NORTH AMERICAN ENERGY STANDARDS BOARD
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NAESB ENERGY USAGE INFORMATION MODEL

The energy usage information model herein is organized consistent with several related models, including the IEC TC57 Common Information Model [IEC 61968 Part 9], ZigBee Smart Energy Profile 2.0 [SEP2.0], that are defined by the Energy Information Standards Alliance [EIS Alliance] and Open Automated Data Exchange [OpenADE]. The energy usage information model, where possible, uses classes, information elements and attribute names drawn from the CIM and the cited references.

The starting point for the energy usage information model is the UsagePoint. UsagePoints identifies key references for the information set optionally including identification of the customer, the location, and the physical asset. UsagePoint is associated in turn with zero or more MeterReadings. A MeterReading composes information about a particular measurement such as kWh or kW. A MeterReading has a ReadingType which describes the nature of the measurement including its units of measure, and zero or more IntervalReadings or Readings and associated quality information. UsagePoint may also be associated with summary information on load and usage, and optionally, power quality. For applications requiring third party access to this information, additional classes are identified to facilitate associating customer and customer agreement information with the measurements available at a UsagePoint.

To find the usage or load in a particular interval, identify the appropriate UsagePoint, select the MeterReading of interest (measurement) and then select the IntervalReading or Reading associated with the given interval.

The energy usage information model includes many optional components. The complete set of information expressable using the energy usage information model satisfies a wide range of applicability requirements identified by the industry. Users of this Business Practice Standard may optionally take advantage of these extended definitions based on need without requiring them. Applications built on the energy usage information model may elect which optional components to present. However, clients of this information can be expected to recognize all components provided in the application.

The NAESB standard idenitifies the set of core model elements that shall be supported by specifications claiming conformance to this Business Practice Standard. The following class diagram illustrates a view[1] of this core of the energy usage information model:

[1] This is but one of several views that might result from choices permitted in the context of the conformance paragraph.

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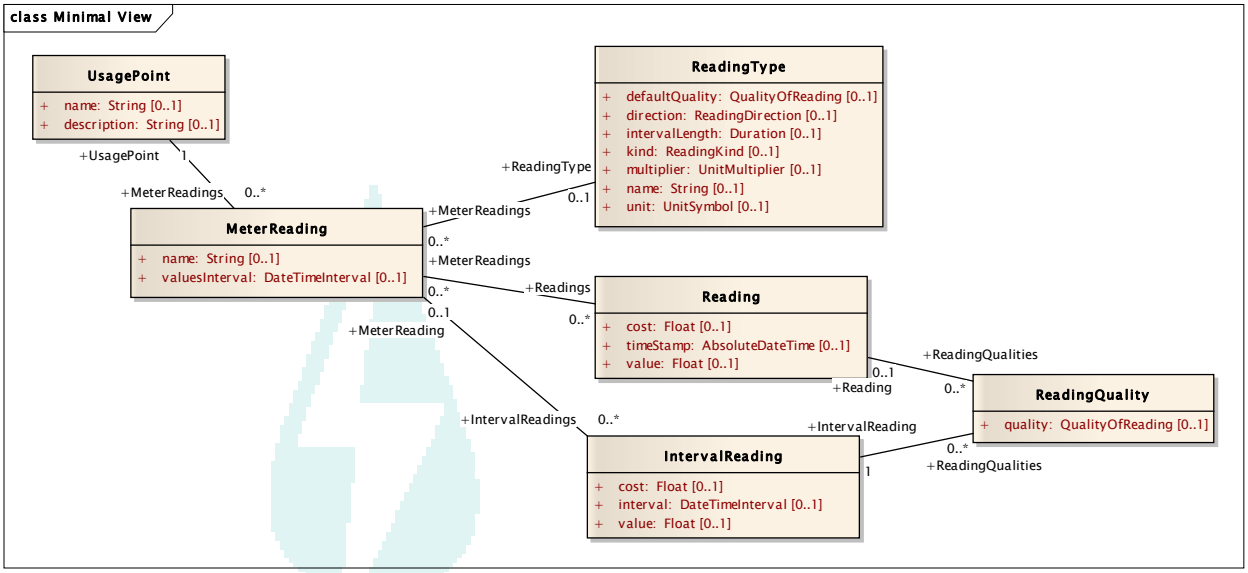

