



NARUC Webinar #1.

Overview of the NIST Standards and Priority Action Plan Activity

December 1, 2009

**Chuck Goldman, Project Manager
Electricity Markets and Policy Group
Lawrence Berkeley National Laboratory**

**Roger Levy, Levy Associates
Doug Houseman, EnerNex**



Agenda

- I. Definitions**
- II. NIST Standards**
 - Original 16
 - Watch list 14, 15, 16
- III. Priority Action Plans**
 - Watch list 3,4,9,10
- IV. Issues**
 - Organizational
 - Technical and Regulatory

1. Requirements and specifications are leading rather than responding to the market
2. Industry participation may not be sufficiently broad in some working groups
 - a) Use cases driven by a few utilities
 - b) Consumer interests under represented
3. Expectations and value of smart grid to customers are difficult to substantiate

Why Develop Standards ?

1. Avoid re-inventing the wheel
2. Learn from industry best practices
3. Specify requirements more easily
4. Reduce integration costs
5. Prevent single vendor “lock-in”
6. Vendors share a much larger market

○ Areas of concern.

Key Criteria for Establishing Standards

1. **What is the purpose of the Standard ?**
2. **Who is the intended user group ?**
3. **How will the standard be applied ?**
4. **How will the standard be enforced ?**

Factors Critical to a Successful Standard

- ① Based on mature well-developed requirements
- ② Involves all relevant user groups both within and outside the industry
3. Includes a certification process
4. Provides for a revision process
5. Addresses marketing and labeling
6. Capable of being implemented
7. Provides tool sets, where necessary

○ Areas of concern.

Definitions



Standard

“...a standard is an agreed, repeatable way of doing something. It is a published document that contains a technical specification or other precise criteria designed to be used consistently as a rule, guideline, or definition”. [1]

Interoperability

“The ability of systems or products to work with other systems or products without special effort by the customer. [2]

Use Case

Describes how a system works. The use case describes the inputs, processes, outputs, and responsibilities of other system or people using the system. [3]

Data Model

Describes how individual data elements are represented, accessed, and organized for a domain or application of interest.

Harmonize

Translate and incorporate competing interests and make them compatible with one standard .

[1] <http://www.bsi-global.com/en/Standards-and-Publications/About-standards/What-is-a-standard/>

[2] Docket No. PL09-4-000, 126 FERC 61,253, 18 CFR Part Chapter 1, Proposed Policy Statement and Action Plan, March 19, 2009.

[3] http://en.wikipedia.org/wiki/Use_case

- 1** Initial 16 NIST Recommendations
- 2** Supplemental 15 NIST Recommendations
- 3** Additional 46 NIST Candidates
- 4** Priority Action Plans (15)

NIST Standards



Standard		Application
1	AMI-SEC System Security Requirements	Advanced metering infrastructure (AMI) and Smart Grid end-to-end security
2	ANSI C12.19/MC1219	Revenue metering information model
3	BACnet ANSI ASHRAE 135-2008/ISO 16484-5	Building automation
4	DNP3	Substation and feeder device automation
5	IEC 60870-6 / TASE.2	Inter-control center communications
6	IEC 61850	Substation automation and protection
7	IEC 61968/61970	Application level energy management system interfaces
8	IEC 62351 Parts 1-8	Information security for power system control operations
9	IEEE C37.118	Phasor measurement unit (PMU) communications
10	IEEE 1547	Physical and electrical interconnections between utility and distributed generation
11	IEEE 1686-2007	Security for intelligent electronic devices
12	NERC CIP 002-009	Cyber security standards for the bulk power system
13	NIST Special Publication (SP) 800-53, NIST SP 800-82	Cyber security standards and guidelines for federal information systems
14	Open Automated Demand Response (Open ADR)	Price response and demand response
15	OpenHAN	Home Area Network device communication, measurement, and control
16	ZigBee/HomePlug Smart Energy Profile	Home Area Network (HAN) Device Communications and Information Model

Open Automated Demand Response (OpenADR)

SCOPE: This specification describes an open standards-based communications data model designed to promote common information exchange between the utility or Independent System Operator and electric customers using demand response price and reliability signals.

PURPOSE: OpenADR provides Internet-based, interoperable price, reliability, or event signals to automated facility energy management or control systems pre-programmed by the customer. Customer systems take action, enabling demand response to be a dispatched, fully automated event, with no manual intervention.

