RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant:	**Wholesale Electric Quadrant (WEQ) and Retail Electric Quadrant (REQ)**
Requesters:	**NAESB Smart Grid Task Force (SGTF)**
Request No.:	**2010 WEQ Annual Plan Item 6(a) / 2010 REQ Annual Plan Item 9(a)**
Request Title:	**Requirements Specifications for Common Electricity Product and Pricing Definition – for NIST PAP03**

1. RECOMMENDED ACTION:

X	Accept as requested
	Accept as modified below
	Decline

EFFECT OF EC VOTE TO ACCEPT RECOMMENDED ACTION:

X	Change to Existing Practice
	Status Quo

2. TYPE OF DEVELOPMENT/MAINTENANCE

Per Request:		**Per Recommendation:**	
X	Initiation	X	Initiation
	Modification		Modification
	Interpretation		Interpretation
	Withdrawal		Withdrawal
X	Principle	X	Principle
X	Definition	X	Definition
X	Business Practice Standard	X	Business Practice Standard
	Document		Document
	Data Element		Data Element
	Code Value		Code Value
	X12 Implementation Guide		X12 Implementation Guide
	Business Process Documentation		Business Process Documentation

3. RECOMMENDATION

SUMMARY:

The NAESB Smart Grid Task Force (SGTF) submits this Recommendation that provides requirements for common pricing attributes that can be used as a basis for messaging protocols throughout the electrical energy system from producer through to a variety of energy consumers and the future intelligent devices employed by these consumers. These attributes are not meant to be a message protocol in and of themselves and further analysis and design work will be completed as part of several initiatives, such as ZigBee smart energy, OpenHAN, and OASIS eMIX. These requirements should also be used as an input to the CIM maintained by UCAIug.

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New WEQ-016 Abbreviations/Acronyms and Defined Terms to be added to WEQ-000 are included below for reference *(previously added in Recommendation 2010 WEQ Annual Plan Item 6(b) / 2010 Retail Annual Plan Item 9(b))*

(NOTE: NAESB Retail numbering convention will replace WEQ numbering convention in NAESB Retail publication)

000-1 ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	Meaning
DDE	Designated Dispatch Entity
EA	Environmental Authority
ED	End Device
FR	Federal Regulator
LA	Local Authority
LSE	Load Serving Entity
MA	Metering Authority
MP	Market Participant
RA	Reliability Authority
RM	Response Method
RMA	Response Method Aggregation
SE	Scheduling Entity
SO	System Operator
SP	Service Provider
SR	State Regulator
TDSP	Transmission/Distribution Service Provider
UC	Utility Customer
UDO	Utility Distribution Operator

000-2 DEFINITION OF TERMS

Term	Definition
Business Entity	The wholesale or retail entity that interacts with other entities in its market.
Communication Method	The method by which an object communicates with another object to instruct, measure or control.
Control	The role associated with the control of an End Device.
Demand Response Objects	Physical and logical types of demand response resource objects.
Designated Dispatch Entity	A role which carries the responsibility of receiving and processing demand resource dispatch instructions or market information and (optionally) providing response information.
End Device	A physical end-use device that consumes or supplies electricity.
Environmental Authority	A regulatory authority responsible for the development, reporting and enforcement of environmental activities.
Facility	The location at which connection to the transmission or distribution system is made.
Federal Regulator	A Federal regulatory authority.
Load Serving Entity	A role which carries the responsibility of serving end-users and selling electric energy to end-users.
Local Authority	A regulatory authority responsible for the oversight and administration of utility service-related functions within its jurisdiction.
Market Enrollment	The collection of enrollment or tariff data for a Demand Resource Object to provide a specific market product or service.
Market Participant	An organization registered with the System Operator that may take on roles such as SP, LSE, TDSP, DDE, SE, and/or MA in accordance with the System Operator's market rules.

Term	Definition
Measurement	The role associated with the device or algorithm that measures the consumption or supply of an End Device.
Metering Authority	A role which carries the responsibility of providing data necessary to determine the performance of a Resource.
P-Node	The price location of the Facility in the transmission and/or distribution network.
Participant	The entity that represents resources to a market or distribution operator.
Regulator	A rule-making and enforcement entity.
Reliability Authority	A regulatory authority responsible for the development, reporting and enforcement of electric reliability-related activities.
Response Method	A measurable action taken in response to an instruction to change consumption.
Response Method Aggregation	A logical entity that has a reportable interval level consumption, e.g. a site may also be a physical entity that may have its own meter, a neighborhood of homes that has a net meter, or an estimate of consumption of an aggregation of retail customers.
Resource	A market-dependent group of Response Method Aggregations that represents a dispatchable entity.
Scheduling Entity	A role which carries the responsibility of submitting bids/offers and receives Schedules and Awards.
Service Provider	A role which carries the responsibility of coordinating resources to deliver electricity products and services to a market or distribution operator.
State Regulator	A regulatory authority responsible for the oversight and administration of electric utilities.
Supporting Objects	Objects that support the interaction of Business Entities and Demand Response Objects.