Figure 1

The full energy usage information model, illustrated in Figure 2, forms the basis of the required Business Practice Standard. Note, some minor classes are omitted from the original diagram to aid in readability (e.g. DateTimeInterval).

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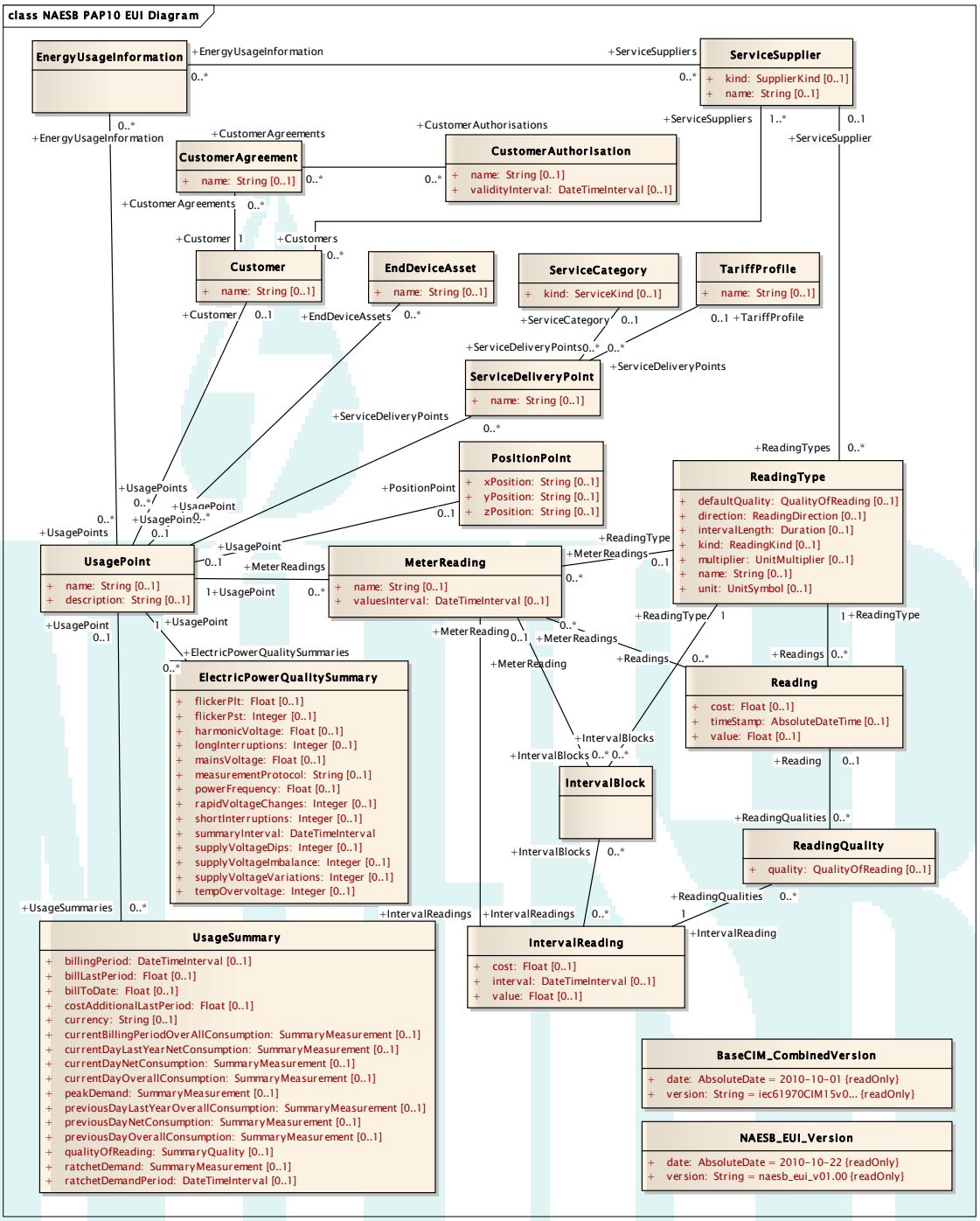

