Update on the ODVA Energy Initiative

Marketing Track

www.odva.org
Agenda

The case for ODVA energy actions

What ODVA is doing about it

What you can do

Where do we go from here?
The Case for ODVA Energy Actions
IT’S ABOUT...
OPTIMIZATION OF ENERGY USAGE (OEU™)
Manufacturing Energy Usage

Total Energy

Offsite Energy
- Fuel: 11,789
- Generation and Transmission Losses: 6,161

Onsite Energy
- Electricity Generation: 329.9
- Steam Generation: 74.3
- Steam Distribution Losses: 952

Process Energy
- Total Primary Energy Use: 21,972 TBtu
- Total Combustion Emissions: 1,260 MMT CO₂e

Nonprocess Energy
- Total: 841.5

A little dated, but makes the point.

Data source: 2015 NFPS
Published: August 2016, revised December 2019
Units: TBtu = Trillion British Thermal Units
MMT CO₂e = Million Metric Ton Carbon Dioxide Equivalent
Notes: Feedback energy not included
Exhaust losses from process heating not estimated

Prepared for the Industrial Technologies Program (ITP) by Energise Incorporated
Energy management is critical for the industrial sector, with energy consumption set to rise by 50% in 20 years. An IP-based industrial information infrastructure is necessary to access real-time energy consumption data, allowing quick analysis and optimization of energy use. Best-in-class manufacturers are already taking advantage of this to drive down costs and increase efficiencies, find out how you could be doing the same.

- Industrial Sector consumes 52% of energy in the US¹
- 20% of machines and process consume up to 80% of energy in an organization²
- Industrial energy consumption will grow by 50% in 20 years
- from 191 billion to 282 quadrillion³
What ODVA is doing about it
ODVA Energy SIG Objectives

Develop CIP specification enhancements to integrate energy utilization and management technologies

Specification enhancement phases:

1. Standard energy reporting tools and methods
2. (a) Commanding equipment to conservation states
   (b) Controlling peak demand
3. Standardized interface to the Smart Grid

Phase 1 was published in November, 2011
- Included in CIP Networks Library, Volume 1, Edition 3.11

Phase 2a was published in November, 2012
- Included in CIP Networks Library, Volume 1, Edition 3.13

Presently working on phase 2b, energy management
Base Energy Object

Energy Supervisor

- Reports energy and/or power
- Standardized reporting units (kWh/kW)
  - 1 kWh = 3600 Joules
- Capabilities
- Accuracy
- Paths
  - To Subordinate Object
  - To Aggregated Objects
## Electrical Energy Object

### Subordinate to Base Energy Object
- Associated Base Energy Object Path EPATH
- Standardized reporting of electrical attributes
  - Energy, Power, Voltage, Current, Power Factor, etc.

<table>
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<tr>
<th>Attribute ID</th>
<th>Need in Implementation</th>
<th>Access Role</th>
<th>Name</th>
<th>Description of Attribute</th>
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<td>Get</td>
<td>Real Energy Consumed Odometer</td>
<td>The total real energy consumed.</td>
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<tr>
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<td>Get</td>
<td>Real Energy Generated Odometer</td>
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<td>The running total of Reactive Energy Consumed minus Reactive Energy Generated</td>
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<tr>
<td>7</td>
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<td>Apparent Energy Odometer</td>
<td>The total apparent energy consumed.</td>
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<tr>
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<td>Amps (A) $0.0...999.9\times10^{21}$</td>
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</table>
Non-Electrical Energy Object

Inclusive of all energy related resources

- Not only electricity!
- Native reporting units
  - Natural Gas in Therms, Chilled Water in Mbtu, etc.
  - Units from ENGUNIT data type (Appendix D)
  - Or text string
- Standardized reporting units
  - Conversion factor to kWh
  - Permits aggregation of diverse energy resources
  - Multiplier/divisor unit conversion factors
Energy Capabilities Examples

Energy Source

- Energy measured
  - Power monitor
    - Line or department
  - Overload relay
    - Motor amps (measured)
    - Voltage (assumed)

- Energy derived
  - Controller or Translator
    - Generic device

- Energy proxy
  - Software application

- Energy aggregated
  - Parent/child relationship
    - Specified using EPATHs

- Energy fixed
  - Power supply 300W
Show me!
Demo goals

Simple demo
Combine products from different vendors
Display data read from their CIP energy objects:

- Base Energy Object
- Electrical Energy Object
Demo Architecture

- Rockwell Automation HMI
- Rockwell Automation Controller
- Rockwell Automation Power Monitor*
- Rockwell Automation Overload Relay*
- Cisco Switch
- Molex CIP Energy Tool*
- Schneider Electric MCEDE*
- Schneider Electric Power Monitor

*Native CIP Energy Objects Implemented
Demo Data Flow

- Rockwell HMI
- Rockwell PLC
- Rockwell PM
- Rockwell OL
- Molex CIP Energy Tool
- Schneider MCEDE
- Schneider PM

- CIP Energy
- PLC Tags
- MODBUS Registers
Power Management
Power Management

Energy saving opportunities when equipment is idle
- Breaks
- Lunch
- Shift change
- Setup change

Management activities to save energy include:
- Pause (low power consumption) state
- Sleep state

