ZigBee Smart Energy in Global Smart Grid Standardization

ETSI SmartGrid Workshop
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ZigBee Alliance
ZigBee Alliance Overview

- Organized as an independent, neutral, nonprofit corporation in 2002 for WSN Standards Development
- Open and global
  - Anyone can join and participate
  - Over 400 companies worldwide are members
  - Membership is global [approx. 40% Americas, 30% EMEA, 30% Asia]
- Activities include:
  - Open Standards for wireless sensor and control
  - Product Certification and compliance programs
  - Branding, market development and user education
- ZigBee is a key enabler for the Internet of Things
ZigBee Application Areas

- **BUILDING AUTOMATION**
  - Security
  - HVAC
  - AMR
  - Lighting Control
  - Access Control

- **ENERGY MGT. & EFFICIENCY**
  - Demand Response
  - Net Metering
  - AMI, SCADA

- **CONSUMER ELECTRONICS**
  - TV
  - VCR
  - DVD/CD
  - Universal Remotes

- **PERSONAL HEALTH CARE**
  - Chronic disease
  - Elderly care
  - Fitness
  - Wellness

- **TELECOM SERVICES**
  - PC & PERIPHERALS
  - Mouse
  - Keyboard
  - Joystick
  - Touchpad

- **INDUSTRIAL CONTROL**
  - Retail Store Mgmt
  - Shopping
  - Supply Chain
  - Environmental Energy Mgmt

- **HOME CONTROL**
  - Security
  - Safety
  - HVAC
  - Lighting Control
  - Access Control
  - Irrigation

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Published ZigBee Standards

- **ZigBee Home Automation (ZHA)**
  Greater safety, reliability, control & convenience for your home

- **ZigBee Smart Energy (ZSE)**
  Green technology saving money & energy in homes everywhere.

- **ZigBee Telecom Service (ZTS)**
  Innovative mobile devices for innovative lifestyles

- **ZigBee Health Care (ZHC)**
  Promoting independent living, health, wellness and fitness

- **ZigBee Remote Control (ZRC)**
  Advanced remote controls for consumer electronic devices

- **ZigBee Input Devices (ZID)**
  Energy efficient and easy-to-use keyboards, touchpads, mice, wands for consumer electronics and computers
ZigBee Standards in Development

- **ZigBee Building Automation (ZBA)**
  Easier to install, more flexible & smarter building systems

- **ZigBee Retail Service (ZRS)**
  Improved customer shopping experience, store, and supply chain management

- **ZigBee Smart Energy 2.0 (ZSE)**
  Green technology saving money & energy in homes everywhere based on Internet Technology.

- **ZigBee 3D Sync (Z3D)**
  The ultimate home 3D viewing experience for gaming and HDTV.

* future profiles proposed by member companies...
Drivers for the Smart Grid

Achieving Changes in…
- Generation
  - Renewables
  - Variability
  - Storage
  - Distributed resources
- Load
  - Reduce peaking
  - Energy management
  - Plug in vehicles
- Reliability and security
  - Improved measurement and control
  - Risk-based methodology

Requires…
- Automated management, operation, control
- 2-way flow of power and information
- Interoperability at many levels
- Standards

Source: George Arnold, NIST
Smart Grid Infrastructure Ecosystem

Central Generation

Transmission Grid (high voltage)

Distribution Grid (low voltage)

Meters & Customers (low voltage)

DG, Storage, Appliances, PHEs and EVs

Picture courtesy of Grid Net
Urgent demand for Smart Energy + compatibility with mainstream Home Automation systems enables customer choice
ZigBee Smart Energy Profile

Supported Features Include:

- Basic metering [measurements, historical info, etc.]
- Demand Response (DR) and Load Control
- Pricing [multiple units & currencies, price tiers, etc.]
- Text messages
- Device support for Programmable Communicating Thermostats (PCTs), Load Controllers, Energy Management Systems, In Home Displays (IHDs), etc.
- Security to allow consumer only, utility only, or shared networks
- Support for water and gas
HAN Side Energy Management

- Optimize Energy Consumption
- Avoid load peaks

Through—
- Customer settings
- Time of Use pricing
- Green Energy availability

Extra Home Automation Services Enabled:
- Remote Control
- Remote Assistance
- Appliance customization
  - Cycle downloads
  - Configuration Upgrades
How is ZigBee Smart Energy Used?