Figure 2

Energy Usage Information Model Details

The following sections contain the classes and attributes defined in the energy usage information model, along with their descriptions. Elements tagged with <<enumeration>> define the valid values for an enumerated data type and so do not have their own data type, and should be self explanatory, not requiring a definition.
Terms in this section may be based upon IEC 61968 classes and their descriptions. Some of the descriptions refer to other components of the IEC model (recognized as camel case terms) and these are not part of the energy usage information model or needed by the components in the energy usage information model. To preserve accurate presentation of unaltered IEC classes, these terms have been retained.

AbsoluteDateTime «Datatype»

Date and time as specified in ISO 8601.

BaseCIM_CombinedVersion

The combined version denotes the versions of the subpackages that have been combined into the total CIM model. This is a convenience instead of having to look at each subpackage.

Name	Type	Description
date	AbsoluteDate	Form is YYYY-MM-DD for example for January 5, 2009 it is 2009-01-05.
version	String	Form is IEC61970CIMXXvYY_IEC61968CIMXXvYY_combined where XX is the major CIM package version and the YY is the minor version, and different packages could have different major and minor versions. For example IEC61970CIM13v18_IEC61968CIM10v16_combined. Additional packages might be added in the future.

Boolean «Primitive»

A type with the value space "true" and "false".

Customer

Organization receiving services from ServiceSupplier.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.

CustomerAgreement

Agreement between the customer and the ServiceSupplier to pay for service at a specific service location. It provides for the recording of certain billing information about the type of service provided at the service location and is used during charge creation to determine the type of service.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.

CustomerAuthorisation

Holds an authorisation for access to specific user-private data granted to a third party service provider.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.
validityInterval	DateTimeInterval	Date and time interval this agreement is valid (from going into effect to termination).

DateTimeInterval «Compound»

Interval of date and time.

Name	Type	Description
start	AbsoluteDateTime	Date and time that this interval started.
end	AbsoluteDateTime	Date and time that this interval ended.
duration	Duration	The duration of this interval, in seconds

Duration «CIMDatatype»

An interval of time, specified in ISO 8601 compatible format.

ElectricPowerQualitySummary

A summary of power quality events. This information represents a summary of power quality information typically required by customer facility energy management systems. It is not intended to satisfy the detailed requirements of power quality monitoring. All values are as defined by measurementProtocol during the period. The standards typically also give ranges of allowed values; the information attributes are the raw measurements, not the "yes/no" determination by the various standards. See referenced standards for definition, measurement protocol and period.

Name	Type	Description
flickerPlt	Float	A measurement of long term Rapid Voltage Change
flickerPst	Integer	A count of Rapid Voltage Change events during the summary interval period
harmonicVoltage	Float	A measurement of the Harmonic Voltage during the period. For DC, distortion is with respect to a signal of zero Hz.
longInterruptions	Integer	A count of Long Interruption events (as defined by measurementProtocol) during the summary interval period.
mainsVoltage	Float	A measurement of the Mains [Signaling] Voltage during the summary interval period.
measurementProtocol	String	A reference to the source used as the measurement protocol definition. e.g. "IEEE1519-2009", "EN50160"
powerFrequency	Float	A measurement of the power frequency during the summary interval period.
rapidVoltageChanges	Integer	A count of Rapid Voltage Change events during the summary interval period
shortInterruptions	Integer	A count of Short Interruption events during the summary interval period
summaryInterval	DateTimeInterval	Interval of summary period

