Standards for Smart Grids Progress and Trends

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Dr Keith Dickerson
Chair, ITU-T Study Group 5 WP3
ETSI Board

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Standards for Smart Grids

- Why are Standards critical?
- Who is driving them?
- Who is developing them?
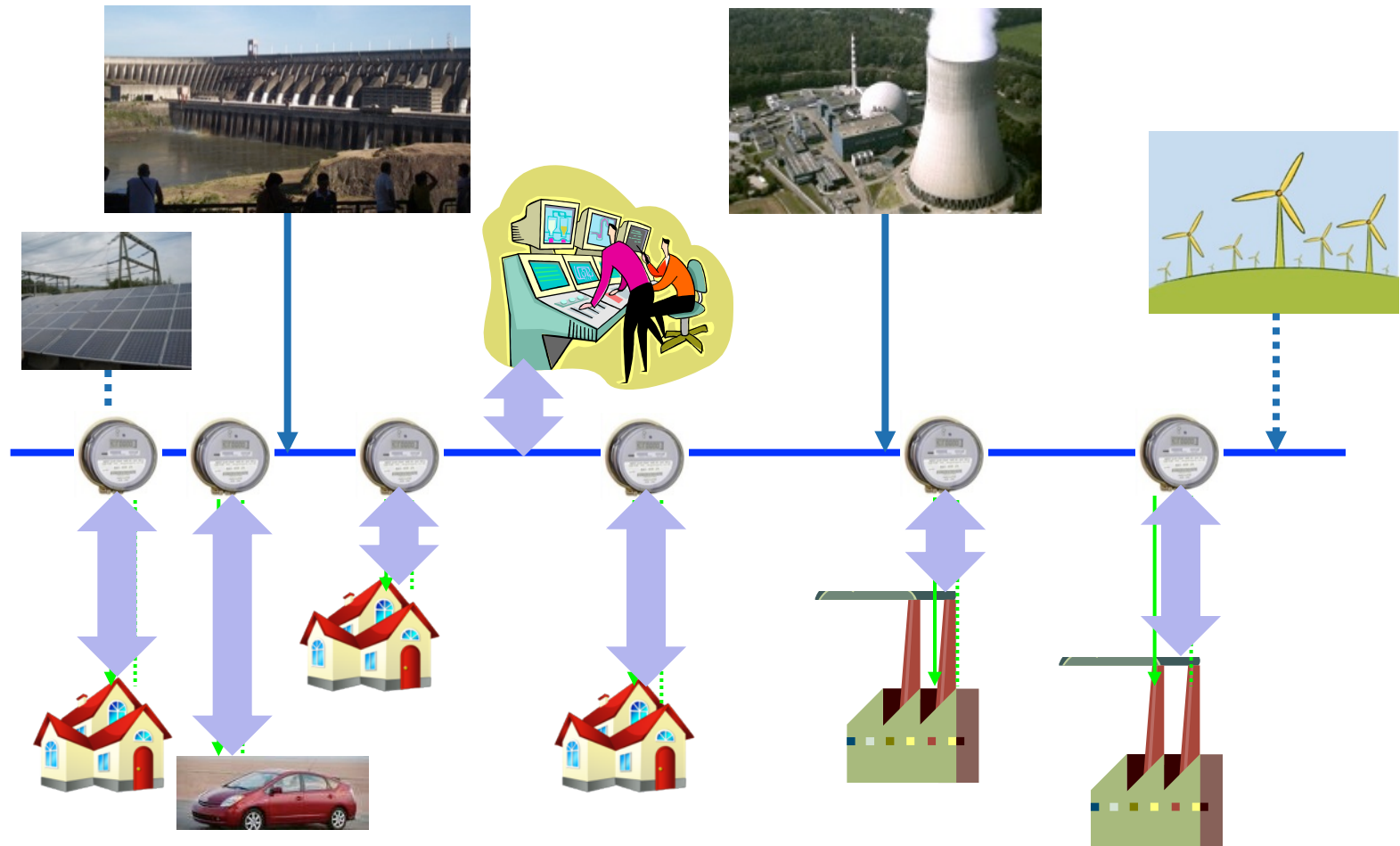- What are the next steps?

Why Standards?