Resource Links: <http://newscenter.lbl.gov/press-releases/2009/04/27/openadr-specification/>

NIST Standards – OpenADR



- Developer**
- Lawrence Berkeley National Laboratory, Demand Response Research Center.
 - Funded by the California Energy Commission, Public Interest Energy Research Program

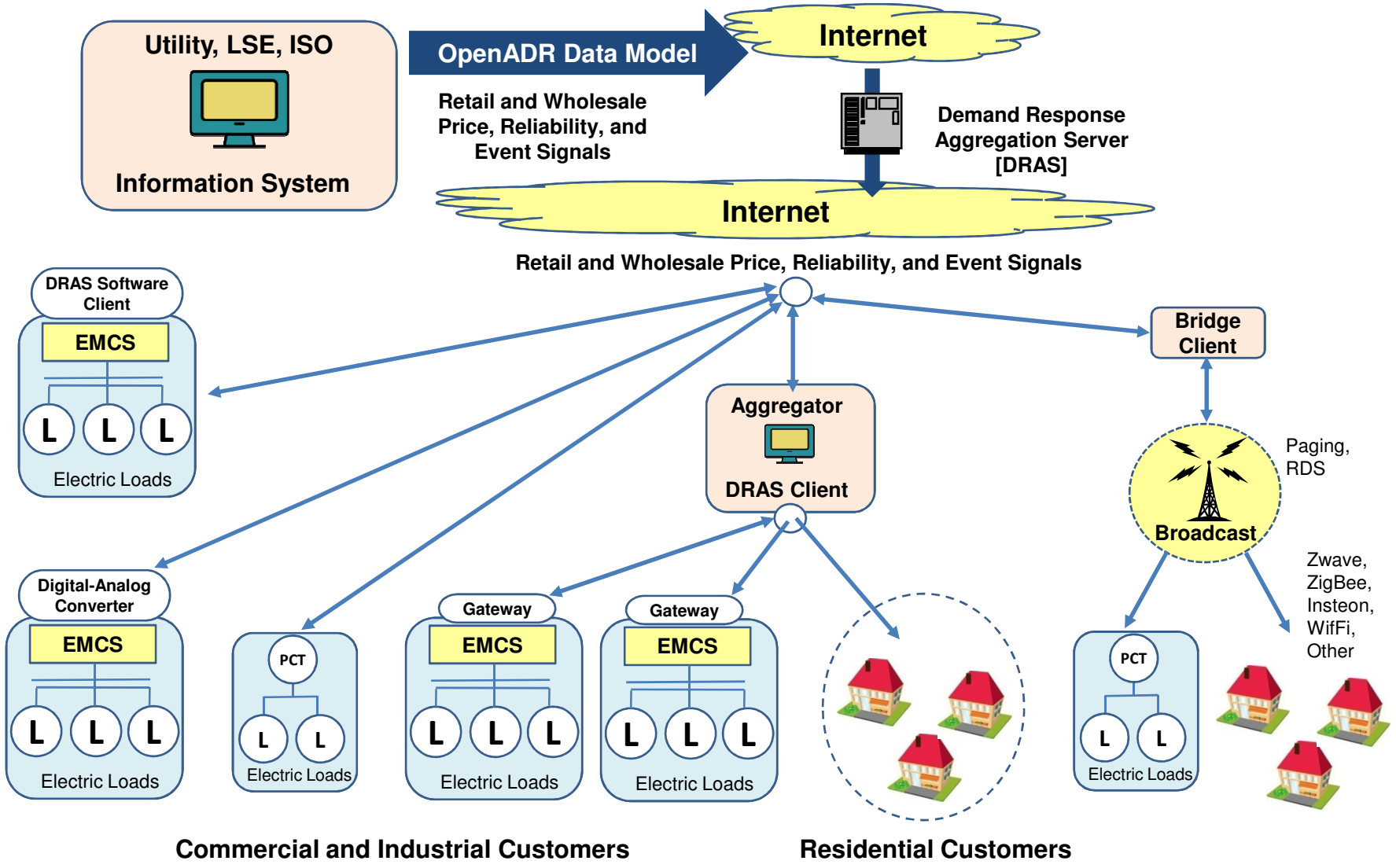
- Status**
- Piloted large (>200kW) commercial and industrial customers from 2003-2006
 - Commercialized in 2006 by CPUC Assigned Commissioner Ruling
 - Began standards process in 2008 in advance of NIST initiative
 - 75 MW retail / wholesale DR operational in California and Washington
 - 120 MW additional capacity under development for 2010

