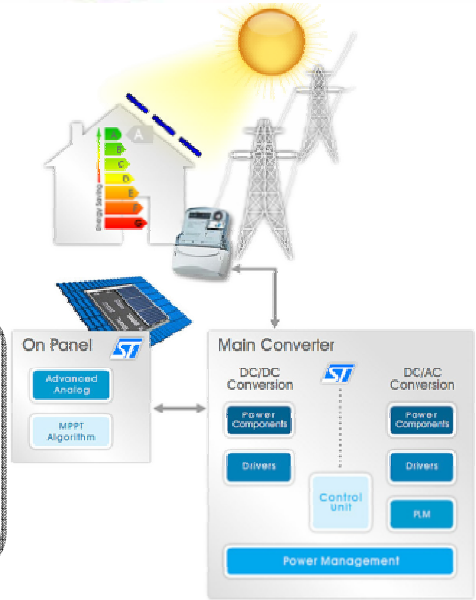
- HAN for Home Automation

- Connectivity solutions for energy & control data transmission



- Outdoor Smart Grid (Photovoltaic, Plug-in Electrical Vehicle, Street Lighting)





- Smart grid delivers smart energy from suppliers to consumers using digital technology to control appliances at consumer's homes to save energy, reduce cost and increase reliability and transparency.

Energy Meters *from Low-end to High-end*

by functions

Basic → Medium → Advanced

POWER: *DC for electronics & battery*	Standard Functions: *Overall housekeep and tamper monitor. Processes, store, display data point. RTC needed for time usage records and multi tariffs*	COMMUNICATIONS *Communication protocols. Used in reading of meter for payment collection purposes, as well as in calibration and verification of meter. Smart card reader for pre-paid features.*
METROLOGY: *Measures Current and Voltage and computes for active power*		

Key blocks are similar in each classification …

by features

- kWH measures
- LCD Display
- Storage Calibration Data

+

- Anti Tamper
- Maximum demand with date and time
- Date&Time
- Cumulative Energy

