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Working Draft 06

23 May 2010

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OASIS Specification Energy Interoperation V1.0, in process

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http://docs.oasis-open.org/emix/2009interim

Abstract:

The data models and XML vocabularies defined by this TC will address issues in energy markets
and the Smart Grid, but may be defined so as to support requirements for other markets. The TC
will develop a data model and XML vocabulary to exchange prices and product definitions for
transactive energy markets.

- Price information
- Bid information
- Time for use or availability
- Units and quantity to be traded
- Characteristics of what is traded
The definition of a price and of other market information exchanged depends on the market
context in which it exists. It is not in scope for this TC to define specifications for markets, nor how
prices are determined, nor the mechanisms for interoperation. The TC will coordinate with others
to ensure that commonly used market and communication models are supported.

**Status:**

This document was last revised or approved by the Energy Market Information Exchange
Technical Committee on the above date. The level of approval is also listed above. Check the
“Latest Version” or “Latest Approved Version” location noted above for possible later revisions of
this document.

Technical Committee members should send comments on this specification to the Technical
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The non-normative errata page for this specification is located at [http://www.oasis-
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1 Introduction

This document defines a set of messages to communicate price and product definition for energy markets. Product definition includes quantity and quality of supply as well as attributes of interest to consumers distinguishing between energy sources. Energy Market Information Exchange (EMIX) is not intended as a stand-alone signal, rather it is anticipated to be used for information exchange in a variety of market oriented interactions.

The Energy Market Information Exchange TC is developing this specification in support of the National Institute of Standards and Technology (NIST) Smart Grid Interoperability Road Map and in support of the US Department of Energy (DOE) as described in the Energy Independence and Security Act of 2007 (EISA 2007).

All examples and all Appendices are non-normative.

We define three things:

• The characteristics of energy that along with price define an energy product
• An information model for price and product definition using the Unified Modeling Language [UML]
• An XML Schema for price and product definition

1.1 Terminology

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in Error! Reference source not found.

1.2 Process

This information exchange was developed primarily by integrating requirements and use cases for price and product definition developed by the North American Energy Standards Board (NAESB) as part of its response to NIST Priority Action Plan 3, Price and Product Definition, which was driven by NIST, Federal Energy Regulatory Commission, and Department of Energy priority items.

Where appropriate, semantic elements from the IEC Power Load Management (TC 57) Common Information Model are used. Business and market information was borrowed from the financial instruments Common Information Models as described in ISO20022 and in the financial trading protocol FIX (Financial Information Exchange). [NEED NON-NORMATIVE REFS]

Energy markets are volatile, so precise time of delivery is always a significant component of product definition. EMIX incorporates schedule and interval definitions from WS-Calendar to communicate schedule-related information.

Additional guidance was drawn from subject matter experts familiar with the design and implementation of enterprise and other systems that may interact with smart grids.

1.3 Normative References


[WS-Calendar] OASIS WS-Calendar Technical Committee, specification in progress

[CalWS] CalConnect TC-XML, specification in progress

[CEFACT] Currency codes, e.g. USD or GBP. Add full reference citation to CEFACT or UBL profile of CEFACT


CalWS CalConnect draft in Process.


1.4 Non-Normative References

http://naesb.org/pdf4/weq_2010_ap6a_retail_2010_ap9a_rec.doc

The FIX protocol (need formal reference)

Transactional Energy Market Information Exchange [TeMIX] an approved White Paper of the EMIX TC
2 Information Model

2.1 Introduction

Price and Product Definition is actionable information. The information needed to make decisions should be included in the EMIX artifact exchanged. Present day markets, particularly wholesale markets, may have deferred charges (e.g. balancing charges) that cannot be determined at point of sale; other markets may require other purchases to allow the use of the energy purchased (e.g. same-time transmission rights or pipeline fees when accepting delivery on a forward contract).

Retail markets and prices generally are all inclusive, while other markets may have many components. The MarketContext is a key to determine other aspects of a market including market rules.


2.2 Information Structure

In describing the structure of the information and its contents we use the metaphor of an envelope containing warrants.

The intrinsic qualities of the energy are on the outside of the envelope. The intrinsic qualities appear on the outside of the envelope. In the simplest model, the intrinsic qualities are limited to the price and the information a meter can provide. In a market of homogenous energy sources and commodity energy, only the intrinsic qualities are actionable. The simplest devices, including the proverbial smart toaster, may understand only the intrinsic qualities. We anticipate that the information on the outside of the envelope will be used for many if not most energy decisions.

