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Energy Object Context MIB  
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## Abstract

This document defines a subset of a Management Information Base (MIB) for energy management of devices. The module addresses device identification, context information, and the relationships between reporting devices, remote devices, and monitoring devices.

## Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

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## 1. Introduction

The EMAN standards provide a specification for Energy Management. This document defines a subset of a Management Information Base (MIB) for use with network management protocols for Energy monitoring of network devices and devices attached to the network and possibly extending to devices in the industrial automation setting with a network interface.

The focus of the MIB module specified in this document is on the identification of Energy Objects and reporting the context and relationships of Energy Objects as defined in [EMAN-FMWK]. The module addresses Energy Object Identification, Energy Object Context, and Energy Object Relationships.

### 1.1. Energy Management Document Overview

This document specifies the ENERGY-OBJECT-CONTEXT-MIB module. This document is based on the Energy Management Framework [EMAN-FMWK] and meets the requirements on identification of Energy Objects and their context and relationships as specified in the Energy Management requirements [EMAN-REQ].

A second MIB module required by the [EMAN-FMWK], the Power and Energy Monitoring MIB [EMAN-MON-MIB], monitors the Energy Objects for Power States, for the Power and Energy consumption. Power State monitoring includes: retrieving Power States, Power State properties, current Power State, Power State transitions, and Power State statistics. In addition, this MIB module provides the Power Characteristics properties of the Power and Energy, along with optional characteristics.

The applicability statement document [EMAN-AS] provides the list of use cases, and describes the common aspects of between existing Energy standards and the EMAN standard, and shows how the EMAN framework relates to other frameworks.

## 2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies MIB modules that are compliant with SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

## 3. Requirements and Use Cases

Firstly, to illustrate the importance of energy monitoring in networks and secondly to list some of the important areas to be addressed by the energy management Framework, several use cases and network scenarios are presented in the EMAN applicability statement document [EMAN-AS]. In addition, for each scenario, the target devices for energy management, and how those devices powered and metered are also presented. To address the network scenarios, requirements for power and energy monitoring for networking devices are specified in [EMAN-REQ]. Based on the requirements [EMAN-REQ], the [EMAN-FMWK] presents an solution approach.

Accordingly, the scope of the MIB module in this document is in accordance to the requirements specified in [EMAN-REQ] and [EMAN-FMWK].

## 4. Terminology

Please refer to [EMAN-FMWK] for the definitions of the following terminology used in this draft.

Device

Component

Energy Management System (EnMS)

ISO Energy Management System

Energy

Power

Demand

Power Characteristics

Electrical Equipment

Non-Electrical Equipment (Mechanical Equipment)

Energy Object

Electrical Energy Object

Non-Electrical Energy Object

Energy Monitoring

Energy Control

Provide Energy:

Receive Energy:

Power Interface

Power Inlet

Power Outlet

Energy Management Domain

Energy Object Identification

Energy Object Context

Energy Object Relationship

Aggregation Relationship

Power Source Relationship

Proxy Relationship

Energy Object Parent

Energy Object Child

Power State

Power State Set

Nameplate Power

## 5. Architecture Concepts Applied to the MIB Module

This section describes the basic concepts specified in the Energy Management Architecture [EMAN-FMWK], with specific information related to the MIB module specified in this document.

The Energy Object Context MIB module defined in this document defines MIB objects for identification of Energy Objects, and reporting context and relationship of an Energy Object. The managed objects are contained in two tables eoTable and eoProxyTable.

The first table eoTable focuses on the link to the other MIB modules, context of the Energy Object. The second table eoRelationTable specifies the relationships between Energy Objects. This is a simplified representation of relationship between Energy Objects. The third table eoProxyTable describes the proxy capabilities of a Energy Object Parent for a specific local Energy Object Child.