+

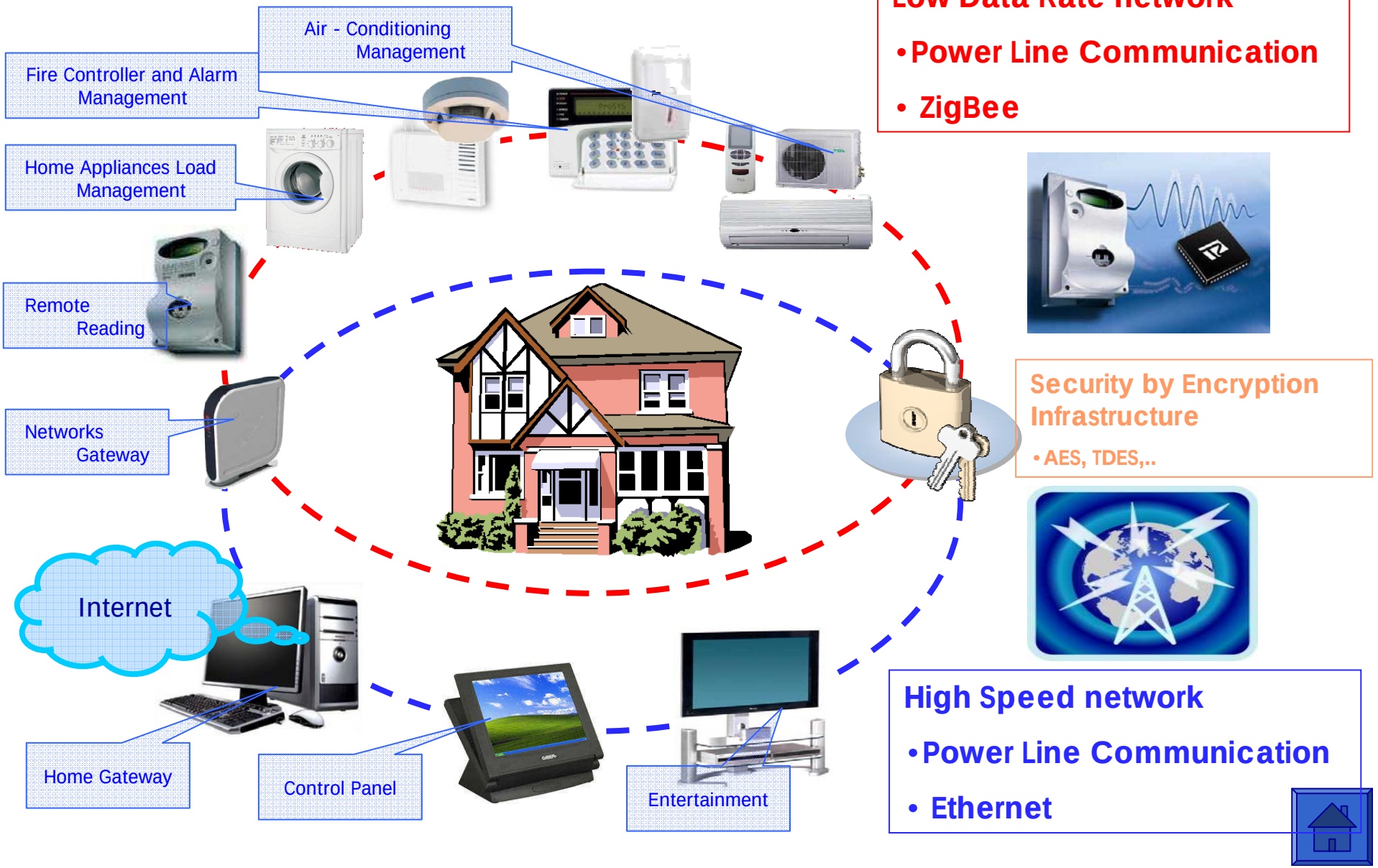
- Automatic Meter reading (PowerLineCommunication, IR, RF, IrDA, ZigBee)
- Multi –Tariff (Peak hours, normal hours, etc)
- Meter calibration trough s/w
- Pre-paid module (Card types used: EEPROM card, Security card, Smart card)

Low End Meter

Medium End

High End Meter

Connectivity Scenario - Communication technologies for Smart Grid



ST approach to Communication Technologies for Smart Grids

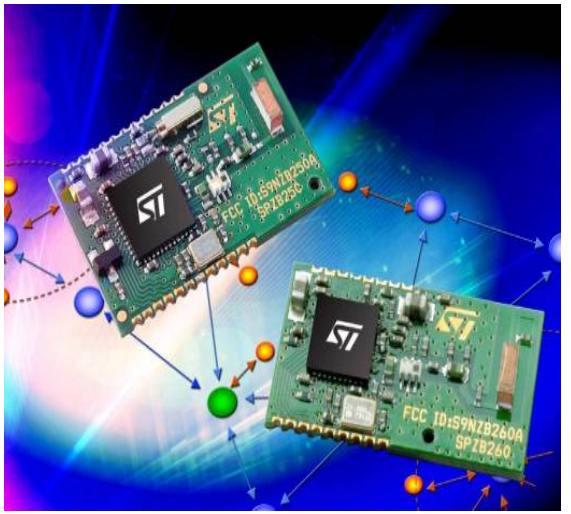
- **ST is a driving technology partner in the most important industrial standardization initiatives (Konnex, HomePlug, Zigbee Alliance, PRIME, OPEN meter…)**

- **ST Smart Grid products are not based on proprietary/patented modulation schemes or communication protocols**

- **ST products are either “protocol agnostic” for application specific customizations or suitable for open standard implementations**

ST wireless solutions for smart grids: the Zigbee smart energy platform

- ST is a promoter member in the ZigBee Alliance



- ST offers a family of ZigBee modules for mass market based on a market-proven ZigBee platform integrating EmberZNet PRO stack

