

## EMIX Version 1.0

### Working Draft

**24 March 2010**

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##### Latest Version:

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<http://docs.oasis-open.org/emix/v1.0/v1.0/wd01/emix-1.0-spec-wd-04.pdf>

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#### Technical Committee:

[OASIS Energy Market Information Exchange TC](#)

#### Chair(s):

Ed Cazalet,  
William T. Cox

#### Editor(s):

Toby Considine

#### Related work:

This specification replaces or supersedes:

- N/A

This specification is related to:

- OASIS Specification WS-Calendar V1.0, in process
- OASIS Specification Energy Interoperation V1.0, in process

#### Declared XML Namespace(s):

<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

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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 or how prices are determined, or 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 Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at <http://www.oasis-open.org/committees/emix/>.

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The non-normative errata page for this specification is located at <http://www.oasis-open.org/committees/emix/>

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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.

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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

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## 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 **[RFC2119]**.

## 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

- |                      |  |
|----------------------|--|
| <b>[RFC2119]</b>     | S. Bradner, <i>Key words for use in RFCs to Indicate Requirement Levels</i> , <a href="http://www.ietf.org/rfc/rfc2119.txt">http://www.ietf.org/rfc/rfc2119.txt</a> , IETF RFC 2119, March 1997.                             |
| <b>[WS-Calendar]</b> | <u>OASIS WS-Calendar Technical Committee, specification in progress</u>  |
| <b>[CEFACT]</b>      | Currency codes, e.g. USD or GBP. Add full reference citation to CEFACT or UBL <u>profile</u> of CEFACT   |
| <b>[UML]</b>         | <i>Unified Modeling Language (UML), Version 2.2</i> , Object Management Group, February, 2009. <a href="http://www.omg.org/technology/documents/formal/uml.htm">http://www.omg.org/technology/documents/formal/uml.htm</a> . |

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43 **1.4 Non-Normative References**

44 **[NAESB 03]** *Requirements Specification for Common Electricity Product and Pricing*  
45 *Definition*, North American Energy Standards Board [NAESB], March, 2010  
46 (Public Review Draft).  
47 [http://naesb.org/pdf4/weq\\_2010\\_ap6a\\_retail\\_2010\\_ap9a\\_rec.doc](http://naesb.org/pdf4/weq_2010_ap6a_retail_2010_ap9a_rec.doc)

48 **[FIX]** ~~The FIX protocol (need formal reference)~~

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49 **[ISO20022]** ~~International Standards Organization, ISO 20022 (need full reference)~~

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## 51 2 Information Model

### 52 2.1 Introduction

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

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

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### 60 2.2 Information Structure

61 In describing the structure of the information and its contents we use the metaphor of an *envelope*  
62 *containing certificates*.

63 We say that **key elements**, those pieces of information which we anticipate will be used in many if not  
64 most information exchanges, appear on the *outside* of the envelope, and supporting information is *inside*  
65 the envelope. Alternatively, we will talk about information *written* on the envelope and information  
66 *contained* in the envelope.

67 We use the term key elements very carefully—within certain situations the necessary *actionable*  
68 *information* may be understood as part of the context. For example, in a single building it is likely that the  
69 Currency used in EMIX artifacts will be constant, and likewise the geospatial location.

70 The content of the envelope within the EMIX artifact consists of a set of **certificates**. These might include  
71 certification of

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

77 Such certificates are validated by an authority. In the case of bilateral trades, they may be validated by  
78 the counterparty to the transaction.

79 We divide the information into key elements, some of which are required (see conformance section), and  
80 some of which are optional, allowing elision of unnecessary information within a domain, market,  
81 microgrid, or facility.

82 *NEED A TERM FOR THIS.*

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83 In addition, we define for each conformant EMIX artifact a list of specific information. This optimization  
84 allows an envelope to have on it a series of prices with sufficient distinguishing information (e.g. interval,  
85 quantity) to communicate a sequence of price and product definitions to which the certificates inside the  
86 envelope apply.