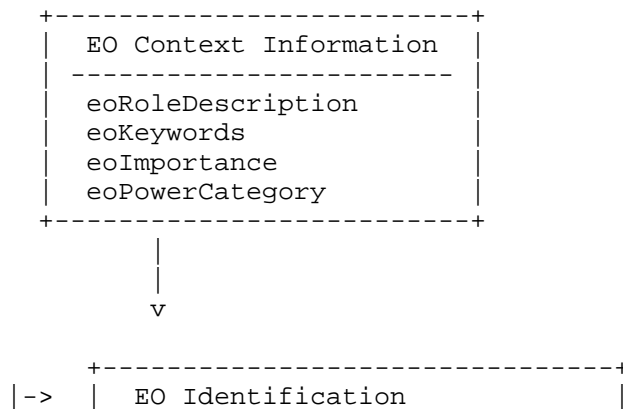
```
+-- eoTable(2)
|
|  +- eoEntry(1) [entPhysicalIndex]
|  |
|  |  +-- r-n PethPsePortIndexOrZero      eoEthPortIndex(1)
|  |  +-- r-n PethPsePortGroupIndexOrZero  eoEthPortGrpIndex(2)
|  |  +-- r-n LldpPortNumberOrZero         eoLldpPortNumber(3)
|  |  +-- rwn MacAddress                   eoMgmtMacAddress(4)
```

```

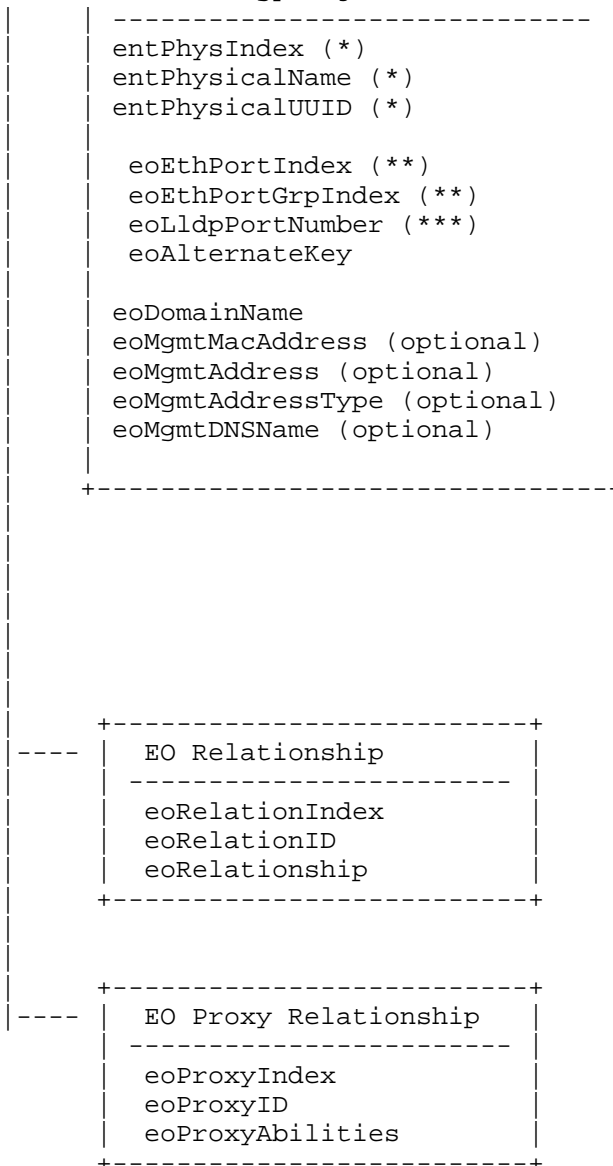
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|
|  +-- r-n eoMgmtAddressType          eoMgmtAddressType(5)
|  +-- r-n InetAddress                eoMgmtAddress(6)
|  +-- r-n SnmpAdminString            eoMgmtDNSName(7)
|  +-- rwn SnmpAdminString            eoDomainName(8)
|  +-- rwn SnmpAdminString            eoRoleDescription(9)
|  +-- rwn EnergyObjectKeywordList    eoKeywords(10)
|  +-- rwn Integer32                  eoImportance(11)
|  +-- r-n INTEGER                    eoPowerCategory(12)
|  +-- rwn SnmpAdminString            eoAlternateKey(13)
|
|  +- eoRelationTable
|  |
|  |  +- eoRelationEntry [entPhysicalIndex, eoRelationIndex]
|  |  |
|  |  |  +-- --n INTEGER              eoRelationIndex(1)
|  |  |  +-- --n OctetString          eoRelationID(2)
|  |  |  +-- rwn BITS                  eoRelationship(3)
|  |
|  +- eoProxyTable(3)
|  |
|  |  +- eoProxyEntry (1)[entPhysicalIndex , eoProxyIndex ]
|  |  |
|  |  |  +-- --n INTEGER              eoProxyIndex(1)
|  |  |  +-- --n OctetString          eoProxyID(2)
|  |  |  +-- r-n BITS                  eoProxyAbilities(3)

```

The following UML diagram illustrates the relationship of the MIB objects in the eoTable, eoRelationTable and eoProxyTable that describe the identity, context and relationship of an Energy Object.







- ```
(*)      Compliance From the ENTITY MIB [EMAN-ENTITY]
(**)    Link with the Power over Ethernet MIB [RFC3621]
(***)   Link with LLDP MIBs [LLDP-MIB] [LLDP-MED-MIB]
```

As displayed in figure 1, the MIB objects can be classified in different logical grouping of MIB objects.

- 1) The Energy Object Identification. See Section 5.1 "Energy Object Identification". Devices and their sub-components are characterized by the power-related attributes of a physical entity present in the ENTITY MIB [EMAN-ENTITY].
- 2) The Context Information. See Section 5.2 "Energy Object Context"
- 3) The links to other MIB modules. See Section 5.3 "Links to other Identifiers"
- 4) The Energy Object Child Relationships specific information. See Section 5.4 "Child: Energy Objects Relationship."
- 5) The Energy Object Parent Relationships specific information. See Section 5.5 "Parent: Energy Objects Relationship."
- 6) The Energy Object Identity Persistence. See Section 5.6 "Energy Object Identity Persistence"

## 5.1 Energy Object Identification

Refer to the "Energy Object Information" section in [EMAN-FMWK] for background information about Energy Objects.