- Applications Supported**
- Retail and wholesale day-ahead and day-of price response, reliability, and ancillary service applications for all commercial, industrial customers
 - Small commercial and residential price response and reliability applications have completed technical field trials
 - Applications supported include RTP, CPP, and multiple pricing options, demand bid, capacity bid, and participating load (spinning reserve)

- Industry Support**
- Tested by EPRI with Tendril, Universal Devices, and Wonderware
 - Production applications in four investor-owned utilities
 - Planned implementations in SMUD, BPA, Tallahassee, and others utilities
 - OpenADR software clients offered by approximately 50 control vendors

- Performance History**
- Demonstrated energy (kWh) and capacity (kW) savings for all applications
 - Low cost and exceptional customer acceptance

NIST Standards – OpenADR



Home Area Network Requirements (OpenHAN)

SCOPE: The Home Area Network requirements document (OpenHAN) defines guiding principles, use cases, system requirements (hardware, software, security, etc.) and policy for establishing a secure utility controlled communication gateway embedded in the utility revenue meter.

PURPOSE: The HAN gateway is intended to control all price, reliability, event, and usage information between the utility, other providers, and customer.* The HAN gateway provides capability to reach inside the customer facility to “commission” or “register customer devices” (PCT’s, washers, dryers, etc.) and to pull back device status, setting, and other information.

<http://www.utilityami.org/docs/UtilityAMI%20HAN%20SRS%20-%20v1.04%20-%20080819-1.pdf>

NIST Standards – OpenHAN



Developer

- Utility OpenAMI HAN Task Force (see list)
- Hosted by UCA International Users Group
- Initial work products and funding contributed by SCE

Status

- Initiated by Settlement Agreement in CPUC SDGE AMI Business Case Application 05-03-015 , March 15, 2005, pp 13.
http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/66766.htm
- System Requirements Specification V1.04 issued by UCAlug August 19, 2008.
- Hardware included but not implemented in Ontario Hydro, SDGE, SCE, PG&E and other utility “smart” meters
- Minimal testing (<100 sites) and no known applications

Applications Supported

- Principally serves as a communication gateway for all price, reliability, event signals; usage and other information related to electric service from both utility and non-utility sources
- The status of testing and certification is uncertain
- No current known applications

Industry Support

- Hardware included but not activated in “smart meter” implementations by Ontario Hydro, SDGE, SCE, PG&E, and plans by several other utilities
- Supported by UCAlug

Performance History

- No information publicly available

NIST Standards: OpenHAN



Core Development Team	Ratification Organizations
<ol style="list-style-type: none">1. American Electric Power (3)2. CenterPoint Energy (1)3. Consumers Energy (2)4. Detroit Edison (1)5. Duke Energy (1)6. EnerNex (1)7. Pacific Gas and Electric (5)8. San Diego Gas and Electric (5)9. Southern California Edison (4) <p>[23 members]</p>	<ol style="list-style-type: none">1. American Electric Power2. BC Hydro3. CenterPoint Energy4. Consumers Energy5. Detroit Edison6. Electricite de France7. Entergy8. Florida Power and Light9. Oncor10. Pacific Gas and Electric11. San Diego Gas and Electric12. Southern California Edison

“UtilityAMI is a forum to define serviceability, security and interoperability guidelines for advanced metering infrastructure (AMI) and demand responsive infrastructure (DRI) from a utility / energy service provider perspective. “ *

* Source: UtilityAMI OpenHAN Task Force, 2008 Home Area Network System Requirements Specification, August 19,2008.
<http://www.utilityami.org/docs/UtilityAMI%20HAN%20SRS%20-%20v1.04%20-%20080819-1.pdf>

OpenHAN Guiding Principles

1. Secure Two-way Communication Interface with the Meter
2. Supports Load Control Integration
3. Direct Access to Usage Data
4. Provides a Growth Platform for Future Products Which Leverage HAN and Meter Data
5. Supports Three Types of Communications: Public Price Signaling, Consumer-Specific Signaling, and Control Signaling
6. Supports Distributed Generation and End-Use Metering
7. Consumer Owns the HAN
8. Meter-to-HAN Interface Is Based on Open Standards

ZigBee HomePlug Smart Energy Profile (SEP)

DEFINITION: ZigBee is the brand name for a low-power wireless radio communication standard built on the IEEE 802.15.4 standard. HomePlug is the brand name for a power line communication standard built on IEEE P1901. Both ZigBee (wireless) and HomePlug (power line) require hardware and software components certified by each group's alliance-designated testing facilities.