More information exchanges rely on the extrinsic qualities, that is, information derived from markets and market rules rather than from energy flows. Extrinsic qualities such as source and environmental attributes are known about the energy, but they are not the energy. The extrinsic qualities enable traceability and auditing, increasing public trust in energy markets and on energy differentiation. These warrants are inside the envelope; dumb gateways or dumb devices may ignore the warrants, that is forward or process messages without opening the envelope.

Most of the extrinsic information consists of warrants, that is, assertions made by an authority. That authority may be the original supplier, a market maker, or a supply chain. These warrants can include assertions of

- source
- source characteristics
- carbon freed in generation or use
- air quality related content (e.g. information on oxides of nitrogen produced in generation)
- audit information

Many artifacts defined as consecutive sequences of similar information. An example would be energy prices for 10 consecutive 15 minute intervals. In all such cases the degenerate set, i.e., a single price for a single interval is valid.
2.2.1 Sources of message components

2.2.1.1 Time
All expressions of time and interval are based upon the IETF iCalendar core calendar model (RFC 5545) and its associated objects. We rely on the XML standard for representing this information (IETF xCal). Models for using this information, including defined time series are based upon the profiles of iCalendar and xCal as defined in the OASIS specification WS-Calendar.

2.2.1.2 Energy Artifacts
The energy models are drawn, when available, for developing work elsewhere. If time permits, the Committee plans to use the information model from the PAP10 Power Load.

The energy models are all in their own chapter. As this is written (May 2010), there are three: Electric Energy, Reactive Energy and Transmission & Distribution (T&D). The model anticipates additional energy models (Natural Gas? Thermal Distribution? …) and therefore maintains a distinction between energy model and the information on the envelope.

Energy Artifacts are defined in Section 3.

2.2.1.3 EMIX Intervals
EMIX Intervals are a time segment of energy delivery. The term Interval used as defined in the WS-Calendar specification. A WS-Calendar interval is a time segment unbounded to a particular date-time. This is in contrast to Emix Periods (see below).

Emix Intervals can be grouped using any of the Interval Set information models as defined in the WS-Calendar specification. WS-Calendar intervals always have an attachment, which is either an XML artifact or an XPOINTER to an XML artifact. In EMIX Intervals, the XML Artifacts are Energy Artifacts as defined in section 3.

2.2.1.4 EMIX Periods
EMIX Periods are EMIX Intervals bound to a particular date and time. While an EMIX Interval might indicate the delivery of energy for a 10 minute period, an EMIX Period would instead indicate the delivery of energy for a 10 minute period starting at 3:00 PM. The EMIX Period uses the Period as defined in the WS-Calendar specification.

The group of intervals are can use any of the Interval Set information models as defined in the WS-Calendar specification. WS-Calendar intervals always have an attachment, which is either an XML artifact or an XPOINTER to an XML artifact. The XML Artifacts are Energy Artifacts as defined in section 3.

2.2.2 The Intrinsic Elements
The following table specifies the Intrinsic elements in the EMIX v1.0 information model. This table contains only those elements of EMIX v1.0 for which there is a consensus description. Elements not included here have no specific constraint or condition for use.

Table 2-1: Intrinsic Elements - the "outside of the envelope"