- Standards are needed for interoperability
- Standards are a great way of reducing costs through commoditisation
- Standards are needed for vendor independence
- Standards will increase the range of applications that can run over the Smart Grid
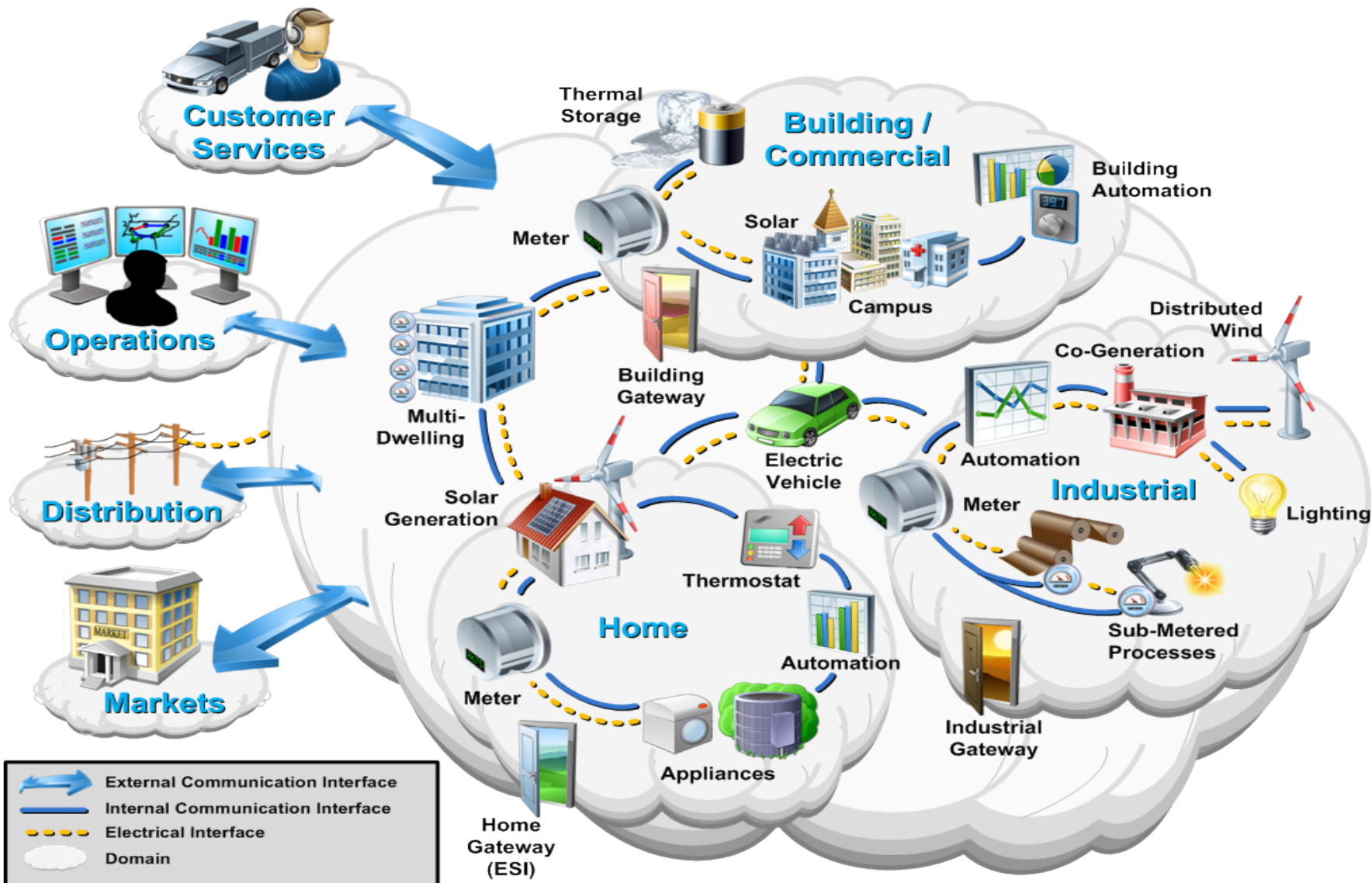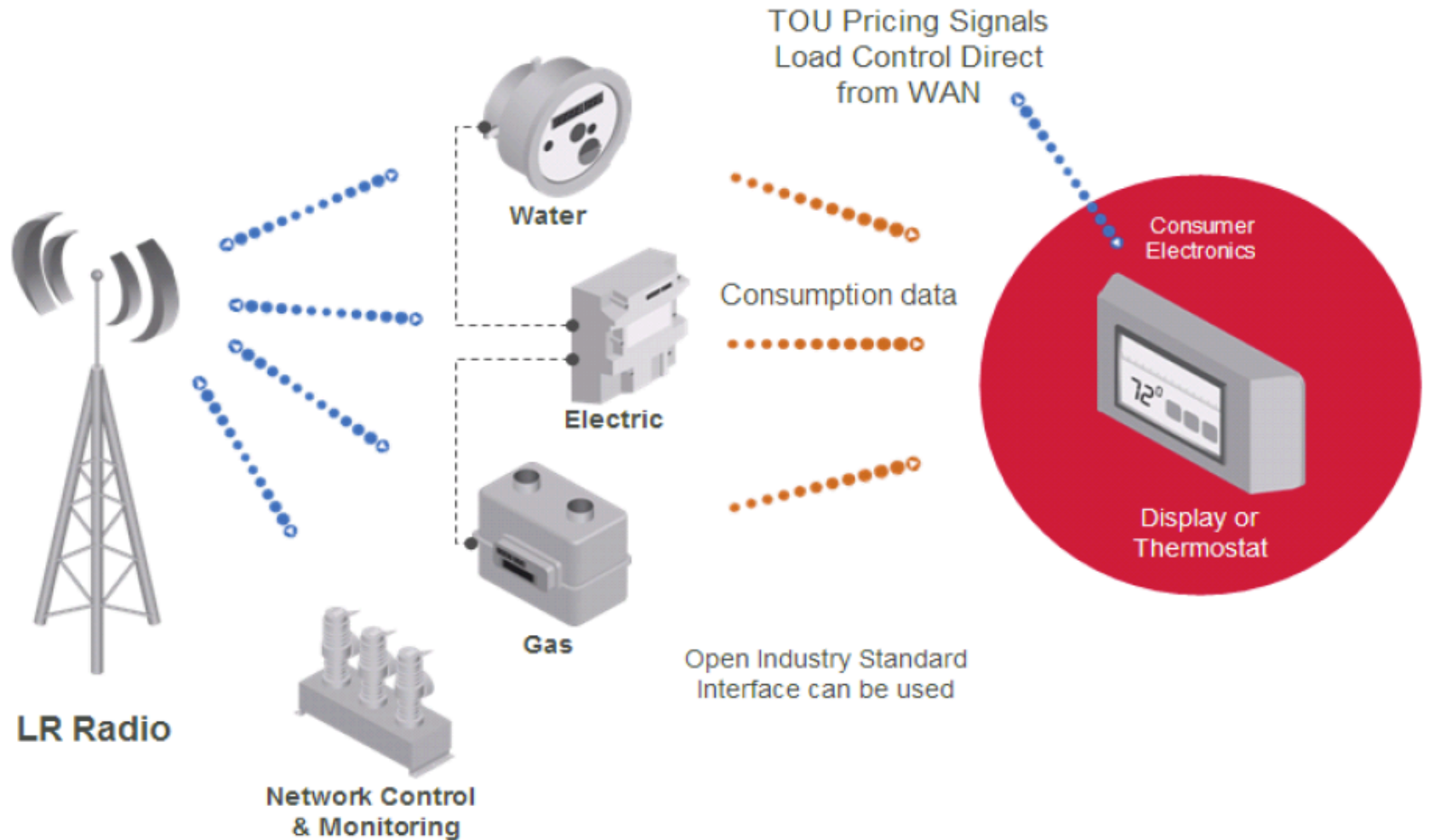
Smart Grid Ecosystem