ZigBee and HomePlug each have unique attributes that when combined provide improved communication reliability than either standard could provide on its own.

PURPOSE: ZigBee-HomePlug Smart Energy Profiles (SEP) will provide software applications and code to support pricing, demand response, and related energy applications.

POTENTIAL ISSUES:

- (a) lack of backward compatibility between SEP 1.0 and SEP 2.0, and
- (b) Low power ZigBee wireless range may limit reception range within a facility.

NIST Standards: ZigBee-HomePlug SEP



Developer

- ZigBee SEP application protocol was developed by the ZigBee Alliance
- HomePlug was developed by the HomePlug Powerline Alliance
- ZigBee and HomePlug are non-profit trade associations made up of technology providers, semiconductor manufacturers, and OEM's
- The ZigBee-HomePlug initiative was started by PG&E with support from several other utilities and EPRI (see list)

Status

- SEP 1.0 developed 2008
- SEP 1.5 addendums to SEP 1.0, informal release 2009
- SEP 2.0 in development, May 2010 scheduled first public release
- NIST development in process

Applications Supported

- SEP 1.0 supports direct control
- SEP 1.5 supports limited text messaging, tiered/TOU rates
- SEP 2.0 expected to support price response

Industry Support

- Implementation anticipated as part of "smart meter" HAN rollout by Ontario Hydro, SDGE, SCE, PG&E, and plans by several other utilities
- Supported by UCAIug

Performance History

- Limited electric utility testing <100 homes
- EPRI completed lab testing



ZigBee HomePlug SEP Development Team

- American Electric Power (1)
- BC Hydro (2)
- Cisco Systems (1)
- Grid Net (1)
- HomePlug Powerline Alliance (1)
- L+G (1)
- Oncor (1)
- Pacific Gas & Electric (1)
- Reliant Energy (3)
- Southern California Edison (1)

Use Case Resources

- Utility AMI 2008 OpenHAN Use Cases
- Southern California Edison Use Cases
- Texas PUC Advanced Meter Use Cases
- ZigBee Alliance Smart Energy Profile 1.0

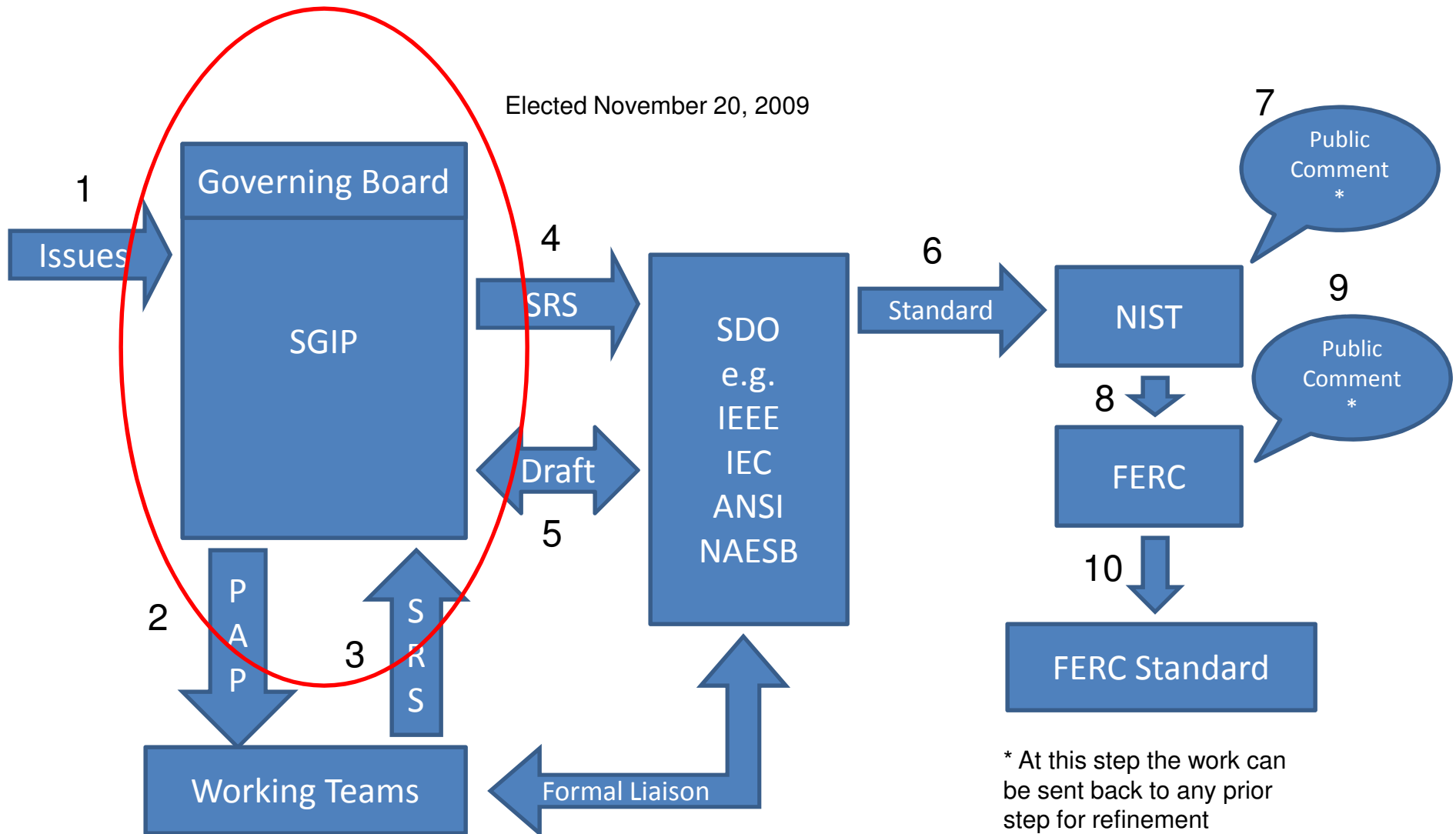
Priority Action Plans (PAP)