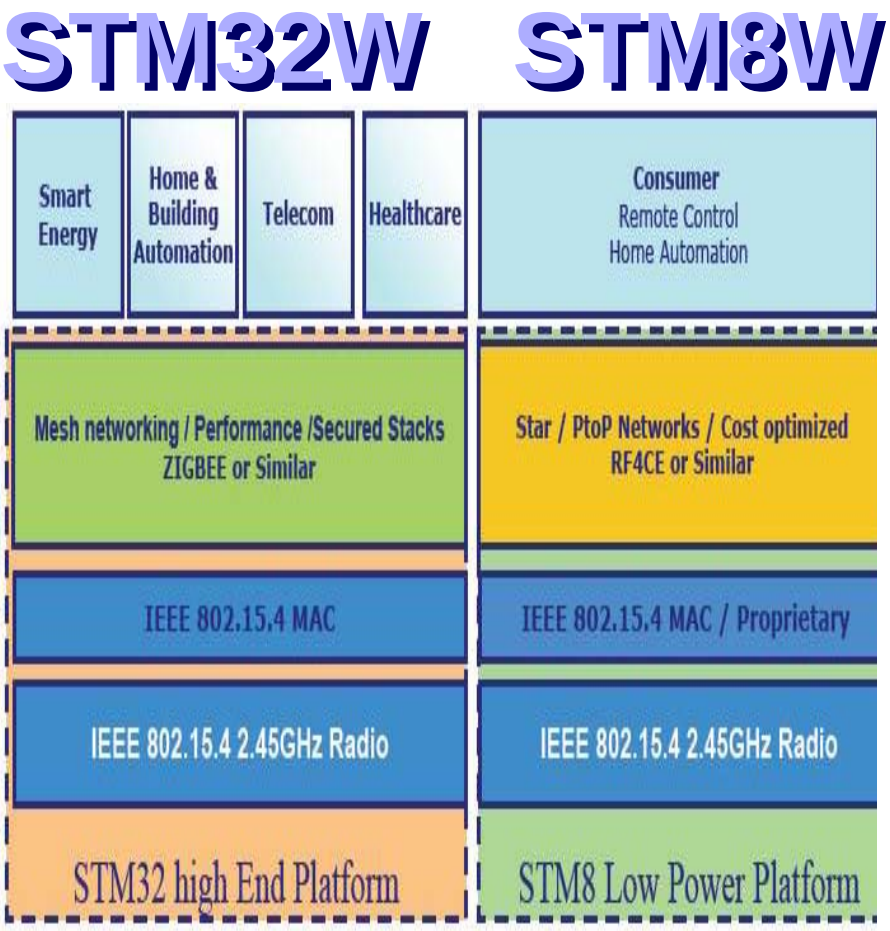
- ST recently announced the next generation of IEEE 802.15.4, ZigBee SoC: STM32W, a derivative of the already well-known STM32 family based on ARM Cortex-M3 core