	Standards Bodies	Influential Bodies	Policy & Regulation
Vision & Framework	IEEE P2030, IEC Smart Grid Strategy Group	EC, NIST, EPRI, SG-ETP SEA, INCITS, OpenADR	IERN, ICER US: FERC, EU: ER-GEG / ACER, CEER China: SERC France: CRE UK: OFGEM Etc.
Service plane	ANSI C12, IETF, Zigbee, ETSI IEC 60870, 61868-70, Cenelec	DLMS, OpenADR, OPC-UA,	
Control & connectivity plane	ANSI C12, IETF, Cenelec, IEEE 1686, 1588, IEC 61850, 62351, Zigbee, ETSI (incl. 3GPP)	DLMS	
Energy plane	IEEE PES, 1547, C37, IEC, NERC, Cenelec	DNP, NEMA	

Power Distribution, Smart Meters, Smart Grids

We won't get a universal communications solution

TOU Pricing Signals
Load Control Direct
from WAN

Water

Consumption data

Electric

Consumer
Electronics

72°

Display or
Thermostat

Gas

Open Industry Standard
Interface can be used

LR Radio

Network Control
& Monitoring

Wide range of communications technologies for the Smart Grid

Communications technologies

Powerline carrier (PLC)

Broadband over powerline (BPL)

WiMAX (700 MHz)

900 MHz RF mesh

ZigBee

WiFi

2.4 GHz mesh wireless

Digital subscriber line (DSL)

Fiber optics

Example companies that implement it

EU M/411 Smart Metering Mandate

- European Commission Mandate
  - Issued in March 2009 by DG TREN
  - Sent to the 3 ESOs: CEN, CENELEC and ETSI

- Main objective
  - To develop standards for European smart meters, allowing interoperability and Consumer actual consumption awareness

- Time schedule:
  - December 2009
    - Gap analysis and first Work Programme
  - September 2012
    - New smart metering standards

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Why Standards?

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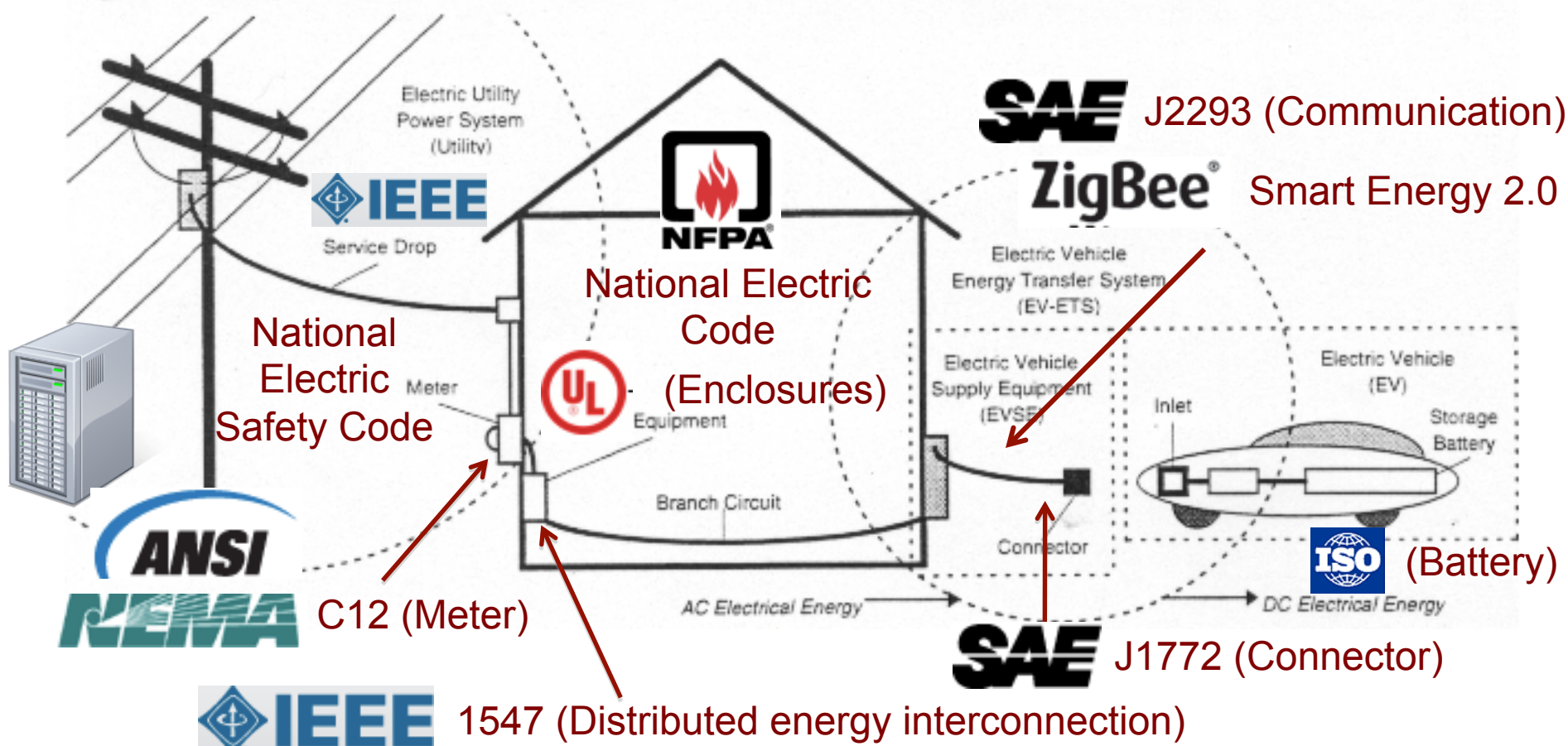
Standards Needed for "Smart Charging"