Every Energy Object MUST implement the unique index, entPhysicalIndex, entPhysicalName and entPhysicalUUID from the ENTITY MIB [EMAN-ENTITY]. Module Compliance of ENTITY-MIB with respect to entity4CRCompliance should be supported which require a limited number of objects supported (entPhysicalClass, entPhysicalName, entPhysicalUUID). entPhysicalIndex is used as index for the primary Energy Object information in the ENERGY-OBJECT-CONTEXT-MIB module.

Every Energy Object MUST have a printable name assigned to it. Energy Objects MUST implement the entPhysicalName object specified in the ENTITY-MIB, which must contain the Energy Object name.

For the ENERGY-OBJECT-CONTEXT-MIB compliance, every Energy Object instance MUST implement the entPhysicalUUID from the ENTITY MIB [EMAN-ENTITY ].

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As displayed in [RFC4122], the following is an example of the  
string representation of a UUID as a URN: urn:uuid:f81d4fae-  
7dec-11d0-a765-00a0c91e6bf6.

For example, to understand the relationship between Energy  
Object Components and Energy Objects, the ENTITY-MIB physical  
containment tree [EMAN-ENTITY ] MUST be implemented.  
A second example deals with one of the ENTITY-MIB extensions: if  
the Energy Object temperature is required, the managed objects  
from the ENTITY-SENSOR-MIB [RFC3433] should be supported.

When an Energy Object Parent acts as a Power Aggregator or a  
Power Proxy, the Energy Object Parent and its Energy Object  
Child/Children MUST be members of the same Energy Management  
Domain, specified by the eoDomainName MIB Object.

Each Energy Object MUST belong to a single Energy Management  
Domain or in other words, an Energy Object cannot belong to more  
than one Energy Management Domain. Refer to the "Energy  
Management Domain" section in [EMAN-FMWK] for background  
information. The eoDomainName, which is an element of the  
eoTable, is a read-write MIB object. The Energy Management  
Domain should map 1-1 with a metered or sub-metered portion of  
the network. The Energy Management Domain MUST be configured on  
the Energy Object Parent. The Energy Object Children MAY inherit  
the some of the domain parameters (possibly domain name, some of  
the context information such as role or keywords, importance)  
from the Energy Object Parent or the Energy Management Domain  
MAY be configured directly in an Energy Object Child.

## 5.2 Energy Object Context

Refer to the "Energy Object Context" section in [EMAN-FMWK] for  
background information.

An Energy Object must provide a value for eoImportance in the  
range of 1..100 to help differentiate the use or relative value  
of the device. The importance range is from 1 (least important)  
to 100 (most important). The default importance value is 1.

An Energy Object can provide a set of eoKeywords. These keywords  
are a list of tags that can be used for grouping and summary  
reporting within or between Energy Management Domains.

An Energy Object can be classified based on the physical properties of the Energy Object. That Energy Object can be classified as consuming power or supplying power to other devices or that Energy Object can perform both of those functions and finally, an Energy Object can be a passive meter.

Additionally, an Energy Object can provide an eoRoleDescription string that indicates the purpose the Energy Object serves in the network.

### 5.3 Links to Other Identifiers

While the entPhysicalIndex is the primary index for all MIB objects in the ENERGY-OBJECT-CONTEXT-MIB module, the Energy Management Systems (EnMS) must be able to make the link with the identifier(s) in other supported MIB modules.

If the Energy Object is a PoE port, and if the Power over Ethernet MIB [RFC3621] is supported by the Energy Object SNMP agent, then the Energy Object eoethPortIndex and eoethPortGrpIndex MUST contain the values of pethPsePortIndex and pethPsePortGroupIndex [RFC3621].

The Energy Object eoLldpPortNumber MUST contain the lldpLocPortNum from the LLDP MIB [LLDP-MIB], if the LLDP-MED MIB is supported on the Energy Object SNMP agent.

The intent behind the links to the other MIB module identifier(s) is to correlate the instances in the different MIB modules. This will allow the ENERGY-OBJECT-CONTEXT-MIB MIB module to reference other MIB modules in cases where the Power over Ethernet and the LLDP MIB modules are supported by the SNMP agent. Some use cases may not implement any of these two MIB modules for the Energy Objects. However, in situation where any of these two MIB modules are implemented, the EnMS must be able to correlate the instances in the different MIB modules.

The eoAlternateKey alternate key object specifies a manufacturer defined string that can be used to identify the Energy Object. Since EnMS may need to correlate objects across management systems, this alternate key is provided to facilitate such a link. This optional value is intended as a foreign key or alternate identifier for a manufacturer or EnMS to use to correlate the unique Energy Object Id in other systems or namespaces. If an alternate key is not available or is not applicable then the value is the zero-length string.

#### 5.4 Child: Energy Object Relationships

Refer to the "Energy Object Parent and Child" section in [EMAN-FMWK] for the definition and background information. In order to link the Energy Object Child and the Energy Object Parent, a separate table (eoRelationTable) has been introduced in this MIB module. The following relationships between Energy objects have been considered in the eoRelationTable.