<table>
<thead>
<tr>
<th>EMIX Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UID</td>
<td>Identifier of this message</td>
<td></td>
</tr>
<tr>
<td>PartyId</td>
<td>ebCore Party ID</td>
<td>Producer of this artifact</td>
</tr>
<tr>
<td>TimeStamp</td>
<td>Time this message was produced</td>
<td></td>
</tr>
<tr>
<td>EMIX Element</td>
<td>Specification (Normative)</td>
<td>Note (Non-Normative)</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MarketContext</td>
<td>An identification of the market in which the product is offered, or the counterparty if part of a bilateral non-market transaction.</td>
<td>This may include standard financial exchanges, markets managed by or for aggregators and distributors, and an identification of the microgrid in which the product is priced. The identification of microgrids is TBD at this time; the Location may be a way to represent this, e.g. a representative point, a point inside, or a polygon.</td>
</tr>
<tr>
<td>EmixIntervals</td>
<td>Array of EMIX Intervals. Indicates the time(s) the product was, is, or will be available and the amount and price of the product.</td>
<td>Includes prices and quantities. Can be a single Interval. Based upon by [WS-Calendar] definition of Period with energy artifacts applied.</td>
</tr>
<tr>
<td>Currency</td>
<td>A code that indicates the currency used.</td>
<td>[CEFACT] or UBL Examples include USD, CAD, GBP, EUR, CNY. Should be a nominative or shadow price referenced to e.g. microgrids.</td>
</tr>
<tr>
<td>Extended Price</td>
<td>The total cost of the transaction over the Delivery Interval.</td>
<td>The Extended Price is the sum of Price times the Rate of Delivery times the duration of the IntervalSet. Confusing.</td>
</tr>
<tr>
<td>Location</td>
<td>The geospatial location for the product (Point of Delivery).</td>
<td>This may be point of use, point of delivery, or a geospatial polygon. We anticipate that we use a constricted set of the OpenGML standards with an eye toward compatibility standards used in Emergency Response.</td>
</tr>
<tr>
<td>Injection Location</td>
<td>Location at which power is injected into the grid</td>
<td>Delivery location may be Injection or Takeout location or an intermediate location.</td>
</tr>
<tr>
<td>Takeout Location</td>
<td>Location at which power is taken out of the grid</td>
<td></td>
</tr>
<tr>
<td>Meter ID</td>
<td>An identifier designating the meter.</td>
<td>A Point of Delivery is most frequently associated with a meter.</td>
</tr>
<tr>
<td>Product Type</td>
<td>Identifies type of Product from the list of approved Product Artifacts.</td>
<td>Some language permitting and encouraging the development and registration of new Artifact types.</td>
</tr>
<tr>
<td>Product Artifact</td>
<td>Matches the Product Type</td>
<td>Different types of Products have different artifacts. See Section 3 for a discussion of Artifacts.</td>
</tr>
<tr>
<td>Envelope</td>
<td>Container only</td>
<td>Container to hold all extrinsic information elements.</td>
</tr>
</tbody>
</table>
2.2.3 Extrinsic Elements

The following table specifies the Extrinsic elements in the EMIX v1.0 information model. This table contains only those elements of EMIX v1.0 for which there is a consensus description. Elements not included here have no specific constraint or condition for use.

Table 2-2: Extrinsic Elements - "Inside the Envelope"

<table>
<thead>
<tr>
<th>EMIX Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrant List</td>
<td>The container for array of warrants. Optional.</td>
<td>An array of the warrants included in the envelope. See section 4 for warrants.</td>
</tr>
<tr>
<td>Price Support</td>
<td>Container holding information supporting price information</td>
<td>May include Energy Artifacts, if several are combined to produce the intrinsic price.</td>
</tr>
<tr>
<td>Program</td>
<td>A possibly structured name for a program in which the price and product are offered or purchased.</td>
<td>This may be analogous to a contract identifier. The variety of DR “programs” inspired this proposed element.</td>
</tr>
<tr>
<td>Contract ID</td>
<td>An identification of the contract under which the energy is supplied or consumed.</td>
<td>ISSUE should this be with MarketID on the envelope?</td>
</tr>
<tr>
<td>Product Quality</td>
<td>Quality measures are specified alongside their associated Artifacts in section 3</td>
<td>Perhaps using IEEE 1159 or other common metrics</td>
</tr>
</tbody>
</table>

2.2.4 Extensible Element Definition

This section blank

2.2.5 Warrant Information Examples

There are a wide variety of warrant types, issuing authorities, and characteristics described by warrants. For bilateral agreements, we described what may be called self-issued warrants. We provide some examples; see NEED REF OR INFORMATIVE APPENDIX for a description of the complexities of warrants across jurisdiction boundaries.