Priority Action Plans (PAP)

- 1 Role of Internet Protocol in the Smart Grid
- 2 Wireless Communications for Smart Grid
- 3 Common Pricing Model**
- 4 Standard Scheduling Mechanism**
- 5 Standard Meter Data Profiles
- 6 Data Tables – Common Semantic Model for Meter Data Tables
- 7 Electric Storage Interconnection Guidelines
- 8 CIM for Distribution Grid Management
- 9 Standard DR Signals**
- 10 Standard Energy Usage Information**
- 11 Common Object Models for Electric Transportation
- 12 IEC 61850 Objects / DNP3 Mapping
- 13 Time Synchronization, IEC 61850 Objects / IEEE C37.118 Harmonization
- 14 Transmission and Distribution Power Systems Model Mapping
- 15 Low Speed Powerline Harmonization

Priority Action Plans (PAP)





PAP 3: Common Pricing Model *

“A **common price model** will define how to exchange energy characteristics, availability, and schedules to support free and effective exchange of information in any market.” ...

“Although today’s energy markets are almost exclusively wholesale, the product definition will be usable in other scenarios including retail markets and “prices to devices” scenarios. “

“The completed price model will be used in Demand Response (DR) communications, in usage sharing between the meter and the premises Energy Service Interface, and in potential market operations.”

“Energy prices and energy products are closely tied to schedules and intervals. Building systems and enterprise activities must share an understanding of those schedules for effective collaborative energy. Product definitions must include schedule information.”

* Attachment 1 – Common Price Communication Model Use Cases Released 0.1, November 13, 2009.
http://www.naesb.org/smart_grid_standards_strategies_development.asp

Priority Action Plans (PAP): PAP 3 Pricing



Use Case	Description - Scenarios
Demand Management	<ul style="list-style-type: none">• Customers reduce usage in response to price• Price schedules support customer automation response
Real-time load balancing	<ul style="list-style-type: none">• None listed
Optimized energy management	<ul style="list-style-type: none">• Prices / costs scheduled in advance to support customer automation and DR pre-cooling, scheduling applications
Decentralized supply	<ul style="list-style-type: none">• Generation sources reflect full pricing
Consumer choices based on environmental attributes	<ul style="list-style-type: none">• Pricing must reflect time-differentiated cost of alternatives, to support customer load scheduling, shifting• Pricing differentiates source composition to support preference purchases for renewables
Climate Impact Adjusted Pricing	<ul style="list-style-type: none">• Wind power premium pricing• Coal power, other sources must reflect carbon credits



PAP 4: Common Scheduling Mechanism

“The purpose of this action is to define the requirements for standard communication of date, time, schedule, and interval by smart grid actors, with particular attention to demand response (DR).”

“The group primarily associated with the development of interoperable enterprise date, time, and interval standards for the IETF is the Calendaring and Schedule Consortium (CALCONNECT).