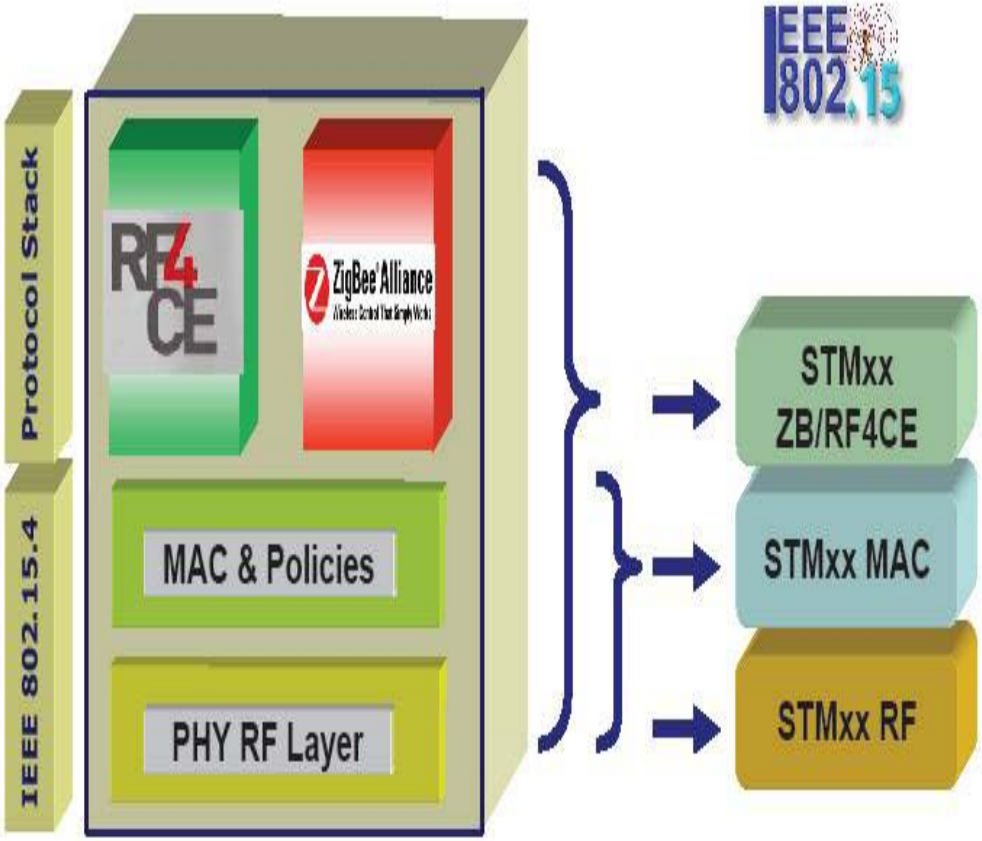
ZigBee
Control your world

Energy

Smart energy profile

STMxxW – Flexible HW platform offering



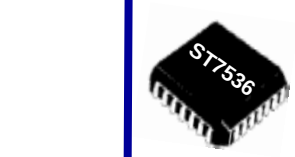


2.45GHz IEEE compliant as a fundamental to offer multiple development opportunities and approaches

ST Power Line Communication solutions for Smart Grids: + 20 years success stories

•By exploiting existing power grids as communication medium, Power Line Communication (PLC) is one of the most attractive communication technology for Smart Grids

1989 — **1st gen.Power-line Modem for simple AMR**

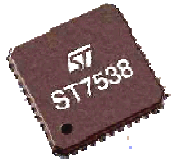


1993 — **2nd gen. Power-line modems for home connectivity**

1995 — **Technology reference for KNX home automation standard**

KNX

2002 — **3rd gen. advanced PLC transceiver with integrated Line Driver**



2003 — **Chosen for multi-million ENEL Telegestore Smart Metering project**

Enel
L'ENERGIA CHE TI ASCOLTA.

2004 — **Chosen by Legrand for home & building automation system**

legrand

2005 — **4th gen. highly compact and cost effective PLC transceiver**

IBM

AEM acea a2a

2006 — **Chosen worldwide for large smart metering deployments**

Landis+Gyr

CNPC

2007 — **New STarGRID™ PLC platform for multiple standards**

2008 — **Technology provider in major smart grid projects: PRIME alliance, OPEN meter**