- Parameters impacting battery charging:
  - Capacity & type of battery
  - Standardize battery versus proprietary solution
  - Battery reserve
  - SLA with a Charging Station supplier
  - Maximum time allocated to charge the battery
- Standards must allow apps to display:
  - Distance & time to the nearest Charging Station considering:
    - Battery reserve
    - EV weight & power
    - Security margin
  - List of Charging Stations including:
    - Price versus charging time
    - Your membership with the best offer versus your requirements
  - Public transport or share transport from the selected Charging Station to end destination.

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EU M/468 Electric Vehicle Charging Mandate

- European Commission Mandate
  - Issued in June 2010
  - Sent to the 3 ESOs: CEN, CENELEC and ETSI
- Main objective
  - To develop standards for interoperability of Electric Vehicle charging including safety and EMC aspects
- Time schedule:
  - 2011
    - Full Work Program for standards
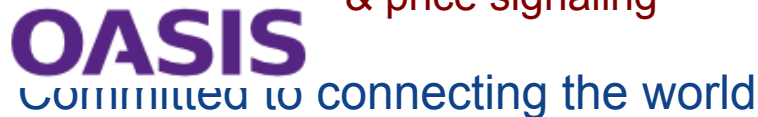 - 2012
    - Adoption of standards

V2G requires many Standards

SAE — J2293 (Communication)

ZigBee — Smart Energy 2.0

IEEE — (referenced near Service Drop)

National Electric Safety Code

National Electric Code (Enclosures)

C12 (Meter)

ANSI NEMA

IEEE — 1547 (Distributed energy interconnection)

ISO — (Battery)

SAE — J1772 (Connector)

IEC — 61850 and 61970/61968 Information models

NAESB

OASIS — Demand response & price signaling

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EU Perspective on Smart Grids

❑ Smart Grids Directive 2009/72/EC of 13 July 2009

> ➢ "Member States should encourage the modernisation of distribution networks, such as through the introduction of smart grids, which should be built in a way that encourages decentralised generation and energy efficiency."
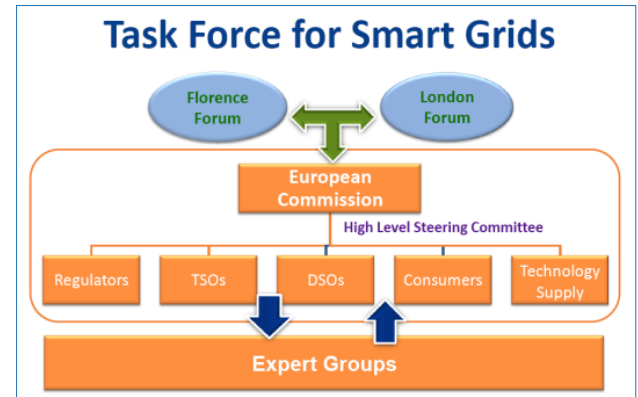
❑ EU Smart Grids Task Force
Steering Committee and 3 Expert Groups

EG 1: Functionalities of Smart Grids and Smart Meters.

EG 2: Regulatory recommendations for data safety, data handling & data protection.

EG 3: Roles and responsibilities of actors involved in the deployment of Smart Grids.

Recommendations: 2010

❑ EC Mandate on Smart Grids: 2011

EU M/490 Smart Grids Mandate

- European Commission Mandate
  - Issued in April 2011
  - Sent to the 3 ESOs: CEN, CENELEC and ETSI

- Main objective
  - To develop set of consistent standards within a common European framework that will enable or facilitate the implementation in Europe of the different high level Smart Grid services and functionalities that will be flexible enough to accommodate future developments