Metering Relationship -> meteredBy , metering

Power Source Relationship -> poweredBy , powering

Aggregation Relationship -> aggregatedBy , aggregating

Proxy Relationship -> proxyBy , proxying

Each Energy object can have one or more Energy Object relationships with other Energy Objects. Depending on the direction of the relationship, an Energy Object can be considered as an Energy Object Parent or an Energy Object Child. The relationship between the Energy Objects is specified with an arbitrary index and the UUID of the remote Energy Object. The UUID MUST comply to the RFC 4122 specifications. It is important to note that it is possible that an Energy Object may not have an Energy Object relationship with other Energy Objects.

Proxy is a special relationship, and the Energy Object can designate another Energy Object that can have the proxy capabilities such as energy reporting, power state configurations, non physical wake capabilities (such as Wake-on-LAN)), or any combination of capabilities.

The eoProxyAbilities object is specific to the Proxy Relationship. This object describes the capabilities of the Energy Object Parent for the Energy Object Child represented by the entPhysicalIndex. The possible capabilities are: report, configuration, and/or wakeonlan. This object only applies to an Energy Object Child.

Since the communication between the Energy Object Parent and Energy Object Child may not be via SNMP (as defined in EMAN-

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FMWK), an Energy Object Child can have additional MIB objects  
that can be used for easier identification by the EnMS. The  
optional objects eoMgmtMacAddress, eoMgmtAddressType  
eoMgmtDNSName can be used to help identify the relationship  
between the child and other NMS objects. These objects can be  
used as an alternate key to help link the Energy Object with  
other keyed information that may be stored within the EnMS(s).

## 5.5 Parent: Energy Object Relationships

When the Energy Object is an Energy Object Parent, the  
relationship table specifies the relationships to every Energy  
Object children. The explicit relationship between the Energy  
Object parent and each Energy Object child can be powering,  
metering, proxying and aggregating.

## 5.6 Energy Object Identity Persistence

In some situations, the Energy Object identity information  
should be persistent even after a device reload. For example,  
in a static setup where a switch monitors a series of connected  
PoE phones, there is a clear benefit for the EnMS if the Energy  
Object Identification and all associated information persist, as  
it saves a network discovery. However, in other situations,  
such as a wireless access point monitoring the mobile user PCs,  
there is not much advantage to persist the Energy Object  
Information. The identity information of an Energy Object  
should be persisted and there is value in the writable MIB  
objects persisted.

## 6. MIB Definitions

```
-- *****  
--  
--  
-- This MIB is used for describing the identity and the  
-- context information of Energy Objects in network  
--  
--  
-- *****
```

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ENERGY-OBJECT-CONTEXT-MIB DEFINITIONS ::= BEGIN

```
IMPORTS
    MODULE-IDENTITY,
    OBJECT-TYPE,
    mib-2,
    Integer32
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, MacAddress, TruthValue
        FROM SNMPv2-TC
    MODULE-COMPLIANCE,
    OBJECT-GROUP
        FROM SNMPv2-CONF
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB
    entPhysicalIndex
        FROM ENTITY-MIB
    UUIDorZero
        FROM UUID-TC-MIB;

energyAwareMIB MODULE-IDENTITY
    LAST-UPDATED      "201210190000Z"
    ORGANIZATION      "IETF EMAN Working Group"
    CONTACT-INFO
        "WG Charter:
         http://datatracker.ietf.org/wg/eman/charter/

        Mailing Lists:
        General Discussion: eman@ietf.org
        To Subscribe: https://www.ietf.org/mailman/listinfo/eman
        Archive: http://www.ietf.org/mail-archive/web/eman

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DESCRIPTION

"This MIB is used for describing the identity and the  
context information of Energy Objects"

REVISION

"201210190000Z"

DESCRIPTION

"Initial version, published as RFC XXXX."

::= { mib-2 xxxxx }

energyAwareMIBNotifs OBJECT IDENTIFIER

::= { energyAwareMIB 0 }

energyAwareMIBObjects OBJECT IDENTIFIER

::= { energyAwareMIB 2 }

energyAwareMIBConform OBJECT IDENTIFIER

::= { energyAwareMIB 3 }

-- Textual Conventions

PethPsePortIndexOrZero ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current

DESCRIPTION



"This textual convention is an extension of the pethPsePortIndex convention, which defines a greater than zero value used to identify a power Ethernet PSE port. This extension permits the additional value of zero. The semantics of the value zero are object-specific and must, therefore, be defined as part of the description of any object that uses this syntax. Examples of the usage of this extension are situations where none or all physical entities need to be referenced."

SYNTAX Integer32 (0..2147483647)

PethPsePortGroupIndexOrZero ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current

DESCRIPTION

"This textual convention is an extension of the pethPsePortGroupIndex convention from the Power Over Ethernet MIB [RFC3621], which defines a greater than zero value used to identify group containing the port to which a power Ethernet PSE is connected. This extension permits the additional value of zero. The semantics of the value zero are object-specific and must, therefore, be defined as part of the description of any object that uses this syntax. Examples of the usage of this extension are situations where none or all physical entities need to be referenced."

SYNTAX Integer32 (0..2147483647)

LldpPortNumberOrZero ::= TEXTUAL-CONVENTION

DISPLAY-HINT "d"

STATUS current

DESCRIPTION

"This textual convention is an extension of the LldpPortNumber convention specified in the LLDP MIB, which defines a greater than zero value used to uniquely identify each port contained in the chassis (that is known to the LLDP agent) by a port number. This extension permits the additional value of zero. The semantics of the value zero are object-specific and must, therefore, be defined as part of the description of any object that uses this syntax. Examples of the usage of

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this extension are situations where none or all physical  
entities need to be referenced."  
SYNTAX Integer32(0..4096)

EnergyObjectKeywordList ::= TEXTUAL-CONVENTION  
STATUS                    current  
DESCRIPTION  
    "A list of keywords that can be used to group Energy  
    Objects for reporting or searching. If multiple keywords  
    are present, then this string will contain all the  
    keywords separated by the ',' character. All alphanumeric  
    characters and symbols (other than a comma), such as #,  
    (, \$, !, and &, are allowed. White spaces before and  
    after the commas are excluded, as well as within a  
    keyword itself.  
  
    For example, if an Energy Object were to be tagged with  
    the keyword values 'hospitality' and 'guest', then the  
    keyword list will be 'hospitality,guest'."  
SYNTAX OCTET STRING (SIZE (0..2048))

EnergyRelations ::= TEXTUAL-CONVENTION  
STATUS                    current  
DESCRIPTION  
    "This object specifies relationship between Energy  
    Objects. For example, poweredby relationship indicates,  
    Energy Object A is powered by Energy Object B. From the  
    point of view of Energy Object B, it is powering Energy  
    Object A. "  
SYNTAX                    BITS {  
                          none (0),                    --  
                          poweredby(1),              -- power relationship  
                          powering(2),  
                          meteredby(3),              -- meter relationship  
                          metering(4),  
                          proxyby(5),                -- proxy relationship  
                          proxying(6),  
                          aggregatedby(7), -- aggregation relationship