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Term	Definition
System Operator	An entity which carries the responsibility of administering the demand response process, from Resource enrollment to performance evaluation.
Transmission/Distribution Service Provider	A role which carries the responsibility of operating a local electricity transmission and/or distribution system.
Utility Customer	An end-use customer of the Utility Distribution Operator that takes on roles such as Facility or Resource.
Utility Distribution Operator	An entity which carries the responsibility of operating an electricity distribution system.
Zone	A physical or electrical region.

New Business Practice Standards WEQ-016 – Smart Grid Activities

(NOTE: NAESB Retail numbering convention will replace WEQ numbering convention in NAESB Retail publication)

RECOMMENDED STANDARDS:

Executive Summary

Specifications for Common Electricity Product and Pricing Definion

The following addresses the business objectives and context for capturing the attributes associated with electricity price and product signals as part of the Smart Grid implementation, which is called for by National Institute of Standards and Technology (NIST) Priority Action Plans (PAP) 03. The North America Energy Standards Board (NAESB) Smart Grid Task Force (SGTF) in cooperation with UCA International Users Group (UCAIug) Open Smart Grid (OpenSG) Task Force, the Independent System Operator/Regional Transmission Organization Council (ISO/RTO Council), and other organizations, has developed the use cases that provide requirements for electricity price and product signal standards.

Because the NAESB Smart Grid Task Force is involved in activities related to several of NIST's Priority Action Plans, the SGTF has developed a standard list of actors and related objects for all Priority Action Plan work coming out of the group. This document also contains an overview of the most common retail rate structures and price-related use cases. Finally, a representative list of price and product attributes is provided.

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The following deals exclusively with the pricing related requirements at both the wholesale and retail levels. The requirements are captured in the form of UML models, where business requirements are captured in Use Case narrative format and data requirements are captured in tabular format. The main use cases that are affected by pricing are:

- Demand Shifting
- Demand Reduction
- Non-Price (Environmental) Response
- Load-follower
- Price-takers

Reliability based responses, both wholesale and retail, is addressed by PAP-09 on DR Signaling.

Introduction

Specifications for Common Electricity Product and Pricing Definion

Purpose: The purpose of the following is to capture business and data requirements related to the definition of a common model for capturing the attributes of an electricity product offered at wholesale and/or retail level. Such attributes will mainly include but are not limited to the pricing information of the product being offered to the end consumers of electricity.

Scope: The scope of the following is to provide business and data requirements, not implementation, of a common pricing model for electricity product.

The electricity rate design process is not included in the scope of these use cases.

Assumptions:

- Wholesale market price signals may have different characteristics than retail market signals.
- Attempts to standardize pricing signals must not hinder regulatory changes or market innovations.

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Business Practice Standards

016-3 Specifications for Common Electricity Product and Pricing Definition

016-3.1 Price signals should be flexible enough to accommodate regulatory changes or market innovations.

016-3.2 ACTORS

The actors used in the use cases are role-based, with the Market Participant and Utility Customer business entities taking on one or more roles. This table contains only actors referenced by use cases in this document.

Actor Name	Proposed Definition	Acronym	Actor ID[1]	Examples
Utility Customer	An end-use customer of the Utility Distribution Operator that takes on roles such as Facility or Resource.	UC	2.4	Residential, Industrial
Communication Method	The method by which an object communicates with another object to instruct, measure or control.		5.5	
Control	The role associated with the control of an End Device.		5.2	Facility EMS, Energy Services Interface (ESI) or Gateway
End Device	A physical end-use device that consumes or supplies electricity.	ED	4.5	HAN, Electric Vehicle, or Smart Appliance, Display
Facility	The location at which connection to the transmission or distribution system is		4.3	Electricity Consumer

[1] Actor IDs refer to the identifiers associated with NAESB's Smart Grid Task Force Actors List. http://www.naesb.org/pdf4/smart_grid_ssd012810a1.xls