Table 2-3: Examples of Warrant Information

<table>
<thead>
<tr>
<th>Warrant Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrant Type</td>
<td>Specification (Normative)</td>
<td>Note (Non-Normative)</td>
</tr>
<tr>
<td>Carbon Warrant</td>
<td>The quantity of carbon released by the production of the product in the quantity and units indicated</td>
<td>This could be CO2, amount of elemental carbon. Units defined by UnitsML.</td>
</tr>
<tr>
<td>Warrant Element</td>
<td>Specification (Normative)</td>
<td>Note (Non-Normative)</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Content Warrant</strong></td>
<td>The proportion of the product defined that is from non-fossil fuel sources, including but not limited to “hydroelectric”, “solar”, and “wind”.</td>
<td>The nature of the original input to storage is not altered when drawn from storage. <em>(except when the storage is CAES with natural gas assist)</em></td>
</tr>
<tr>
<td><strong>Source Warrant</strong></td>
<td>Individual source warrants</td>
<td>In aggregate may be the same as ContentWarrant</td>
</tr>
</tbody>
</table>
### 3 Energy Artifacts

Each type of Energy product has its own definitions and its own descriptive parameters. The energy Artifacts are the specific descriptions relevant to defining the potential utility of the energy product. The Energy Artifacts describe the intrinsic information. There may be cases when an energy artifact is used “inside the envelope”, perhaps as supporting information supporting the internal prices.

*In a perfect world, this will come from the PAP10 effort. We may not be in a perfect world. The author acknowledges that the element names below should all be reviewed for use in the IEC TC 57 Power and Load Management CIM. For editorial reasons, drafts so far have focused on the interactions first. I invite Commenters who know the CIM to make name suggestions.*

#### 3.1 AC Power Artifact

The most common product for delivery of Electricity is AC Power. Depending upon the market, AC Power can be bought in blocks or made available for use up to the maximum deliverable by the in-place infrastructure. Today, use of the former is typical in wholesale markets, and the latter in residential markets.

The same AC power can be offered to provide multiple services at different market prices. Some markets, known as ancillary services, can offer substantially more for the same load than does the traditional market. Suitability of an offering for these diverse markets is determined by aspects of the response such as how fast the resource can offer the power, how long it can offer the power, how frequently the resource can offer the power, etc. Higher prices come with higher risks; the costs of non-performance in ancillary markets can be substantially higher as well.

##### 3.1.1 Block AC Power

The AC Power Block is used today in wholesale markets and in demand response (DR). It is also acceptable for end user sales in transactional markets. As the Power Block is contained inside or referred to by a WS-Calendar interval, it has no native duration. This artifact can be used in forward bidding, committed purchases, and in after-the fact (post parte) reporting.

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of Delivery</td>
<td>Normally in $kW$ or $MW$</td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>How fast can this resource respond if asked</td>
</tr>
<tr>
<td>Ramp Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>How long to get up to full service after response</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>Minimum time between being invocation and re-invocation.</td>
</tr>
<tr>
<td>Power Factor</td>
<td>Power factor – float from 0 to 1. Optional</td>
<td>Low power factor affects the rest of the distribution grid by introducing harmonic distortion, so a power factor of 1 should be the most valuable.</td>
</tr>
</tbody>
</table>

*Table 3-1: AC Block Power Attributes*

**Deleted:** KWh
3.1.2 Full-Requirements AC Power

Electricity sold under full-requirements tariffs and contracts to retail customers is a common regulated tariff today. A full-requirements retail contract is an offer to a customer by a retail service provider (RSP) to deliver any amount of power (at a rate-of-delivery up to the capacity of the customer's service connection) at an offer price over a specified interval. Ancillary services brought to market may have similar limits, including a minimum and a maximum offer. A minimum offer is the smallest load the supplier is willing to bring to market. A maximum offer may be the maximum DR that a customer can provide.

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min Rate</td>
<td>In KWh (optional)</td>
<td>Minimum rate of delivery to acquire this product</td>
</tr>
<tr>
<td>Max Rate</td>
<td>In KWH</td>
<td>Maximum rate of delivery obtainable from this asset</td>
</tr>
<tr>
<td>Response Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>How fast can this resource respond if asked</td>
</tr>
<tr>
<td>Ramp Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>How long to get up to full service after response</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>Minimum time between being invocation and re-invocation.</td>
</tr>
<tr>
<td>Power Factor</td>
<td>Power factor – float from 0 to 1. Optional</td>
<td>Low power factor affects the rest of the distribution grid by introducing harmonic distortion, so a power factor of 1 should be the most valuable.</td>
</tr>
</tbody>
</table>

3.1.3 AC Power Quality

Higher quality power can obtain a market premium. A buyer willing to accept lower quality power may be able to obtain inexpensive power. Power Qualities should be measurable, so AC Power Quality from usage can be tracked against the AC Power Quality bid.