- Time schedule:
  - 2012
    - Technical Reference Architecture
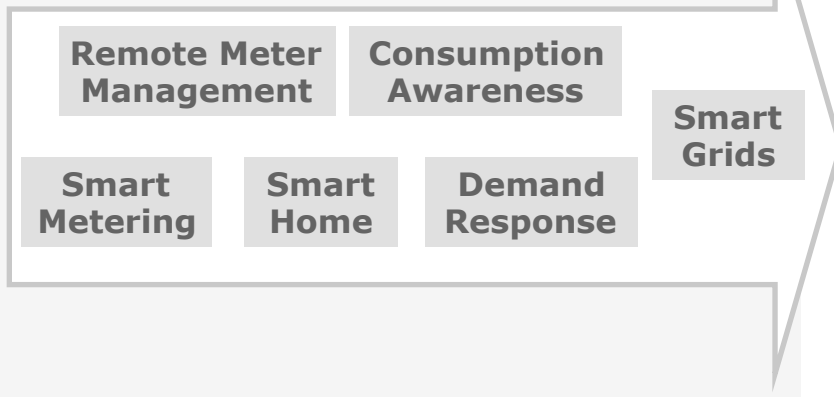   - First set of standards

EU and US: Similar end goals but different paths

EU

Background: a fragmented electricity market

Deregulation of electricity in some EC states

Vision:

Start with a smart metering infrastructure then extend to a smart grid network
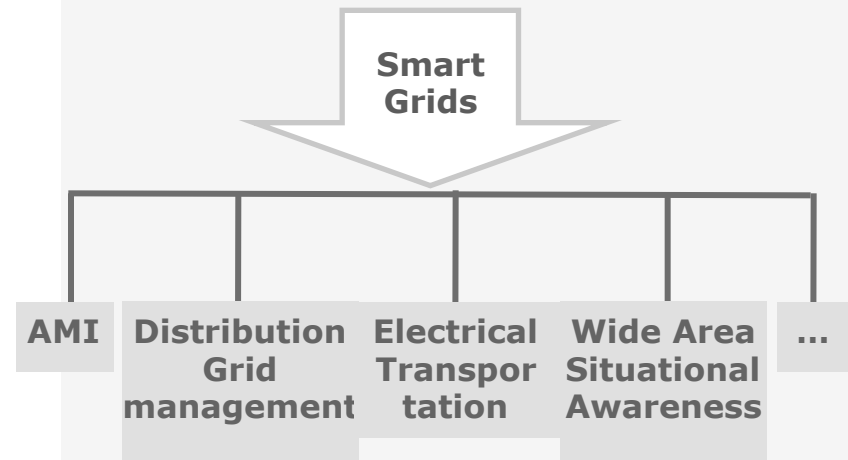
Remote Meter Management	Consumption Awareness	
Smart Metering	Smart Home	Demand Response

Smart Grids

US

Background: an aging power grid

Vision:

Smart meters and AMI are part of the toolbox that allows to build a smart grid infrastructure

Smart Grids

| AMI | Distribution Grid management | Electrical Transportation | Wide Area Situational Awareness | ... |

AMI: Advanced Metering Infrastructure

Need for a global (architecture) approach and for regional implementation

NIST and Smart Grids

- NIST (National Institute of Standards and Technology)
  - Provides Coordination of Interoperability Standards in USA
  - Adopted three phase plan for Smart Grid Interoperability
  - Published NIST Framework and Roadmap, Release 2.0
  - 8 Priority Areas
  - 19 Priority Action Plans
- NIST created Smart Grid and Interoperability Panel (SGIP)
  - Not a Standards Developing Organization
  - Project Management of production of appropriate standards
  - Public Plenary Meetings
    - http://www.nist.gov/smartgrid/
    - http://collaborate.nist.gov/twiki-sggrid