Actor Name	Proposed Definition	Acronym	Actor ID[1]	Examples
	made.			
Load Serving Entity	A role which carries the responsibility of serving end-users and selling electric energy to end-users.	LSE	3.2	
Measurement	The role associated with the device or algorithm that measures the consumption or supply of an End Device.		5.1	Meter
Resource	A market-dependent group of Response Method Aggregations that represents a dispatchable entity.		4.1	Supplier, Distributed Energy Resource (DER)
Service Provider	A role which carries the responsibility of coordinating resources to deliver electricity products and services to a market or distribution operator.	SP	3.1	Retail Service Provider, Demand Response Provider, Dynamic Price Service Provider
System Operator	An entity which carries the responsibility of administering the demand response process, from Resource enrollment to performance evaluation.	SO	2.1	Market and System Operators

Actor Name	Proposed Definition	Acronym	Actor ID[1]	Examples
Transmission/ Distribution Service Provider	A role which carries the responsibility of operating a local electricity transmission and/or distribution system.	TDSP	3.5	Utility Distribution Company
Utility Distribution Operator	An entity which carries the responsibility of operating an electricity distribution system.	UDO	2.3	Distribution Operator

016-3.3 CONVENTIONS

The use case modeling technique is used for capturing business and date requirements relative to electric product and price information. The relationships used in the Use Case diagrams are as follows:

- Includes: this indicates additional scenarios
- Extends: this indicates alternatives scenarios
- Generalization (line with triangle head): this indicates variations (sub-types) of the main use case.
- Precedes: this indicates a time sequence
- Invokes: this indicates a pre-condition or dependency

016-3.4 USE CASE OVERVIEW

A tariff establishes the prices paid for the services received, and is based on a variety of factors including wholesale prices, quality and type of service and costs associated with transmission and distribution grid infrastructure and operation. The use cases in this document illustrate the high-level activities associated with publishing prices and how the information is used to evoke a change in consumption.

The table below provides information on common types of energy supply rate structures.

Tariff Rate Type	Target Customers	Description
Block Rate	C&I, Residential	An energy supply rate structure in which the per unit energy price increases or decreases for each successive block of energy consumed.
Critical Peak Price (CPP)	C&I, Residential	An energy supply rate structure whereby "Time of Use Pricing" is in effect with the exception of certain "peak days" at which time electric prices may reflect the costs of electricity at the wholesale level.
Demand Rate	Mainly for C&I Customers, Pilot for Residential Customers	A component of an energy supply rate structure based on the highest demand for electricity measured in a billing period.
Day Ahead Market Rate (DAMR)	C&I, Residential	An energy supply rate structure, typically hourly, based on the day-ahead wholesale market price.
Market Clearing Price for Energy (MCPE)	C&I	An energy rate structure that allows for price changes every 15 minutes based on real-time wholesale market prices.
Peak Time Rebate (PTR)	C&I, Residential	An incentive rate in which the utility pays Customers to reduce demand during peak periods on critical days.
Real Time Price Rate (RTP)	C&I	An energy supply rate structure in which prices can vary, typically on an hourly basis, based on forecast (day-ahead) or actual (real-time) market conditions.
Time of Use	C&I, Residential	An energy supply rate structure where the

Tariff Rate Type	Target Customers	Description
Rate (TOU)		per unit charge (kWh or kW) varies according to the time of day. Time-of-Use rates may have daily and seasonal variations.
Variable Peak Pricing (VPP)	C&I, Residential	An energy supply rate structure that combines features of TOU and RTP structures to include the flexibility of market price variation and the fixed time periods of a time of use rate.