```
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                  aggregating(8)
                  }
```

-- Objects

```
eoTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF EoEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table lists Energy Objects."
    ::= { energyAwareMIBObjects 2 }
```

```
eoEntry OBJECT-TYPE
    SYNTAX          EoEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "An entry describes the attributes of an Energy Object.
        Whenever a new Energy Object is added or an existing
        Energy Object is deleted, a row in the eoTable is added
        or deleted."

    INDEX          {entPhysicalIndex }
    ::= { eoTable 1 }
```

```
EoEntry ::= SEQUENCE {
    eoEthPortIndex          PethPsePortIndexOrZero,
    eoEthPortGrpIndex       PethPsePortGroupIndexOrZero,
    eoLldpPortNumber        LldpPortNumberOrZero,
    eoMgmtMacAddress         MacAddress,
    eoMgmtAddressType        InetAddressType,
    eoMgmtAddress            InetAddress,
    eoMgmtDNSName            SnmpAdminString,
    eoDomainName             SnmpAdminString,
    eoRoleDescription        SnmpAdminString,
    eoKeywords               EnergyObjectKeywordList,
    eoImportance             Integer32,
    eoPowerCategory          INTEGER,
    eoAlternateKey           SnmpAdminString
}
```

eoEthPortIndex OBJECT-TYPE  
SYNTAX PethPsePortIndexOrZero  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"This variable uniquely identifies the power Ethernet  
port to which the attached device is connected [RFC3621].  
In addition, PoE MIB should be instantiated on the  
device. If such a power Ethernet port cannot be specified  
or is not known then the object is zero."  
::= { eoEntry 1 }

eoEthPortGrpIndex OBJECT-TYPE  
SYNTAX PethPsePortGroupIndexOrZero  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"This variable uniquely identifies the group containing  
the port to which a power Ethernet PSE is connected  
[RFC3621]. In addition, PoE MIB should be instantiated on  
the device. If such a group cannot be specified or is not  
known then the object is zero."  
::= { eoEntry 2 }

eoLldpPortNumber OBJECT-TYPE  
SYNTAX LldpPortNumberOrZero  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"This variable uniquely identifies the port component  
(contained in the local chassis with the LLDP agent) as  
defined by the lldpLocPortNum in the [LLDP-MIB] and  
[LLDP-MED-MIB]. In addition, LLDP MIB should be  
instantiated on the device If such a port number cannot  
be specified or is not known then the object is zero."  
::= { eoEntry 3 }

eoMgmtMacAddress OBJECT-TYPE  
SYNTAX MacAddress  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"This object specifies a MAC address of the Energy  
Object. This object typically only applies to Energy  
Object Children. This object can be used as an alternate  
key to help link the Energy Object with other keyed  
information that may be stored within the EnMS(s). The

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    eoMgmtMacAddress MIB object SHOULD be implemented for  
    Energy Object Children, and MAY be implemented for Energy  
    Object Parents."  
::= { eoEntry 4 }

eoMgmtAddressType OBJECT-TYPE  
    SYNTAX            InetAddressType  
    MAX-ACCESS        read-only  
    STATUS            current  
    DESCRIPTION  
        "This object specifies the eoMgmtAddress type, i.e. an  
        IPv4 address or an IPv6 address. This object MUST be  
        populated when eoMgmtAddress is populated. The  
        eoMgmtAddressType MIB object SHOULD be implemented for  
        Energy Object Children, and MAY be implemented for Energy  
        Object Parents."  
::= { eoEntry 5 }

eoMgmtAddress OBJECT-TYPE  
    SYNTAX            InetAddress  
    MAX-ACCESS        read-only  
    STATUS            current  
    DESCRIPTION  
        "This object specifies the management address as an IPv4  
        address or IPv6 address of Energy Object. The IP address  
        type, i.e. IPv4 or IPv6, is determined by the  
        eoMgmtAddressType value. This object can be used as an  
        alternate key to help link the Energy Object with other  
        keyed information that may be stored within the EnMS(s).  
        The eoMgmtAddress MIB object SHOULD be implemented for  
        Energy Object Children, and MAY be implemented for Energy  
        Object Parents."  
::= { eoEntry 6 }

eoMgmtDNSName OBJECT-TYPE  
    SYNTAX            SnmpAdminString  
    MAX-ACCESS        read-only  
    STATUS            current  
    DESCRIPTION  
        "This object specifies the DNS name of the eoMgmtAddress.  
        This object can be used as an alternate key to help link  
        the Energy Object with other keyed information that may  
        be stored within the EnMS(s). The eoMgmtDNSName MIB  