NIST Priority areas in Smart Grid Standardization

1. Demand response and consumer energy efficiency
2. Wide-area situational awareness
3. Energy storage
4. Electric transportation
5. Advanced metering infrastructure (AMI)
6. Distribution grid management
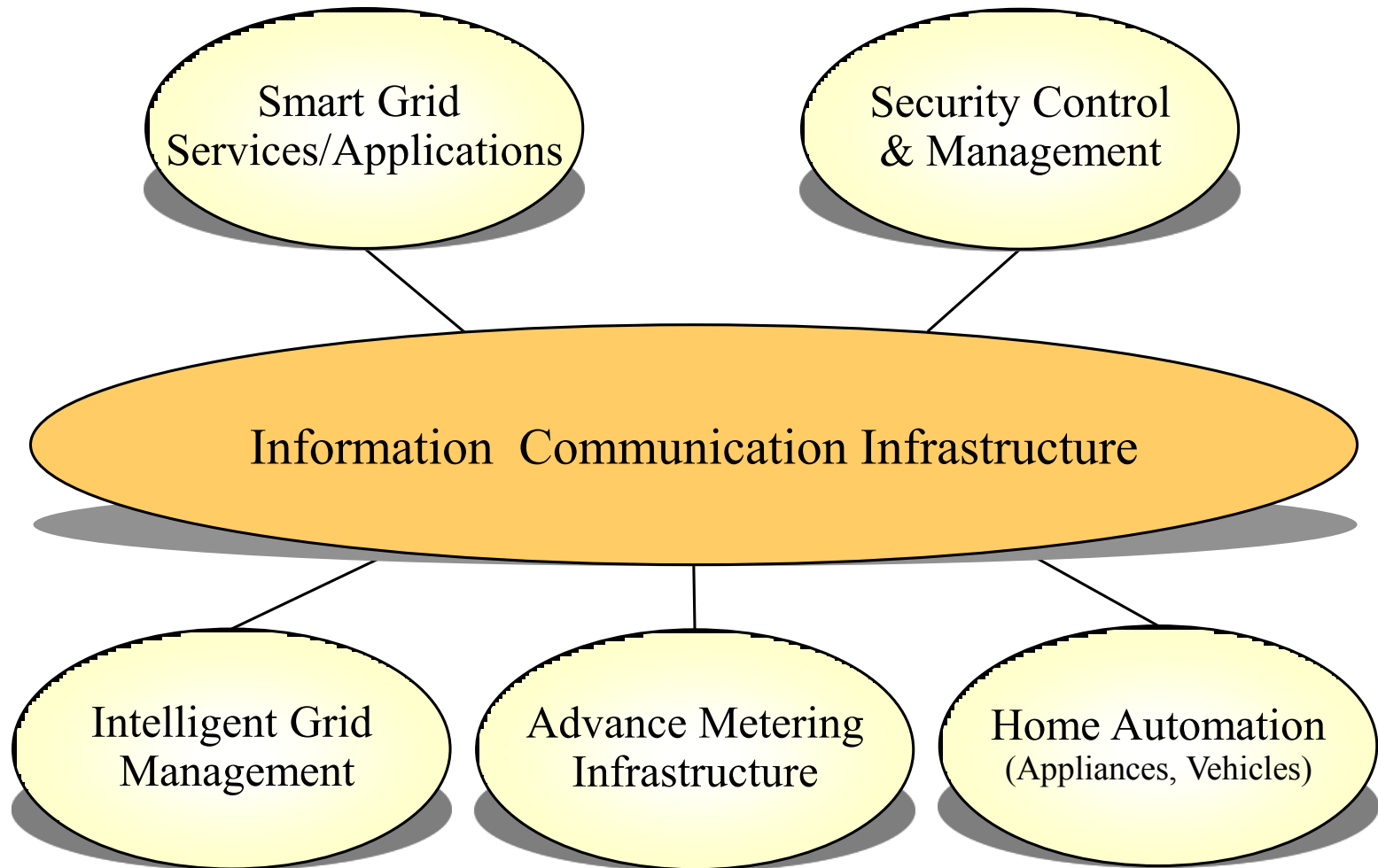7. Cybersecurity
8. Network communications

Source: NIST, http://www.nist.gov/smartgrid/

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Smart Grids in ITU

- Smart Grid is a priority area for ITU
- In 2010 created Focus Group on Smart Grid with International Leadership
- *"Plug-and-Work"* architecture needed, based on:
  - open standards,
  - functional requirements,
  - best practices,
  - business policies,
  - reference designs and implementations
- Standards and interoperability are vital

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Key areas for standardization

Smart Grid Services/Applications

Security Control & Management

Information Communication Infrastructure

Intelligent Grid Management

Advance Metering Infrastructure

Home Automation (Appliances, Vehicles)