Name	Type	Description
supplyVoltageDips	Integer	A count of Supply Voltage Dip events during the summary interval period
supplyVoltageImbalance	Integer	A count of Supply Voltage Imbalance events during the summary interval period
supplyVoltageVariations	Integer	A count of Supply Voltage Variations during the summary interval period
tempOvervoltage	Integer	A count of Temporary Overvoltage events (as defined by measurementProtocol) during the summary interval period

EndDeviceAsset

AssetContainer that performs one or more end device functions. One type of EndDeviceAsset is a MeterAsset which can perform metering, load management, connect/disconnect, accounting functions, etc. Some EndDeviceAssets, such as ones monitoring and controlling air conditioner, refrigerator, pool pumps may be connected to a MeterAsset. All EndDeviceAssets may have communication capability defined by the associated ComFunction(s). An EndDeviceAsset may be owned by a consumer, a service provider, utility or otherwise.

There may be a related end device function that identifies a sensor or control point within a metering application or communications systems (e.g., water, gas, electricity).

Some devices may use an optical port that conforms to the ANSI C12.18 standard for communications.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.

EnergyUsageInformation

A collection of customer energy usage information. This class is a container, and has no attributes.

Float «Primitive»

A floating point number. The range is unspecified and not limited.

IdentifiedObject

This is a root class to provide common identification for all classes needing identification and naming attributes

Integer «Primitive»

An integer number. The range is unspecified and not limited.

IntervalBlock

Time sequence of Readings of the same ReadingType.

IntervalReading

Data captured over a specific interval of time. If not specified, the duration is the intervalLength of the associated ReadingType, where the full definition of the units of measure is located.

Name	Type	Description
cost	Float	The cost associated with this reading for this interval.

interval	DateTimeInterval	The time interval associated with the reading.
value	Float	Value of this interval reading.

MeterReading

Set of values obtained from the meter.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.
valuesInterval	DateTimeInterval	Date and time interval of the data items contained within this meter reading.

NAESB_EUI_Version

This class contains the version of the NAESB model.

Name	Type	Description
date	AbsoluteDate	Form is YYYY-MM-DD for example for January 5, 2009 it is 2009-01-05.
version	String	Form is naesb_eui_vXX.YY where XX is the major version and YY is the minor version.

Name

The Name class provides the means to define any number of human readable names for an object.

Name	Type	Description
name	String	Any free text that name the object.

NameType

Type of name. Possible values for attribute 'name' are implementation dependent but standard profiles may specify types. An enterprise may have multiple information technology systems each having its own local name for the same object, e.g. a planning system may have different names from an energy management system. An object may also have different names within the same IT system, e.g. localName and aliasName as defined in CIM version 14. Their definitions from CIM14 are:

localName: A free text name local to a node in a naming hierarchy similar to a file directory structure. A power system related naming hierarchy may be: Substation, VoltageLevel, Equipment etc. Children of the same parent in such a hierarchy have names that typically are unique among them. The localName is a human readable name of the object. It is only used with objects organized in a naming hierarchy.

aliasName: A free text alternate name typically used in tabular reports where the column width is limited.

Name	Type	Description
name	String	Name of the name type.

NameTypeAuthority

Authority responsible for creation and management of names of a given type; typically an organization or an enterprise system.

Name	Type	Description

name	String	Name of the name type authority.

PositionPoint

Set of spatial coordinates that determine a point, defined in coordinate system "WGS 84" if not specified otherwise. Use a single position point instance to desribe a point-oriented location. Use a sequence of position points to describe a line-oriented object (physical location of non-point oriented objects like cables or lines), or area of an object (like a substation or a geographical zone - in this case, have first and last position point with the same values).

Name	Type	Description
xPosition	String	X axis position.
yPosition	String	Y axis position.
zPosition	String	(if applicable) Z axis position.