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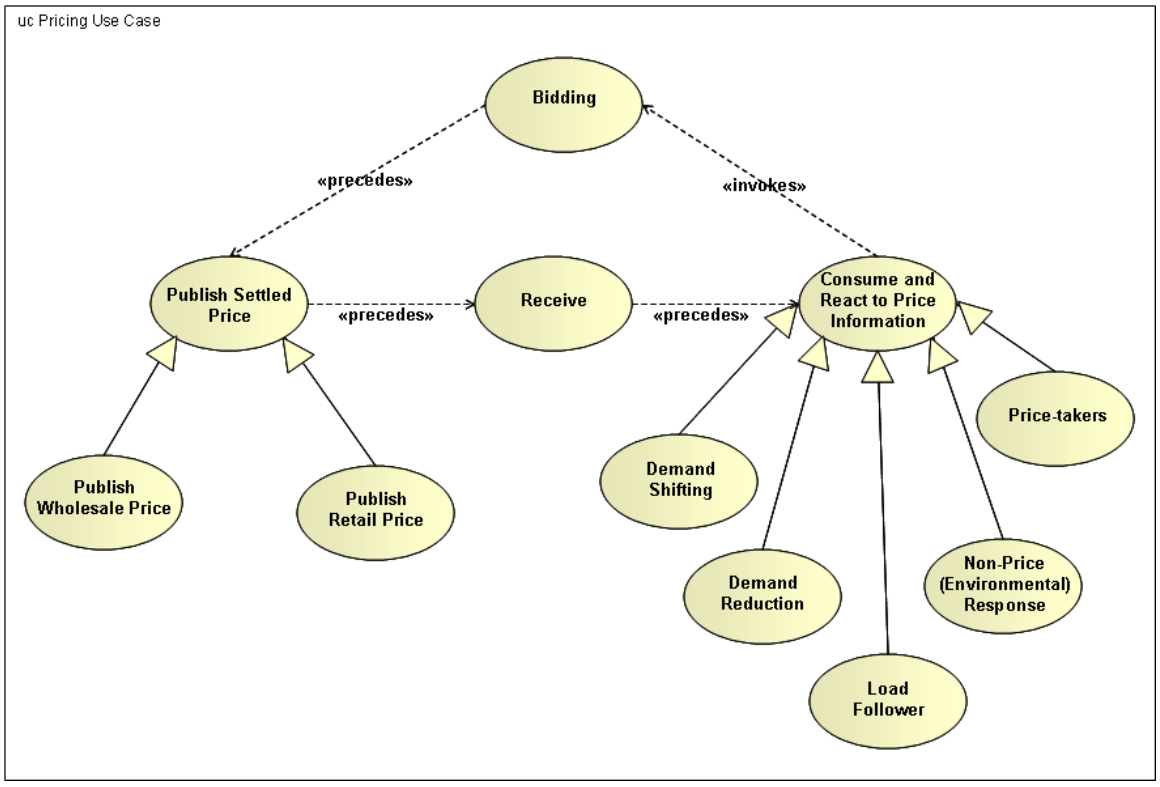
The Pricing Use Case below provides an overview of the specific use cases described in this document. The results of Bidding produce the Settled Price which is published and then received. The recipient reacts to the price, which affects the next bidding cycle. The following use cases where electricity pricing and product information can be used are described in this document:

- Demand Shifting
- Demand Reduction
- Non-Price (Environmental) Response
- Load-Follower
- Price-takers



016-3.5 SPECIFIC USE CASES

Specific use cases for what end use consumers of electricity might do when pricing signals are received are listed as follows:

Use Case	Actors	Description	SAMPLE Scenarios
Demand Shifting	Service Provider End Device Facility	Pricing signals are used as a tool to influence when consumers use electricity.	The System Operator published day-ahead prices which are statistically higher than average between 2:30 and 5:30 in the afternoon. Illustrate how different End Devices will respond to a forward energy price signal including: • An Energy Management System (EMS) requests Building Automation System (BAS) to "pre-cool" until 2:30 PM. • Home-based intelligent device is programmed to operate at a time when electricity is cheaper. • An electric plug-in vehicle is programmed to charge when electricity is cheaper.

Use Case	Actors	Description	SAMPLE Scenarios
Demand Reduction	Control Facility	Pricing signals are used as a tool to influence the quantity of electricity that consumers use.	A Utility Distribution Company's fixed time-of-day tariffs indicates higher price during day, and lower price after 11:00 PM. Demonstrate how different End Devices will response to price differentials: • Time-insensitive building systems schedule their run-time programs after 11:00 PM. • Homeowner starts appliance at 5:10. The appliance notifies that by waiting 20 minutes to run, the consumer will get lower cost electricity. Homeowner acknowledges.
Environmental Response	Resource End Device Facility	Product characteristics (other than price) are used to influence either the quantity or the time at which the customer uses electricity.	Customer set a price threshold at which "green" power is desirable. Above the "green price" the customer will take any power, below the "green price" the customer will choose suppliers with renewable portfolios. Test the scenario where, at 5:00 PM wind power picks up such that the price of power from renewable sources falls below the "green price" set by the customer. Utility delivers blend of 20% wind, 80% coal during this time of day at .10/kWh. 25% of customers indicate preference to buy pure wind, an over-subscription. Prices for pure wind are bid up to .15/kWh as the wind-sensitive market decreases. 20% of consumers pay the 50% premium to get only wind-only power. 1) Local PUC requires that