IBERDROLA

OPENmeter
Open Public Extended Network Metering

2009 — **STarGRID™ chosen for 13 million smart meters in Spain**

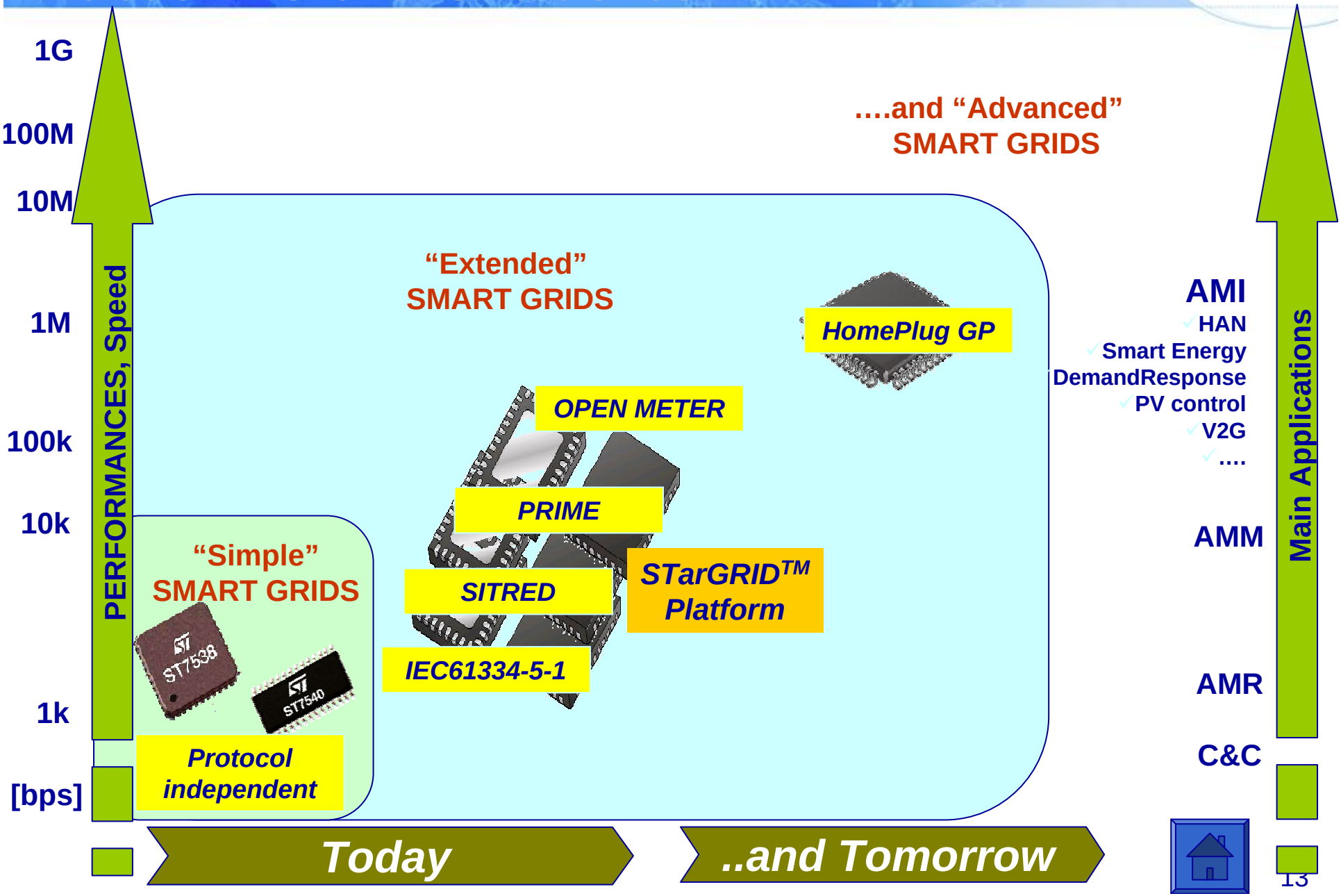
endesa

Enel
L'ENERGIA CHE TI ASCOLTA.

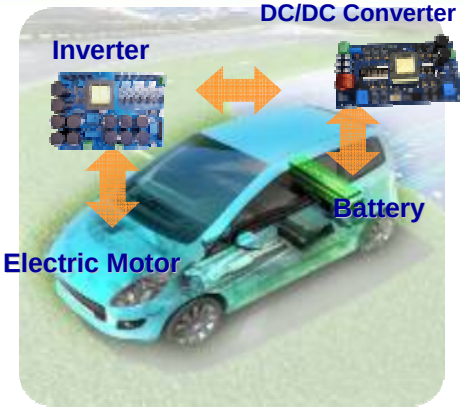
2010

More than 30 Millions PLC transceivers provided in the last 5 years !