QualityOfReading «enumeration»

List of codes indicating the quality of the reading.

Name	Type	Description
estimated		
forecast		
mixed		
raw		
validated		
normalizedForWeather		
other		

Reading

Specific value measured by a meter or other asset. Each Reading is associated with a specific ReadingType.

Name	Type	Description
cost	Float	Cost in a currency
timeStamp	AbsoluteDateTime	The time when the value was last updated
value	Float	Value of this reading.

ReadingDirection «enumeration»

Direction of reading**.**

Name	Type	Description
forward		
reverse		
net		
total		

ReadingKind «enumeration»

Kind of reading.

Name	Type	Description
energy		
power		
demand		
voltage		
current		
voltageAngle		
currentAngle		
phaseAngle		
powerFactor		
pressure		
volume		
date		
time		
frequency		
other		
carbon		
carbonDioxide		
currentAverage		
currentRMS		
currentTHD		
distortionPower		
HCH		
methane		
NOx		
perfluorocarbons		
phasorPower		
quantityPowerQ45		
quantityPowerQ60		
SO2		
sulfurHexafluoride		
voltageAverage		
voltageRMS		
voltageTHD		
relativeHumidity		
volumetricFlow		

ReadingQuality

Quality of a specific reading value or interval reading value. Note that more than one quality may be applicable to a given reading. Typically not used unless problems or unusual conditions occur (i.e., quality for each reading is assumed to be 'good' unless stated otherwise in associated reading quality).

Name	Type	Description
quality	QualityOfReading	Quality, to be specified if different than ReadingType.defaultQuality.

ReadingType

Type of data conveyed by a specific Reading.

Name	Type	Description
defaultQuality	QualityOfReading	Characteristics of a data value conveyed by a specific Reading, which allow an application to understand how a specific Reading is to be interpreted.
direction	ReadingDirection	Specifies the direction of flow of the measurement.
intervalLength	Duration	(if incremental reading value) Length of increment interval.
kind	ReadingKind	Kind of reading.
multiplier	UnitMultiplier	Multiplier for 'unit'.
name	String	The name is any free human readable and possibly non unique text naming the object.
unit	UnitSymbol	Unit for the reading value.

Seconds «Datatype»

Time, in seconds.

Name	Type	Description
value	Float	Time, in seconds
unit	UnitSymbol	
multiplier	UnitMultiplier	

ServiceCategory

Category of service provided to the customer.

Name	Type	Description
kind	ServiceKind	Kind of service.

ServiceDeliveryPoint

Logical point on the network where the ownership of the service changes hands. It is one of potentially many service points within a service location, delivering service in accordance with a customer agreement. Used at the place where a meter may be installed.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.

ServiceKind «enumeration»

Kind of service.

Name	Type	Description
electricity		
gas		
water		
time		
heat		Includes hot water and steam
refuse		
sewerage		
rates		
tvLicence		
internet		
other		
cold		Includes chilled water and ice

ServiceSupplier

Organization that provides services to customers.

Name	Type	Description
kind	SupplierKind	Kind of supplier.
name	String	The name is any free human readable and possibly non unique text naming the object.

String «Primitive»

A string consisting of a sequence of 8 bit characters. The character encoding is UTF-8. The string length is unspecified and unlimited.

SummaryMeasurement

An aggregated summary measurement reading.

Name	Type	Description
multiplier	UnitMultiplier	The multiplier part of the unit of measure, e.g. "kilo" (k)
timeStamp	AbsoluteDateTime	The date and time (if needed) of the summary measurement.
unit	UnitSymbol	The units of the reading, e.g. "Wh"
value	Float	The value of the summary measurement.

SummaryQuality «enumeration»

List of codes indicating the quality of the summary.

Name	Type	Description
estimated		
forecast		
mixed		
validated		
raw		

Name	Type	Description
normalizedForWeather		
other		

SupplierKind «enumeration»

Kind of supplier.