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#### 87 2.2.1 Required Elements

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

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91 The column labeled *List Element* indicates whether the element will appear in the list of price+product  
92 definition on the envelope.

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| EMIX Element          | Specification (Normative)   | List Element (Normative) | Note (Non-Normative)  |
|-----------------------|---|--------------------------|---|
| Price                 | The price of a single unit of the product   | Yes                      | Price per unit multiplied by quantity equals total price.<br><br>The price may not include normal and customary deferred charges, e.g., balancing charges in wholesale markets, but is intended to be the nominal (and where feasible) all inclusive price for the energy product.  |
| Quantity              | The number of units. An integer or fixed point number.  | Yes                      | <u>The number of Units (see below)</u>  |
| <u>Interval</u>       | The time interval in which the product was, is, or will be available <u>as defined by [WS-Calendar].</u>                            | Yes                      | <u>[WS-Calendar] in progress defines common schedule information</u>  |
| Market <u>Context</u> | An identification of the market in which the product is offered, or the counterparty if part of a bilateral non-market transaction. | Yes                      | 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.<br><br>The identification of microgrids is TBD at this time; the <b>Location</b> may be a way to represent this, e.g. a representative point, a point inside, or a polygon. |
| <u>ExtendedPrice</u>  | <u>The total price computed by summing the product of each quantity times each price</u>  | No                       | <u>The total price for the included quantities and intervals.</u>   |
| Currency              | A code <u>that indicates</u> the currency used.   | No                       | <b>[CEFACT]</b> or UBL. Examples include USD, CAD, GBP, EUR, CNY. <u>Should be a nominative or shadow price referenced to e.g. microgrids</u>   |
| Location              | The geospatial location for the product   | No                       | This may be point of use, point of delivery, or a geospatial polygon. <u>Details TBD.</u>   |

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Deleted: Requires understanding of the units (optional)

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| EMIX Element    | Specification (Normative)  | List Element (Normative) | Note (Non-Normative)   |
|-----------------|--|--------------------------|--|
| Type            | The type of energy for the product, including <a href="#">Electricity</a> , <a href="#">NaturalGas</a> , <a href="#">Thermal</a> | No                       | There are several subclasses of energy product related to <a href="#">source or use</a> , e.g. Natural Gas, ElectricReserve, FrequencyRegulation, VoltageSupport, ElectricCapacity. <a href="#">See separate white paper on this subject for discussion of named versus quality based product definition</a> |
| Units           | The units of measure for the product.  | No                       | Use UnitsML to define.   |
| CertificateList | A list of certificates included in the envelope  | No                       | The container for the list of certificates.  |
| ProductList     | A list of products on the envelope   | No                       | This is the container for the list of product tuples.  |

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## 94 2.2.2 ProductList Structure

95 The structure of the product list will be completely defined in Section 3.

96 The list of price+product definition can be considered to be a table with **ListCardinality** defining the  
 97 number of rows, and each row being a four-tuple consisting of a single product's **Price**,  
 98 **Quantity**, **Interval**, and **MarketContext**.

99 It is RECOMMENDED that the tuples be sorted by the start time indicated in each line's **Interval** element  
 100 to allow easier processing.

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## 101 2.2.3 CertificateList Structure

102 The structure of the certificate list will be completely defined in Section 3.

103 The certificates are contained in a list of indefinite length. An empty list is permitted.

## 104 2.2.4 Defined Optional Elements

105 The following table specifies defined OPTIONAL elements in the EMIX v1.0 information model. This table  
 106 contains only those elements of EMIX v1.0 for which there is a consensus description. If the information  
 107 as defined here is included in an EMIX v1.0 artifact, it SHALL use these element names and definitions.  
 108 The use of these elements has no specific constraint or condition for use.

109 Certain characteristics, e.g. carbon produced and regulated air quality characteristics, are represented by  
 110 certificates that are logically contained within the EMIX artifact.