Power Line Communication Technology Possible Evolution Trend for Smart Grids



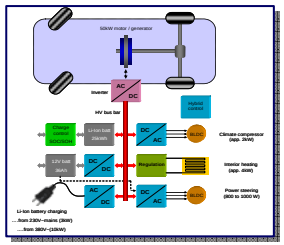
Examples of Smart Grids solutions beyond smart metering and HAN: (Hybrid) Electric Vehicles scenario



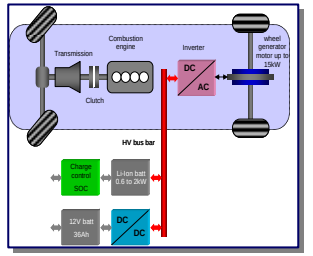
Offering solutions for EV/HEV parts

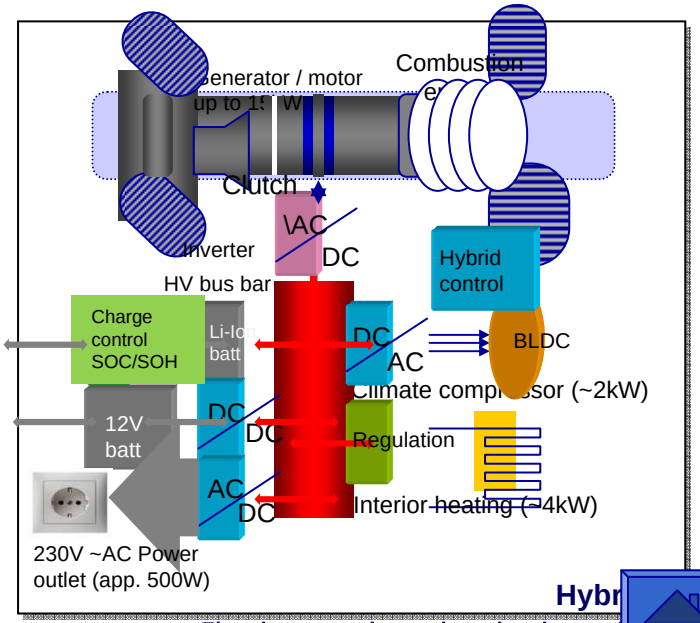
- Electric Traction
- Power Conversion
- Power interfaces for HV battery to AC
- Battery management
- "Comfort and Service" electrification :
  - Climate compressor
  - Power Steering
  - Engine cooling
  - Interior heating

Pure Electric Car



Plug-in Hybrid
Electric motor charged from external power source

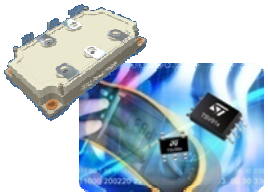




Hybr
Electric motor + internal combustion engi

Innovating with new products for EV/HEV

- New Gate Drivers
- New MOSFET
  FDMESH V Power MOSFET
  1200V SiC MOSFET
  Low Voltage GaN MOSFET



- A1 Power Module
  High power Six-pack power modules
- High Voltage IGBT
  New Trench Gate 600V PT IGBT

Smart Grids solutions beyond smart metering and HAN: grid-connected PV modules

MPPT Converter Management

PLM or RF Transceiver

Control Unit

Communication

PV Modules

DC/DC

DC/AC

50Hz Filter

Connection To Grid

- BOOST
- BUCK
- BUCK-BOOST

- HALF-BRIDGE
- FULL-BRIDGE

CONCLUSIONS

- **Smart Grids are becoming a reality driven by “green” initiatives and technologies evolution worldwide**
- **Smart Grids will significantly contribute to global energy savings and CO_2 emissions reduction in the next few years**
- **Italy is a pioneer in the Smart Grid world**
- **Since its creation, ST has maintained its commitment to R&D and Innovative Technology (in 2008 spent over US$2B approximately 22% of the Company’s 2008 revenues in R&D)**
- **With more than 20 years experience on integrated “smart energy” systems, ST is the technology provider of reference for Smart Grids solutions**