The specification defines:
- Power Management Object
- Ethernet specific sleep mechanism
Timing Relationships

Power Management object includes several time elements

- Requested Pause or Sleep
- Resume
- Wake from Sleep
- Minimum Pause or Sleep Time

Requested Pause or Sleep Time

Resume Time

Wake from Sleep Time

Time to achieve low power level

Minimum Pause or Sleep Time
Energy Management
Energy Management

Energy saving opportunities when equipment is running

Device can contain one or more Energy Management Object instances

Uses curtailment levels to manage energy usage

- Estimated savings (% of normal load)
- Capabilities and status
- Description
- Associated vendor-specific data for transition

Reduced production
What you can do
Vendor engagement

Assess how your products can participate in the energy dialog

- Does your product consume energy and talk CIP? DUH!
- Does your product control an energy load?
- Can your product measure, derive, or know its energy load?
- Can your product display, report, or otherwise visualize energy data?
- What DOES your product know about energy in a system?

Plan to add CIP Energy™ to your products!
User engagement

- Is your organization ready to optimize its energy usage?
  - Do you have an energy management plan?

- Are your systems capable of:
  - Collecting energy data?
  - Making sense of energy’s impact on products and vice versa?
  - Making decisions that automatically reduce energy when it’s not needed?

- Are your suppliers energy-enabling their devices?

Help us build out the CIP Energy ecosystem!
Where do we go from here?
Principal Member Update

Schneider Electric – Martyn Jones

Cisco Systems – Dave Cronberger

Rockwell Automation
Optimization of Energy Usage in Schneider Electric’s PlantStruxure & MachineStruxure architectures

Peter Hogg & Martyn Jones
ODVA Annual Meeting & Technical Conference
Phoenix, AZ 12 March 2014
The Market

● Standard Interfaces
  ● We know exactly what data is available from each of the devices and in what form

● Market Drivers
  • Dec 2015 (EU Deadline: installed EnMS or system audits)
    The obligation for large enterprises to carry out an energy audit at least every four years, with a first energy audit at the latest by 5 December 2015. Incentives for SMEs to undertake energy audits to help them identify the potential for reduced energy consumption.
  • Customers need to be delivering energy data for analysis now to be linked to these EM projects
Our Response

1. Bring ODVA data compliance to existing data
   - Bring ODVA data compliance means we can start to work with customers now and have them ready for a more standard future.
   - Making customers value ODVA compliance will add it to standards and drive prescription.

2. Embed ODVA energy compliance in new equipment
   - New Equipment has ODVA Energy embedded retaining the advantages on migration but simplifying the solution.
   - New and Old work seamlessly together so all customers gain benefit.
ODVA Data Compliance

- Energy Management
- Library
  - Electrical Objects
    - Meters
    - Voltage/Current
    - Virtual Devices
  - Non-Electrical
    - Thermal (Liquid)
    - Pressure (Air)
    - Fuel (Gas)
    - Boiler (Steam)
  - Process Levels
    - Aggregation

Liquid Flow

Energy rate (power) in kW

Energy rate in local units

Temperature Input and Output

Total Energy Consumed

Total Energy in last period
ODVA Energy For Action

● Energy Alarms
  ● Process Energy Block
    ● Normalises energy collection and within the context of production.
    ● Allows you to see issues with processes consuming too much energy (even during idle time)
    ● Makes your energy measurement valuable for process action
Acquiring energy data from legacy systems

- Many MODBUS devices exist that measure power and energy
- No consistent data representation
  - Across manufacturers
  - Within manufacturers
- Need custom software interfaces
- Popularity of MODBUS will result in continued similar product offers
MODBUS to CIP Energy Data Extractor (MCEDE)

● Collects energy data from MODBUS devices and puts it into CIP Energy objects

● MODBUS port(s)
  ● Serial
  ● Ethernet

● CIP port(s)
  ● EtherNet/IP
  ● DeviceNet
  ● Etc.

● Implementation Platform(s)
  ● PC
  ● Dedicated
Basic MCEDE Functions

- A set of MODBUS energy device descriptions
- A set of data type conversion functions
- A configuration function
- A method to add/delete MODBUS energy device descriptions
- A scan function to periodically read MODBUS data
- A discovery function to search for MODBUS devices (optional)
- A MODBUS driver
- A CIP driver
- An energy object service handler
New Offers with CIP Energy Objects built in

- **Altivar Process**
  - **Energy Objects**
    - Managed by our Ethernet/IP interface
      - All Mandatory interfaces
      - Partial Optional interfaces
  - **CIP Base Energy Object**
    - Class Code 4Eh
  - **CIP Electrical Energy Object**
    - Class Code 4Fh
Make the most of your energy™

schneider-electric.com
Optimization of Energy Usage:
Energy-Aware Devices

Clifford J. Whitehead
Energy-Aware Devices
Leveraging Investment
Phase 3 – Transacting Energy

Development of a standardized interface

- ODVA does not anticipate direct connection of devices to the Smart Grid
- Collaborating with other SDOs
  - ASHRAE/NEMA Facility Smart Grid Information Model
For more information

To learn more about ODVA’s energy initiative, visit www.odva.org and click on Optimization of Energy Usage

To get involved in the ODVA Energy activities, contact ODVA at:
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