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awaiting Input</td>
<td></td>
<td>Awaiting metrics of AC Power Quality from committee or PAP10</td>
</tr>
</tbody>
</table>

3.2 T&D Artifact

The T&D Artifact is used for both Transmission and Distribution. Distribution artifacts are appropriate when there is a distinction between the point of purchase of energy and the point of delivery. For example, A consumer could contract to buy power directly form a desirable power source, such as a

Comment: These sounds like energy interop and not a product.
particular wind farm. The consumer would then pay the delivery costs to get the energy to the consumer’s
358
derm.

Three types of costs typically can affect delivery costs. Normal delivery charges may be either fixed price 360
or based upon distance, as in a cost per mile. Line losses can reduce the amount delivered to an amount 361
below the amount purchased; if the consumer wants an unblended product, this amount cannot be made 362
up from the distribution factor’s account. Finally, certain distribution assets can be constrained. Energy 363
transiting through a constrained distribution asset may incur congestion charges.

Table 3-4: Energy Distribution Artifact

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>Number</td>
<td>Multiplier for the other elements that need to be extended</td>
</tr>
<tr>
<td>Distance Units</td>
<td>Unit of Measure</td>
<td>May not be required for computation or understanding. It will reassure the recipient, though, to know it is 300 miles and not 300 feet</td>
</tr>
<tr>
<td>Delivery loss</td>
<td>The loss per distance unit of transmission.</td>
<td>The amount of energy purchased is reduced by the extended loss, i.e., the EDPU to the power of the Distance.</td>
</tr>
<tr>
<td>Extended Delivery Loss</td>
<td>The effective loss for delivery</td>
<td>The amount of energy purchased is reduced by the extended loss, i.e., the (1 – delivery loss) to the power of the Distance.</td>
</tr>
<tr>
<td>Distribution Rate</td>
<td>The charge per distance unit of distribution</td>
<td></td>
</tr>
<tr>
<td>Extended Distribution Charge</td>
<td>Total Distribution Charge</td>
<td>Distribution Rate times Distance</td>
</tr>
<tr>
<td>Congestion Charge</td>
<td>Charge per unit of energy</td>
<td>Time sensitive charges to allocate scarce distribution capacity</td>
</tr>
<tr>
<td>Extended Congestion Charge</td>
<td>Total congestion charge</td>
<td>Congestion Charge times purchase quantity</td>
</tr>
</tbody>
</table>

Comment: Modeling losses and rates in this way is not common in part because of network effects it is not accurate. Generally a table of marginal or average losses is provided for point to point transactions.

There could well be multiple instances of the above. T&D infrastructure could create a distance for Transmission and a distance for transmission, each with associated charges. A distant purchase could transit multiple congestion points.

3.3 DC Power Artifact

There is a growing discussion of the sale of DC Power. Pilot projects in several parts of the country are using high voltage DC to transmit electrical energy over great distances. Others anticipate a growing use for DC distribution within microgrids.

3.4 DC Power Load Artifact

Table 3-5: DC Power Load Artifact

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
</table>
3.4.1 Full-Requirements  DC Power

It is possible that DC Power will be sold in the same manner as today’s full-requirements tariffs. A full-requirements retail contract is an offer to a customer by a retail service provider (RSP) to deliver any amount of power (at a rate-of-delivery up to the capacity of the customer’s service connection) at an offer price over a specified interval.

Ancillary services brought to market may have similar limits, including a minimum and a maximum offer. A minimum offer is the smallest load the supplier is willing to bring to market. A maximum offer may be the maximum DR that a customer can provide.

Table 3-6: DC Full Requirements Offering

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Number</td>
<td>For microgrids, often 48 or 325</td>
</tr>
<tr>
<td>Power Factor</td>
<td>Volt-Amps/Hour</td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>How fast can this resource respond if asked</td>
</tr>
<tr>
<td>Ramp Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>How long to get up to full service after response</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>Duration as defined in WS-Calendar</td>
<td>Minimum time between being invocation and re-invocation.</td>
</tr>
</tbody>
</table>

Comment: Power factor not relevant for DC power

Comment: These are getting into defining the capability of a device. What role does this play in price and product communication? Are we to have different products for every device?
3.4.2 DC Power Quality

Higher quality power can obtain a market premium. A buyer willing to accept lower quality power may be able to obtain inexpensive power. Power Qualities should be measurable, so DC Power Quality from usage can be tracked against the AC Power Quality bid.