111 *Table 2: EMIX v1.0 Information Model—Defined Optional Elements*

| EMIX Element | Specification (Normative)  | Note (Non-Normative)  |
|--------------|--|---|
| SourceDetail | A list of name-value pairs where the name is from the extensible enumeration of <b>Source</b> type and the value is the percent of the product | This corresponds to the common technique of retrospectively or prospectively declaring the source contributions to the product defined. |

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|                            |  |  |
|----------------------------|--|--|
|                            | from each enumerated source, represented as a decimal fraction   |  |
| <b>Class</b>               | The broad use and utility of the product defined. Values include "usage", "load", "peak", and "curtailment". | ISSUE: Perhaps should be on envelope. Usage is most common, but distinguishing at the envelope level may be much more efficient. |
| <b>Program</b>             | A possibly structured name for a program in which the price and product are offered or purchased.            | This may be analogous to a contract identifier. The variety of DR "programs" inspired this proposed element.                     |
| <b>ContractID</b>          | An identification of the contract under which the energy is supplied or consumed.                            | ISSUE should this be with MarketID on the envelope?  |
| <b><u>PowerQuality</u></b> | <u>TBD</u>   | <u>Perhaps using IEEE 1159 or other common metrics</u>   |

112

113 **2.2.5 Extensible Element Definition**

114 **2.2.6 Certificate Information Examples**

115 There are a wide variety of certificate types, issuing authorities, and characteristics described by  
 116 certificates. For bilateral agreements, we described what may be called self-issued certificates.

117 We provide some examples; see NEED REF OR INFORMATIVE APPENDIX for a description of the  
 118 complexities of certification across jurisdiction boundaries.

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| <b>Certificate Type</b>   | <b>Specification<br/>(Normative)</b>   | <b>Note<br/>(Non-Normative)</b>   |
|---------------------------|--|---|
| <b>CarbonCertificate</b>  | The quantity of carbon released by the production of the energy product in the quantity and units indicated                                    | This could be CO <sub>2</sub> , amount of elemental carbon. Units defined by UnitsML. |
| <b>ContentCertificate</b> | The proportion of the product defined that is from non-fossil fuel sources, including but not limited to "hydroelectric", "solar", and "wind". | The nature of the original input to storage is not altered when drawn from storage.   |
| <b>SourceCertificate</b>  | Individual source certificates   | In aggregate may be the same as ContentCertificate                                    |

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121 **3 Detailed Information Model**

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

124 **3.1 Information Structure Detail**

125 **3.2 Element Naming Convention**

126 **3.3 Evolution of the Information Model**

127 **3.4 ProductList Definition**

128 **3.5 CertificateList Definition**

129

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## 4 XML Schema for the EMIX Information Model

130

In this section we define the XML Schemas for EMIX.

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131 **# Conformance**

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

134

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## A. Acknowledgements

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

137 **Participants:**

138 [Participant Name, Affiliation | Individual Member]

139 [Participant Name, Affiliation | Individual Member]

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## B. Non-Normative Text

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## C. Revision History

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| Revision | Date              | Editor             | Changes Made  |
|----------|-------------------|--------------------|---|
| 1        | 2009-12-08        | Toby Considine     | Initial Draft from templates and outline  |
| 2        | 2010-01-12        | William Cox        | Inserted information model details from TC discussions                                      |
| 3        | 2010-03-10        | William Cox        | Change to envelope and certificate metaphor. Changes in mandatory and optional definitions. |
| <u>4</u> | <u>2010-03-24</u> | <u>William Cox</u> | <u>Updates based on TC comments and corrections. Additional open issues in TC agenda.</u>   |

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|                        |  |    |  |
|------------------------|--|----|--|
| <b>ListCardinality</b> | A positive integer that indicates how many elements are in the list. | No | The degenerate case is a list of one element, with ListCardinality equal to one. |
|------------------------|--|----|--|