CALCONNECT and OASIS will work together to define the common communication of date time and interval to meet the needs of smart grid transaction communications as well as for building systems integration, enterprise interaction, and financial transactions. This commonality is anticipated to reduce barriers to interoperation and thereby to expand participation in DR and DER.”

* Priority Action Plan 04 – Requirements for a Common Scheduling Mechanism Recommendation, November 17, 2009.
http://www.naesb.org/smart_grid_standards_strategies_development.asp

PAP 4: Common Scheduling Mechanism

Representative Instance	Description
Adjustment window	Time prior to DR event to calc. baseline.
Advance notification	Communication of impending DR event
Baseline window	Time over which DR impacts evaluated
Demand Response Event	Time periods, deadlines, for DR performance
Deployment	Time when DR reduction begins
Deployment Period	Time between deployment and release
Meter Data Recording Interval	Time between meter recording intervals
Meter Data Reporting Deadline	Max time after DR event, meter data submitted
Normal Operations	Time following release, recall
Performance Window.	Analysis period for DR compliance
Ramp Period	Time between deployment and reduction
Recovery Period	Time DR load required return to normal use
Reduction Deadline	Time at end of ramp
Release / Recall	Time Prog Adm. Notifies DR over
Sustained Response Period	Time between DR deadline and release
Telemetry Interval	Time between DR provider and Prog. Adm

PAP 9: Standard DR Signals

Objectives *

1. “DR signals standardization must support all four market types; i.e. regions with (1) no open wholesale and no retail competition, (2) open wholesale market only, (3) open retail competition only, and (4) open wholesale and open retail competition.
3. Most Customers (with a the exception of C&I) will not interact directly with wholesale market when it comes to DR and pricing signals.
4. Retail pricing models are complex, due to the numerous tariff rate structures that exist in both regulated and un-regulated markets. Attempts to standardize DR control and pricing signals must not hinder regulatory changes or market innovations when it comes to future tariff or pricing models.
6. DER may play an increasingly important role in DR, yet the development of tariff and/or pricing models that support DER’s role in DR is still in its infancy.
7. The Customer’s perspective and ability to react to DR control and pricing signals must be a key driver during the development of DR standards.”

* Framework for Integrated Demand Response (DR) and Distributed Energy Resources (DER) Models, November 12, 2009.
http://www.naesb.org/smart_grid_standards_strategies_development.asp



PAP 9: Standard DR Signals

2.1 Register / Enroll Customer for DR Program

The registration/enrollment process must capture the key identifiers to enable accurate accounting of DR resources.

3.2.4.1 Register DR Asset

The DR Asset registration process must capture the key identifiers to enable accurate tracking of DR assets and their capabilities.



PAP 10: Standard Energy Usage Information

0.3 Objectives:

1. Develop a summary of information needs for various means of customer information access about metering and billing.
2. Develop short term plans for near-term customer access to usage data based upon today's installed meters.
3. Develop composite information model that can be easily transformed without loss for transport via standards in OASIS, IEC61970/61968, IEC61850, ANSI C12.19/22, AHRAE 135, and ZigBee.
4. Development and implement a plan to expedite harmonized standards development and adoption within the associated standards bodies.

* PAP 10 Provide Energy Usage Information, July 30, 2009..
http://www.naesb.org/smart_grid_standards_strategies_development.asp



PAP 10: Contributing Companies

1. CIMple Solutions
2. Comverge
3. Consumers Energy
4. Dominion
5. Ecologic Analytics
6. E:SO
7. Florida Power & Light
8. Google
9. Greenbox
10. IBM
11. Illinois Citizens Utility Board
12. IntellEnergyUtil
13. Juice Technologies
14. NIST
15. Oncor (2)
16. PG&E
17. Reliant Energy (2)
18. Saker Systems
19. SCE
20. SDG&E
21. Sensus
22. Sonoma Innovation
23. Tendril Networks
24. Texas PUC
25. Utility Consumer's Action Network
26. Xtensible Solutions (3)

Choices Facing Regulators

- 1. Try to get more involved in the NIST process, principally to encourage more consumer and industry participation.**
- 2. Take a chance that the Smart Grid standards that evolve will allow or will be late enough for individual states to address the issues on their own and set precedent or guidance for other commissions.**
- 3. NARUC could create a series of case studies or reports that document the regulatory questions, tradeoffs, and decision choices for a prioritized list of smart grid issues.**