Use Case	Actors	Description	SAMPLE Scenarios
			segmentation be revenue-neutral, so bidding for Wind Power reduces undifferentiated power to .0875 kWh. 2) No bidding was required for undifferentiated power, so provider is incentivized to find additional sources of Wind Power. 3) Consumers unable to buy desired Wind Power reduce their aggregate demand. Consumers have programmed non-time-sensitive systems and appliances to not run when Wind Power is not available, time-shifting some demand until Wind Power is available at the desired price. Wind Power always commands a premium over coal power because of higher cost of production. Local regulatory policy requires pass-through of actual market costs for differentiated power. Consumers who buy coal power must buy carbon credits as well. If the [low] cost of coal is combined with the cost of the credit, renewable energy sources become more competitive.
Load Follower	Distributed Energy Resource (DER) and Utility Customer (UC)		A Utility Customer (UC) is also a Distributed Energy Resource (DER). The UC would purchase power up to the price at which they can economically produce power. The use case must prove that such a resource can receive enough information from the pricing signals to change its output according to the resource owner's price curve.

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Use Case	Actors	Description	SAMPLE Scenarios
Price Taker	Distributed Energy Resource (DER)		A DER with no storage capability and zero fuel cost, such as a wind farm or solar array, will produce power at whatever the "market rate" for generation is at the time of production. The use case must prove that such a resource can identify its cost curve (zero in this case), supply energy to the grid, and get paid at the appropriate rate.

016-3.6 PRICING AND PRODUCT ATTRIBUTES

The following initial attributes were presented early in the PAP-03 meetings and will serve as the initial starting point for further refinement.

016-3.6.1 Product Identification

Attribute	Description	Considerations
Product Identifier	Energy, although largely a non-storable and transitory commodity, is nonetheless still a tradable and sellable entity. Any commodity benefits from having a unique identifier (external) that can unambiguously be used by consumers to identify what it is that they are purchasing.	Examples of product identification scheme used in the financial world is the ISIN (International Security Identifier Number), and Stock ticker symbols used by exchanges. This not a transaction identifier – this would be an industry agreed upon identifier for a particular energy product offering.
Identifier source	Identification of the source of the product identifier.	In most systems there are competing or alternative product identification schemes. The Identifier source reference the product identification scheme for the Product Identifier.
Product Type	A product type.	Attempt to fit the product type within already in place ontologies or product classifications used within industry for trading energy. See 5.1 for suggestions.
Product Sub-Type	The sub-type of product	Products may be further divided into subtypes, for example Reserve products may be 10-minute or 30-minute response.
Unit of Measure for Product	Unit of measure the product.	The unit of measure such as MWh or kWh.

016-3.6.2 Pricing Attributes

Attribute	Description	Considerations
Total Price	Total Price of the product at point of delivery	Price is expressed as currency per Unit of Measure, i.e. quantity is not required, e.g. $/MWh Total Price = Sum (Price Components)
Set of 1..n Price Components		
Price Component	A component of the price.	Price may have one or more components. The sum of all Price Components must equal the Total Price
Price Component Type	The type of Price Component	A standard set of price component types shall be enumerated, such as: • Wholesale electricity cost • Transmission costs • Distribution costs
Price Type	Type of price	A standard set of price types will need to be defined Real Time, 5 minute, day ahead, as examples for price types
Override Unit of Measure for the Product	Unit of measure which is used to determine the price	Alternative Unit of Measure used in calculating the price.
Currency	The Currency of the Total Price and Price Components	Currency is required to determine the units of measure of the Total Price and Price Components. The Energy Units of Measure are defined by the Product Type.

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Attribute	Description	Considerations
Time and Interval	Interval of energy delivery	Timezone conventions and use need to be unambiguously defined and agreed upon. Daily blocks, hourly markets, 5 minute markets. A decision in how basic product information will reference and interact with the WS-Calendar initiative being completed as part of PAP-04.
Source Location Identifier	Location of the source of the electric energy	Electrical energy cost and value are greatly impacted by the distance between generation and consumption. Indicating the source of the generation is important in terms of pricing decisions on part of consumers and intermediaries. The use of source location would mainly be used for bilateral transactions.
Source Location Identifier Type	Type of location.	The mechanism used to identify location can be defined in multiple sources based upon specific usage from control areas to GPS coordinates it is anticipated that there may need to be more than one method to identify a geographical location. Where possible existing industry standards should be adopted to identify geographic locations.