        objects SHOULD be implemented for Energy Object Children,  
        and MAY be implemented for Energy Object Parents."

eoDomainName OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object specifies the name of an Energy Management Domain for the Energy Object. This object specifies a zero-length string value if no Energy Management Domain name is configured. The value of eoDomainName must remain constant at least from one re-initialization of the entity local management system to the next re-initialization."

::= { eoEntry 8 }

eoRoleDescription OBJECT-TYPE

SYNTAX SnmpAdminString

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object specifies an administratively assigned name to indicate the purpose an Energy Object serves in the network.

For example, we can have a phone deployed to a lobby with eoRoleDescription as 'Lobby phone'.

This object specifies the value is the zero-length string value if no role description is configured.

The value of eoRoleDescription must remain constant at least from one re-initialization of the entity local management system to the next re-initialization. "

::= { eoEntry 9 }

eoKeywords OBJECT-TYPE

SYNTAX EnergyObjectKeywordList

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This object specifies a list of keywords that can be used to group Energy Objects for reporting or searching. The value is the zero-length string if no keywords have been configured. If multiple keywords are present, then

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this string will contain all the keywords separated by  
the ',' character. For example, if an Energy Object were  
to be tagged with the keyword values 'hospitality' and  
'guest', then the keyword list will be  
'hospitality,guest'.

If write access is implemented and a value is written  
into the instance, the agent must retain the supplied  
value in the eoKeywords instance associated with  
the same physical entity for as long as that entity  
remains instantiated. This includes instantiations  
across all re-initializations/reboots of the local  
management agent. "  
::= { eoEntry 10        }

eoImportance OBJECT-TYPE

SYNTAX                Integer32 (1..100)

MAX-ACCESS           read-write

STATUS                current

DESCRIPTION

"This object specifies a ranking of how important the  
Energy Object is (on a scale of 1 to 100) compared with  
other Energy Objects in the same Energy Management  
Domain. The ranking should provide a business or  
operational context for the Energy Object as compared to  
other similar Energy Objects. This ranking could be used  
as input for policy-based network management.

Although network managers must establish their own  
ranking, the following is a broad recommendation:

90 to 100 Emergency response  
80 to 90 Executive or business critical  
70 to 79 General or Average  
60 to 69 Staff or support  
40 to 59 Public or guest  
1 to 39 Decorative or hospitality

The value of eoImportance must remain constant at least  
from one re-initialization of the entity local  
management system to the next re-initialization. "

DEFVAL                { 1 }

::= { eoEntry 11        }

eoPowerCategory OBJECT-TYPE

SYNTAX                INTEGER {  
                        consumer(0),

```

        producer(1),
        consumerproducer(2),
        meter(3)
    }
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION

```

"This object describes the Energy Object category, which indicates the expected behavior or physical property of the Energy Object, based on its design. An Energy Object can be a consumer(0), producer(1), or consumerproducer(2) or meter (3).

There are devices with a dual mode - consuming energy and producing of energy and those are identified as consumerproducer.

In some cases, a meter is required to measure the power consumption. In such a case, this meter Energy Object category is meter(3). "

```
 ::= { eoEntry 12 }
```

eoAlternateKey OBJECT-TYPE

```

    SYNTAX          SnmpAdminString
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION

```

"This object specifies a manufacturer defined string that can be used to identify the Energy Object. Since Energy Management Systems (EnMS) and Network Management Systems (NMS) may need to correlate objects across management systems, this alternate key is provided to provide such a link. This optional value is intended as a foreign key or alternate identifier for a manufacturer or EnMS/NMS to use to correlate the unique Energy Object Id in other systems or namespaces. If an alternate key is not available or is not applicable then the value is the zero-length string.

The value of eoAlternateKey must remain constant at least from one re-initialization of the entity local management system to the next re-initialization. "

