Energy Management Object Preview

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Technical Track

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Agenda

Definition of Terms

States

Attributes

Services

Implementation Considerations
Definition of Terms

- Managed Entity – Device that supports Energy Management object
- Energy Management Client (Client) – Application that controls Managed Entities via instances of Energy Management Objects
- Managed Instance – An instance of an Energy Management object
Definition of Terms Continued

- Energy Management State (State) – Conditions defining Managed Instance behavior

- Curtailment Level (Level) – Collection of power level data defining a reduced power condition

- Pass Code – Client-created 32-bit unsigned integer that must be present in all Energy Management object specific service requests
Energy Management

Energy saving opportunities during production

Managed Entity can contain one or more Managed Instances

Uses curtailment levels to manage energy usage

Altered production during power saving Levels
Energy Management States

Three States

Nonexistent
- Power is off or
- Not created

Not owned
- Default state on power up or creation
- Energy management not possible in this state
- Client issues service request to establish ownership between itself and Managed Instance
Energy Management States

Managed

- Energy management possible

- Energy Management Client can:
  - Check status
  - Command to a Curtailment Level
  - Execute Curtailment Level services
  - Release ownership
Instance Attributes

9 Attributes
Instance Attributes

9 Attributes

- Curtailment Levels Array

Array of Curtailment Levels
Curtailment Levels Array

7 Members
Curtailment Levels Array

7 Members

- ID

Unique number assigned to each Level in the array
Curtailment Levels Array

7 Members
- ID
- Data Object Path

Path to Data Object
Data Object is
- Transition instructions
- Vendor-specific content
- e.g. use File Object
Curtailment Levels Array

7 Members

- ID
- Data Object Path
- Data Object Validity Check

Manage integrity between Managed Instance and Data Object
Vendor-specific
Curtailment Levels Array

7 Members
- ID
- Data Object Path
- Data Object Validity Check
- Capabilities

4 Fields
- Hide Data Object Association
- Protected From Deletion
- Protected From Modification
- Data Object Unnecessary
Curtailment Levels Array

7 Members
- ID
- Data Object Path
- Data Object Validity Check
- Capabilities
- Status

2 Fields
- Data Status
- Level Unavailable
Curtailment Levels Array

7 Members

- ID
- Data Object Path
- Data Object Validity Check
- Capabilities
- Status
- Percent Power

Expected power in percentage of full power

1 – 10000 = 0.01% - 100.00%
Curtailment Levels Array

7 Members

- ID
- Data Object Path
- Data Object Validity Check
- Capabilities
- Status
- Power
- Description

Multi-language text string to describe Level
**Instance Attributes**

**9 Attributes**

- Curtailment Levels Array
- Number of Curtailment Levels

**Number of Curtailment Levels in Curtailment Levels array**
Instance Attributes

9 Attributes

- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities

1 Field

- Curtailment Level Array Read Only
Instance Attributes

9 Attributes
- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities
- Instance Status

7 Fields
- Matching ID
- Present State
- In Transition
- Management Unavailable
- Curtailment Level Array Full
- Level Mismatch
- Capture in Progress
Instance Attributes

9 Attributes

- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities
- Instance Status
- Present Curtailment Level ID

Level at which Managed Instance is currently operating
Instance Attributes

9 Attributes

- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities
- Instance Status
- Present Curtailment Level ID
- Present Expected Power

Calculated power based on Level
Instance Attributes

9 Attributes

- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities
- Instance Status
- Present Curtailment Level ID
- Present Expected Power
- Client Path

CIP path to owning client
Instance Attributes

9 Attributes

- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities
- Instance Status
- Present Curtailment Level ID
- Present Expected Power
- Client Path
- Uncurtailed Power

Power in kWh when operating with no curtailment
Instance Attributes

9 Attributes

- Curtailment Levels Array
- Number of Curtailment Levels
- Instance Capabilities
- Instance Status
- Present Curtailment Level ID
- Present Expected Power
- Client Path
- Uncurtailed Power
- Options

1 Field

- Power Up Curtailment Level
Object Specific Services

Establish_Ownership  Capture_Level
Change_Ownership     Remove_Level
Release_Ownership    Revise_Level

Energy_Management    Read_Level
Energy_Management_Query Write_Level
Associate_Level
Disassociate_Level
Ownership Services

Establish_Ownership
- Used to establish ownership relationship between Energy Management Client and instance
- Transitions device to Managed state

Change_Ownership
- Allows an owning client to change Pass Code and Owner Path
- Only allowed in Managed state

Release_Ownership
- Used to clear ownership relationship between Energy Management Client and instance
- Only allowed in Managed state
- Transitions instance to Not Owned state
Energy_Management_Services

Energy_Management_Query service

- Used to test the contents of an Energy_Management service request without executing
- Can also be used to check ownership

Energy_Management service

- Used to command instance to a curtailment level
  - Equal or below, equal, equal or above

Request contains command and Requested Curtailment Level

If device cannot find level that satisfies request, no action taken
Curtailment Level Services

Capture_Level
- Saves current operating configuration to curtailment level

Revise_Level
- Allows modification of curtailment level content

Remove_Level
- Removes a curtailment level from instance
Curtailment Level Services

**Read_Level**
- Provides backup capability for curtailment levels

**Write_Level**
- Provides restore capability for curtailment levels

**Associate_Level**
- Establish link between Managed Instance and Data Object instance

**Disassociate_Level**
- Remove link between Managed Instance and Data Object instance
Implementation Candidates

Simple Device

Highly Configurable Device

Energy Management Client
Conclusions

Energy Management Object

- Completes CIP Energy Object triangle
- Provides common interface to manage energy usage
- Provides proxy capabilities for non-CIP devices