<table>
<thead>
<tr>
<th>Load Element</th>
<th>Specification (Normative)</th>
<th>Note (Non-Normative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awaiting Input</td>
<td></td>
<td>Awaiting metrics of DC Power Quality from committee or PAP10</td>
</tr>
</tbody>
</table>

Table 3-7: DC Power Quality

3.5 Reactive Load Artifact

This section is rudimentary only as of this draft

Attributes describing the utility of Reactive Load

- Total Harmonic Distortion (reactive load) (Volt-Amps)
- Power Factor
- VoltAmps-Hours
4 EMIX Warrants

In this section we define the detailed information model for EMIX artifacts. In Section 4 we define the XML Schema for the EMIX Information Model.

4.1 Warrant List Definition

Still blank
5 XML Schema for the EMIX Information Model

In this section we define the XML Schemas for EMIX.
6 Conformance

The last numbered section in the specification must be the Conformance section. Conformance Statements/Clauses go here.
Acknowledgements

The following individuals have participated in the creation of this specification and are gratefully acknowledged:

Participants:

Timothy Bennett, Drummond Group Inc.
Edward Cazalet, Individual
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Jeremy Roberts, LonMark International*
Anno Scholten, Individual
Pornsak Songkakul, Siemens AG
David Sun, Alstom Power Inc.
Jake Thompson, EnerNOC
David Webber, Individual
Leighton Wolffe, Individual
A. Notes on Ancillary Services (non-normative)

Some markets, known as ancillary services, can offer substantially more for the same load than does the traditional market. Suitability of an offering for these diverse markets is determined by aspects of the response such as how fast the resource can offer the power, how long it can offer the power, how frequently the resource can offer the power, etc. Higher prices come with higher risks; the costs of non-performance in ancillary markets can be substantially higher as well.

Ancillary services require detailed interval metering. For the regulation product, 4 to 6 second interval metering and direct control of the generator is today required by the balancing system operator. However, there are current initiatives by FERC and many ISOs to allow loads and storage to provide ancillary services. One of the potential applications of the metering and communications infrastructure of the smart grid is to facilitate the participation of loads and distributed energy resources such as storage in providing balancing / ancillary services to the grid.

There is general agreement across North America on the names of ancillary services. There is general agreement on the performance profile for each ancillary service as well. There are minor differences in some of the actual performance profiles from region to region. Periodically, the performance requirements are changed for named services.

Ancillary service performance can be characterized as "meet or exceed" requirements. A given service level may meet the requirements for more than one named service. A power product that can be sold in more than one market has more potential value to the seller. Transparent service and performance requirements associated with market prices are likely to encourage sellers to make minor upgrades when they can thereby reach new markets.

For these reasons, we opted not to name the ancillary services in the standard, but instead to exchange the actual performance requirements either offered or required.

A.1 Common Requirements today

For reference, here are some common performance requirements in use today. These are non-normative.

They are include here to assist the practitioner in thinking about ancillary services as a deliverable.

Regulation

Spinning Reserve

Non-Spinning Reserve
## Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Editor</th>
<th>Changes Made</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2009-12-08</td>
<td>Toby Considine</td>
<td>Initial Draft from templates and outline</td>
</tr>
<tr>
<td>2</td>
<td>2010-01-12</td>
<td>William Cox</td>
<td>Inserted information model details from TC discussions</td>
</tr>
<tr>
<td>3</td>
<td>2010-03-10</td>
<td>William Cox</td>
<td>Change to envelope and certificate metaphor. Changes in mandatory and optional definitions.</td>
</tr>
<tr>
<td>4</td>
<td>2010-03-24</td>
<td>William Cox</td>
<td>Updates based on TC comments and corrections. Additional open issues in TC agenda.</td>
</tr>
<tr>
<td>5</td>
<td>2010-05-18</td>
<td>Toby Considine</td>
<td>Aligned elements with current draft if WS-Calendar, cleaned up some language to align with the last two months of conversation. Extended envelop and intrinsic/extrinsic language</td>
</tr>
<tr>
<td>6</td>
<td>2010-05-21</td>
<td>Toby Considine</td>
<td>Began incorporating TeMIX language. Changed Certificates to Warrants. Fleshe out Energy Artifacts</td>
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