```
 ::= { eoEntry 13 }
```

eoRelationTable OBJECT-TYPE

```

    SYNTAX          SEQUENCE OF EoRelationEntry
    MAX-ACCESS      not-accessible

```



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 STATUS                    current  
 DESCRIPTION  
 "This table describes the relationships between Energy Objects."  
 ::= { energyAwareMIBObjects 3 }

eoRelationEntry OBJECT-TYPE  
 SYNTAX                    EoRelationEntry  
 MAX-ACCESS               not-accessible  
 STATUS                    current  
 DESCRIPTION  
 "An entry in this table describes the relationship between  
 Energy objects."  
 INDEX                    { entPhysicalIndex, eoRelationIndex }  
 ::= { eoRelationTable 1 }

EoRelationEntry ::= SEQUENCE {  
                   eoRelationIndex    Integer32,  
                   eoRelationID        UUIDorZero,  
                   eoRelationship      EnergyRelations  
 }

eoRelationIndex        OBJECT-TYPE  
 SYNTAX                    Integer32 (0..2147483647)  
 MAX-ACCESS               not-accessible  
 STATUS                    current  
 DESCRIPTION  
 "This object is an arbitrary index to identify the Energy Object  
 related to another Energy Object"  
 ::= { eoRelationEntry 1 }

eoRelationID            OBJECT-TYPE  
 SYNTAX                    UUIDorZero  
 MAX-ACCESS               read-only  
 STATUS                    current  
 DESCRIPTION  
 "This object specifies the Universally Unique Identifier (UUID)  
 of the peer (other) Energy Object. The UUID must comply to the  
 RFC 4122 specifications. "  
 ::= { eoRelationEntry 2 }

eoRelationship         OBJECT-TYPE  
 SYNTAX                    EnergyRelations  
 MAX-ACCESS               read-write  
 STATUS                    current

DESCRIPTION

"This object describes the relations between Energy objects. For each Energy object, the relations between the other Energy objects are specified using the bitmap. If the Energy Object is a Parent and has no other relations, none(0) is specified."

::= { eoRelationEntry 3 }

eoProxyTable OBJECT-TYPE

SYNTAX SEQUENCE OF EoProxyEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This table describes the proxy capabilities of a Energy Object Parent for a specific local Energy Object Child. "

::= { energyAwareMIBObjects 4 }

eoProxyEntry OBJECT-TYPE

SYNTAX EoProxyEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry describes the attributes of an Energy Object. Whenever a new Energy Object is added or deleted, a row in the eoProxyTable is added or deleted."

INDEX { entPhysicalIndex, eoProxyIndex }

::= { eoProxyTable 1 }

EoProxyEntry ::= SEQUENCE {

    eoProxyIndex           Integer32,  
    eoProxyID             UUIDorZero,  
    eoProxyAbilities       BITS

}

eoProxyIndex OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This object is an arbitrary index for an Energy Object."

::= { eoProxyEntry 1 }

eoProxyID OBJECT-TYPE

SYNTAX UUIDorZero

MAX-ACCESS read-only

STATUS current

DESCRIPTION

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    "This object describes the Universally Unique Identifier  
    (UUID) of the Energy Object Parent.

    The UUID must comply to the RFC 4122 specifications.

    The object contains an URI and, therefore, the syntax of  
    this object must conform to RFC 3986, section 2."

REFERENCE

    "RFC 3986, Uniform Resource Identifiers (URI): Generic  
    Syntax, section 2, August 1998.  
    RFC 4122, Uniform Resource Identifier (UUID) URN  
    Namespace, July 2005."

::= { eoProxyEntry 2 }

eoProxyAbilities OBJECT-TYPE

SYNTAX               BITS {  
                        none(0),  
                        report(1),  
                        configuration(2),  
                        wakeonlan(3)  
                    }

MAX-ACCESS           read-only

STATUS               current

DESCRIPTION

    "This object describes the proxy capabilities of the  
    Energy Object Parent for the local Energy Object Child  
    specified in the EoRelationTable. none (0) is be used  
    when the Energy Object Parent does not have any proxy  
    abilities regarding the Energy Object Child. report(1)  
    indicates that the Energy Object Parent reports the usage  
    for the Energy Object Child.  
    configuration(2) indicates that the Energy Object Parent  
    can configure the Power Level for the Energy Object  
    Child.  
    wakeonlan(3) indicates that the Energy Object Parent can  
    wake up the Energy Object Child (the mechanism is  
    unspecified)."

::= { eoProxyEntry 3 }

-- Conformance

energyAwareMIBCompliances OBJECT IDENTIFIER

::= { energyAwareMIBObjects 5 }

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energyAwareMIBGroups    OBJECT IDENTIFIER  
     ::= { energyAwareMIBObjects 6    }

energyAwareMIBFullCompliance MODULE-COMPLIANCE

     STATUS                    current

     DESCRIPTION

         "When this MIB is implemented with support for  
         read-write, then such an implementation can  
         claim full compliance. Such devices can then  
         be both monitored and configured with this MIB."

     MODULE                    -- this module

     MANDATORY-GROUPS {  
         energyAwareMIBTableGroup,  
         energyAwareRelationTableGroup  
     }

GROUP           energyAwareOptionalMIBTableGroup

     DESCRIPTION

         "A compliant implementation does not have to  
         implement. Module Compliance of ENTITY-MIB  
         with respect to entity4CRCompliance should  
         be supported. "

GROUP           energyAwareProxyTableGroup

     DESCRIPTION "A compliant MIB implementation does  
     not have to implement. Module Compliance of  
     ENTITY-MIB with respect to entity4CRCompliance  
     should be supported. "

     ::= { energyAwareMIBCompliances 1 }

energyAwareMIBReadOnlyCompliance MODULE-COMPLIANCE

     STATUS                    current

     DESCRIPTION

         "When this MIB is implemented without support for  
         read-write (i.e. in read-only mode), then such an  
         implementation can claim read-only compliance.  
         Such a device can then be monitored but cannot be  
         Configured with this MIB.  
         Module Compliance of ENTITY-MIB with respect to