Interfaces to be standardized

5 domains+5 reference points

Services/ Applications		**Service provider domain** • Markets • Operators • Service providers
Communication (Control & Connectivity)		**Communication Network**
Energy (Power Generation & Energy Consumption)	**Grid domain** • Bulk generation • Distribution • Transmission	**Smart metering** — **Customer domain** • Smart appliances • Electric vehicles • premises networks
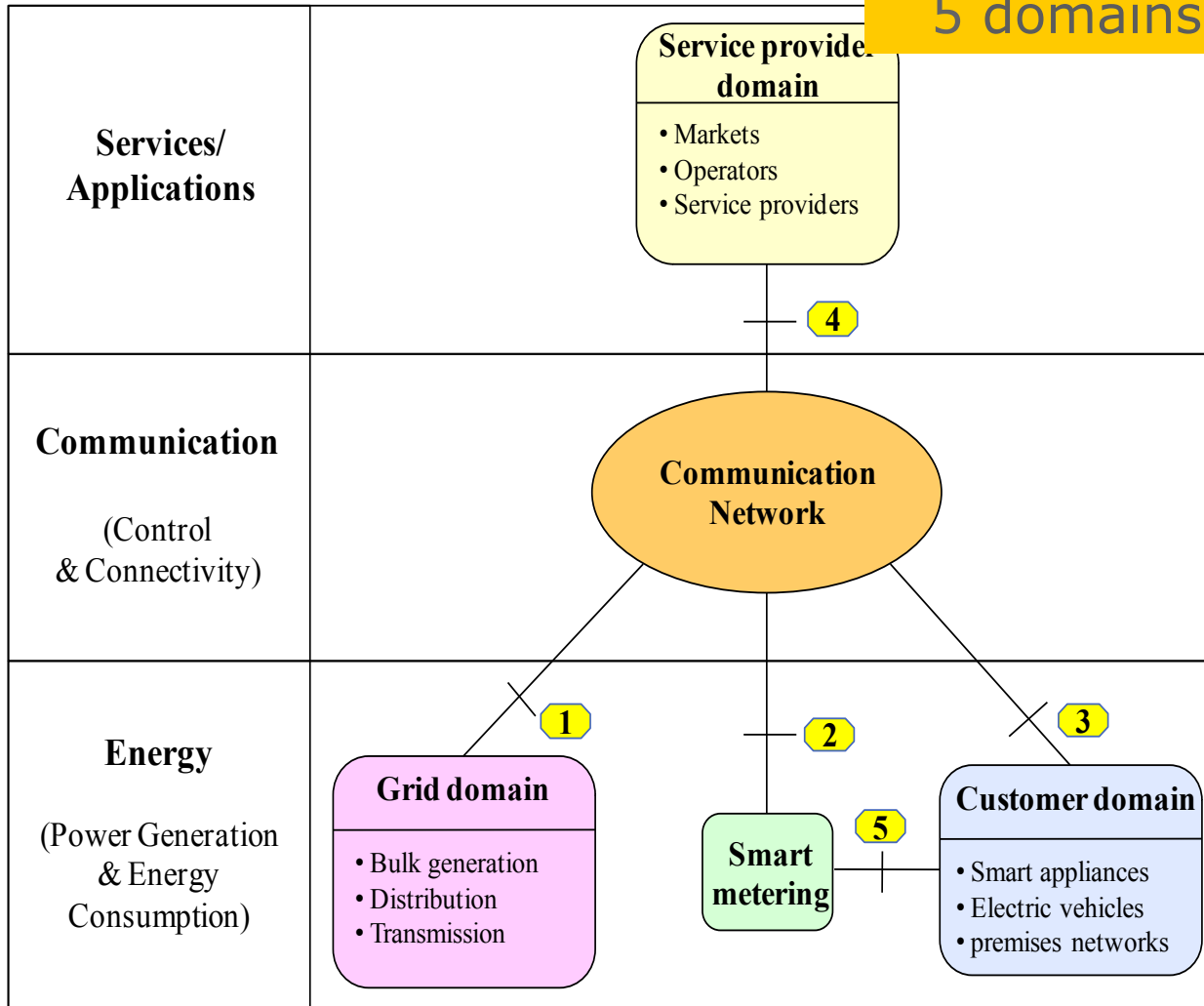
■**RP 1**—Interface between grid Domain and the Service Providers domains

■**RP 2**—For metering information exchange

■**RP 3**—Interface between operators/ service providers and customers

■**RP 4--**services and applications to all actors

■**RP 5**—optional, between Smart metering and Customer domain

Source: ITU

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Collaboration is essential

- Build on ITU's strengths in e.g. communications

- But avoid duplication of effort

- More than 25 related organizations participated in meetings including:

  - National Institute of Standards and Technology (NIST),

  - Institute of Electrical and Electronics Engineers (IEEE),

  - International Electrotechnical Commission (IEC)

Conclusions

- Deployment of Smart Grids needs global standards not regional or national
  - to reduce costs
  - to ensure interoperability
- Must develop a global ecosystem of interoperable standards to enable 'plug and work'
  - to enable multitude of apps to be built on top