016-3.7 SUPPLEMENTAL MATERIAL

016-3.7.1 Product Types and Sub Type Enumerations

The following values are suggested for use in classification of electrical energy.[2] NERC document (see section 1.2). These would be in addition to ENERGY and CAPACITY.

Value	Description
REGULATION	The provision of generation and load response capability, including capacity, energy, and MANEUVERABILITY, that responds to automatic controls issued by the OPERATING AUTHORITY.
LOAD FOLLOWING	The provision of generation and load response capability, including capacity, energy, and MANEUVERABILITY, that is dispatched within a scheduling period by the OPERATING AUTHORITY.
CONTINGENCY RESERVE	The provision of capacity deployed by the OPERATING AUTHORITY to reduce AREA CONTROL ERROR to meet the Disturbance Control Standard (DCS) and other NERC and Regional Reliability Council contingency requirements. CONTINGENCY RESERVES are composed of CONTINGENCY RESERVE–SPINNING and CONTINGENCY RESERVE–SUPPLEMENTAL.
REACTIVE POWER SUPPLY FROM GENERATION SOURCES	The provision of reactive capacity, reactive energy, and responsiveness from IOS RESOURCES, available to control voltages and support operation of the BULK ELECTRIC SYSTEM.

[2] NERC Reference Document Interconnected Operations Services, 1.2 Definition of Terms.

Value	Description
FREQUENCY RESPONSE	The provision of capacity from IOS RESOURCES that deploys automatically to stabilize frequency following a significant and sustained frequency deviation on the INTERCONNECTION.
SYSTEM BLACK START CAPABILITY	The provision of generating equipment that, following a system blackout, is able to: 1) start without an outside electrical supply; and 2) energize a defined portion of the transmission system. SYSTEM BLACK START CAPABILITY serves to provide an initial startup supply source for other system capacity as one part of a broader restoration process to re-energize the transmission system.

4. Supporting Documentation

a. Description of Request:

On September 30, 2009 the National Institute of Standards and Technology officially assigned NAESB the responsibility to develop Requirements and Use Cases pertinent to Priority Action Plan items 3, 4 and 9. A complete description of each item is available on the NIST Web site located at http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/WebHome

This recommendation specifically pertains to PAP 03[3], "Develop Common Specification for Price and Product Definition".

b. Description of Recommendation:

See Section 3 Summary

c. Business Purpose:

This recommendation has been developed in response to a request from NIST to provide use cases and requirements germane to the development of common specification for electric price and production definition.

[3] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PAP03PriceProduct

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d. Commentary/Rationale of Subcommittee(s)/Task Force(s):

Joint Smart Grid Standards Task Force and Fix Protocol Meeting Notes/Documents:

- September 17, 2009 Meeting Notes – To be posted
- October 1, 2009 Meeting Notes – To be posted
- October 15, 2009 Meeting Notes – To be posted

NAESB Smart Grid Standards Task Force Sub-Group Meeting Notes/Documents:

- October 13, 2009 Meeting Notes – To be posted
- October 20, 2009 Meeting Notes – To be posted
- October 27, 2009 Meeting Notes – To be posted
- November 3, 2009 Meeting Notes – To be posted
- November 4-6, 2009 Meeting Notes – To be posted
- November 10, 2009 Meeting Notes – To be posted

NAESB Smart Grid Standards Task Force Meeting Notes/Documents:

- October 22, 2009 Meeting Notes – http://naesb.org/pdf4/smart_grid_ssd102209notes.doc
- October 29, 2009 Meeting Notes – To be posted
- November 5, 2009 Meeting Notes – To be posted
- November 13, 2009 Meeting Notes – To be posted
- December 3, 2009 Meeting Notes – To be posted
- December 10, 2009 Meeting Notes – http://naesb.org/pdf4/smart_grid_ssd121009notes.doc
- December 17, 2009 Meeting Notes – http://naesb.org/pdf4/smart_grid_ssd121709notes.doc
- January 7, 2010 Meeting Notes – To be posted
- January 14, 2010 Meeting Notes – To be posted
- January 21, 2010 Meeting Notes – To be posted
- January 28, 2010 Meeting Notes – To be posted
- February 5, 2010 Meeting Notes – To be posted
- February 18, 2010 Meeting Notes – To be posted