Name	Type	Description
utility		
retailer		
other		
district		
intermediary		
local		
microgrid		

TariffProfile

A schedule of charges; structure associated with Tariff that allows the definition of complex tariff structures such as step and time of use.

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text naming the object.

UnitMultiplier «enumeration»

The unit multipliers defined for the CIM.

Name	Type	Description
p		Pico 10**-12
n		Nano 10**-9
micro		Micro 10**-6
m		Milli 10**-3
c		Centi 10**-2
d		Deci 10**-1
k		Kilo 10**3
M		Mega 10**6
G		Giga 10**9
T		Tera 10**12
none		

UnitSymbol «enumeration»

The units defined for usage in the CIM.

Name	Type	Description

Name	Type	Description
VA		Apparent power in volt ampere
W		Active power in watt
VAr		Reactive power in volt ampere reactive
VAh		Apparent energy in volt ampere hours
Wh		Real energy in Watt hours
VArh		Reactive energy in volt ampere reactive hours
V		Voltage in volt
ohm		Resistance in ohm
A		Current in ampere
F		Capacitance in farad
H		Inductance in henry
C		Relative temperature in degrees Celsius
degC		Relative temperature in degrees Celsius. In the SI unit system the symbol is ºC. Electric charge is measured in coulomb that has the unit symbol C. To destinguish degree Celsius form coulomb the symbol used in the UML is degC. Reason for not using ºC is the special character º is difficult to manage in software.
s		Time in seconds
min		Time in minutes
h		Time in hours
deg		Plane angle in degrees
rad		Plane angle in radians
J		Energy in joule
N		Force in newton
S		Conductance in siemens
none		Dimension less quantity, e.g. count, per unit, etc.
Hz		Frequency in hertz
g		Mass in gram
Pa		Pressure in pascal (n/m2)
m		Length in meter
m2		Area in square meters
m3		Volume in cubic meters
thm		Energy, in therms
m3/h		Volumetric flow, in cubic meters per hour
ft3/h		Volumetric flow, in cubic feet per hour

UsagePoint

Logical point on a network at which consumption or production is either physically measured (e.g. metered) or estimated (e.g. unmetered street lights).

Name	Type	Description
name	String	The name is any free human readable and possibly non unique text

Name	Type	Description
		naming the object.
description	String	A human readable description of the object

UsageSummary

Summary of usage for a billing period.

Name	Type	Description
billingPeriod	DateTimeInterval	The billing period to which the included measurements apply
billLastPeriod	Float	The amount of the bill for the previous period
billToDate	Float	The bill amount related to the billing period as of the date received
costAdditionalLastPeriod	Float	Additional charges from the last billing period
currency	String	The ISO 4217 code indicating the currency applicable to the bill amounts in the summary. See list at http://www.unece.org/cefact/recommendations/rec09/rec09_ecetrd203.pdf
currentBillingPeriodOverAllConsumption	SummaryMeasurement	The total consumption for the billing period
currentDayLastYearNetConsumption	SummaryMeasurement	The amount of energy consumed one year ago
currentDayNetConsumption	SummaryMeasurement	Net consumption for the current day (delivered - received)
currentDayOverallConsumption	SummaryMeasurement	Overall energy consumption for the current day
peakDemand	SummaryMeasurement	Peak demand recorded for the current period
previousDayLastYearOverallConsumption	SummaryMeasurement	The amount of energy consumed on the previous day one year ago
previousDayNetConsumption	SummaryMeasurement	Net consumption for the previous day
previousDayOverallConsumption	SummaryMeasurement	The total consumption for the previous day
qualityOfReading	QualityOfReading	Indication of the quality of the summary readings
ratchetDemand	SummaryMeasurement	The current ratchet demand value for the ratchet demand period
ratchetDemandPeriod	DateTimeInterval	The period over which the ratchet demand applies

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