```

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                entity4CRCompliance should be supported."
MODULE            -- this module

MANDATORY-GROUPS {
                    energyAwareMIBTableGroup,
                    energyAwareRelationTableGroup
                }

GROUP energyAwareOptionalMIBTableGroup
DESCRIPTION
    "A compliant implementation does not have to implement
    the managed objects in this GROUP.
    Module Compliance of ENTITY-MIB
    with respect to entity4CRCompliance should
    be supported. "

 ::= { energyAwareMIBCompliances 2 }

-- Units of Conformance

energyAwareMIBTableGroup OBJECT-GROUP
    OBJECTS
        {
            eoDomainName,
            eoRoleDescription,
            eoAlternateKey,
            eoKeywords,
            eoImportance,
            eoPowerCategory
        }
    STATUS      current
    DESCRIPTION
        "This group contains the collection of all the objects
        related to the EnergyObject.
        Module Compliance of ENTITY-MIB
        with respect to entity4CRCompliance should
        be supported. "
 ::= { energyAwareMIBGroups 1 }

energyAwareOptionalMIBTableGroup OBJECT-GROUP
    OBJECTS
        {

```

```

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    eoEthPortIndex,
    eoEthPortGrpIndex,
    eoLldpPortNumber,
    eoMgmtMacAddress,
    eoMgmtAddressType,
    eoMgmtAddress,
    eoMgmtDNSName
    }
STATUS            current
DESCRIPTION
    "This group contains the collection of all the objects
    related to the Energy Object."
 ::= { energyAwareMIBGroups 2 }


energyAwareRelationTableGroup OBJECT-GROUP
    OBJECTS
        {
            -- Note that object eoRelationIndex is not
            -- included since it is not-accessible

            eoRelationID,
            eoRelationship
        }
    STATUS            current
DESCRIPTION
    "This group contains the collection of all objects
    specifying the relationship between Energy Objects."
 ::= { energyAwareMIBGroups 3 }


energyAwareProxyTableGroup OBJECT-GROUP
    OBJECTS
        {
            -- Note that object eoProxyIndex is not
            -- included since it is not-accessible

            eoProxyID,
            eoProxyAbilities
        }
    STATUS            current
DESCRIPTION
    "This group contains the collection of all objects
    specifying the Proxy relationship."
 ::= { energyAwareMIBGroups 4 }


END

```

Some of the readable objects in these MIB modules (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP.

There are a number of management objects defined in these MIB modules with a MAX-ACCESS clause of read-write and/or read-create. Such objects MAY be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. The following are the tables and objects and their sensitivity/vulnerability:

- . Unauthorized changes to the eoDomainName, entPhysicalName, eoRoleDescription, eoKeywords, and/or eoImportance MAY disrupt power and energy collection, and therefore any predefined policies defined in the network.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example, by using IPsec), there is still no secure control over who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in these MIB modules.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of these MIB modules is properly configured to give access to the objects only to those principals (users) that have legitimate rights to GET or SET (change/create/delete) them.

## 8. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

| Descriptor     | OBJECT IDENTIFIER value |
|----------------|-------------------------|
| -----          | -----                   |
| energyAwareMIB | { mib-2 xxx }           |

Additions to this MIB module are subject to Expert Review [RFC5226], i.e., review by one of a group of experts designated by an IETF Area Director. The group of experts MUST check the requested MIB objects for completeness and accuracy of the description. Requests for MIB objects that duplicate the functionality of existing objects SHOULD be declined. The smallest available OID SHOULD be assigned to a new MIB objects. The specification of new MIB objects SHOULD follow the structure specified in Section 6 and MUST be published using a well-established and persistent publication medium.

## 9. Acknowledgement

We would like to thank Juergen Quittek and Juergen Schoenwalder for their suggestions on the new design of EnergyRelationsTable which was a proposed solution for the open issue on the representation of Energy Object children as a UUIDlist.

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