Programmable Communicating Thermostats respond to pricing signals and grid disturbances.

Rooftop Solar provides renewable energy coincident with peak demand.

Fixed Electricity Storage Batteries store off-peak power to use during peak periods and backs up.

Smart Appliances respond to grid disturbances and shifts consumption during peak demand periods.

Plug-In Hybrid Vehicles draw energy from its roaming plug-in location. It can store energy for utility or home use.

Source: wsj.com
Achieving Consumer Participation is Key

Engage consumers through information and convenience

Insights

Controls

Choices

Use/Spend Analysis
Peer Compare
Mobile Devices
Alerts

Display
Portal/email
Solar
Carbon Credits
EV and Fleet Vehicles
Appliances
Switches/Plugs
Thermostat

Load Response / Economic Dispatch
Pricing Plans
Payment Plans
Efficiency Tips

Smart Energy enables a new experience that transforms the way customers use and value electricity

Provides platform for new services

Enable new product choices to empower consumers

Source: Reliant Energy

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Energy Awareness Drives Behavior

Customer energy awareness alone could reduce up to 15% energy consumption (Darby – Oxford university)
AHAM Communications Study

“**This technical assessment finds that these application protocols, and the media capable of delivering them, are the best performing protocols for Smart Grid targeted applications for a consumer audience.**”

– October 2010
Major Activity Underway

Society of Automotive Engineers and ZigBee working to use ZigBee Smart Energy to define how EVs and the grid interact, whether at the consumer’s home or at a remote location. This initiative will provide:

- essential control functions necessary to safely manage the charging of PEVs while maintaining grid integrity
- management of charging costs and utility incentives
- real-time information for control of transportation energy use

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Install of 40+ million meters in USA continues at full speed with additional pilots/tests being carried out all around the country

Texas market hitting major milestones (millions of meters installed)

State of Victoria in Australia upgrading all its meters with ~50% completed to date

British Gas planning to use ZigBee Smart Energy for its multi-million meter roll-out in the UK
The Texas Environment

- Texas is a leading market in the rollout of Smart Metering with more than 6 million residents accessing information and interacting with the grid,

- Texas represents combination of utility, state portal, AMI providers, vendors and energy retailers

- Operational use cases being evaluated include commissioning, text messages, price events, etc. using ZigBee SE Certified HAN Devices containing actual production security certificates
British Gas plans to install up to 2 million ZigBee Smart Energy equipped gas and electric smart meters.

The in-home system architecture has 4 main components:
1. Gas Meter
2. Electricity Meter
3. Telecommunications Hub (comms hub)
4. In home display unit (IHD)

Business partners include: mobile operator Vodafone; billing systems SAP; software and communications firms, OSIsoft and Trilliant; and global smart meter manufacturer, Landis+Gyr.
Recent ZSE Enhancements

What’s in the update?
- Standardized Over-the-Air Bootloader
- Enhanced Price Cluster Support
  - Block tariffs, in which price changes are triggered by accumulated consumption, rather than time of day
  - Price acknowledgements, application-level messages acknowledging receipt of a price update by a device
- Tunneling Support
  - Tunneling manufacturer-specific messages between back-office systems and in-home devices, delivered through an ESI
  - Tunneling other standards-based protocols, such as ANSI C12.18 or DLMS COSEM
- Meter Swap-Out Support
  - Allow replacement of the Trust Center, which manages device provisioning
  - Allow devices on the HAN to provision to new Trust Center
- Prepayment
  - Credit monitoring
  - Service connect/disconnect notification
Future ZSE Enhancements

- Enhanced Network/Communications options
  - Integration with ZigBee IP stack
  - Support for multiple communications protocols
- Added Support for EVs, Distributed Generation, etc.
- Input through partnerships with Global SDOs and Industry Groups
- Other Improvements based on continuing feedback and market needs
ZigBee Alliance Partner Relations

We work with a number of SDOs, industry associations, groups, and initiatives...