



# Price Communication, Product Definition, and Service-Oriented Energy

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# Agenda

- Motivation
- Energy market information
- Collaborative and managed energy
- Enabling markets and collaboration
- National standards, national markets
- Standard information exchanges
- Microgrids
- Microstandards
- Standards in progress
- More information

# Motivation

- This work grew out of discussions in the NIST Domain Expert Working Groups on Building-to-Grid and Industry-to-Grid (B2G and I2G)
- Initial requirements were developed by David Hardin, Martin Burns, Toby Considine, and William Cox
- There are twenty-some wholesale markets in the US
  - With twenty-some different ways of communicating price
- There are three thousand utilities in the US
  - With more than one way of communicating price
- What innovation is enabled by removing the complexities of price communication?

# Energy Market Information

- Actionable Price and Product definition for energy markets
- Some characteristics
  - Price and currency
  - quantity and units
  - generation source
  - carbon trading or tracing
  - power quality and reliability
  - availability (ramp time)
  - schedule



# Issues

- Markets
- Consumers
- Suppliers
- Microgrids as structure
- Price not pricing
  - Price is that which is communicated
  - Pricing is how those prices are determined
- Don't represent tariffs or contracts
  - Price is the result of a tariff or contract computation
- Price is actionable information to exchange

# We Do Not Define...

- How prices are determined
- Market operations
- Market structures
- How products are defined
  - Product definition is the combination of price and market-relevant characteristics
- What are the relevant characteristics?
  - 20 years ago growing organic tomatoes was a lifestyle choice
  - Now it's a business decision
  - What works changes as markets and understanding evolve
  - Extensibility and evolvability is required

# Markets and Architecture

Market Design and Description

*What Is Communicated - Price, Characteristics*

Price  
Comm

*How It's Communicated - Messages, Protocols*

Energy  
Interoperation

# Collaborative and Managed Energy

- Managed Energy
  - More intrusive
  - External control
  - Doesn't address occupant's business goals or aspirations
- Collaborative energy
  - Allows occupant's business goals and aspirations in the mix
  - Smarter loads, better collaboration
  - Services, not processes
    - Desired results not specific processes or actions
- See other papers by the authors in Grid-Interop 2009
  - Smart Loads and Smart Grids—Building the Smart Grid Business Case
  - Architecturally Significant Interfaces for the Smart Grid



# Enabling Market Interactions

- Markets and prices (and the description of goods bought and sold) drive efficient allocation of resources
- Defining characteristics drives markets in those characteristics
  - Already happening to an extent
  - Determine market clearing price for products
- Factor out complexities of price computation
- Clearly communicate price and product definition
- Enables equipment markets
  - Move from custom install to out-of-the-box

# Adapt Automatically to Conditions

- End nodes need price information
  - Commercial Buildings
  - Industrial facilities
  - Homes
  - Micro-grids
  - Electric transportation
  - ...
- Participants must automate interpretation of dynamic prices and characteristics of energy bought and sold
- Participants must be able to understand prices and characteristics

# Extensibility

- Anticipate new distributed energy resources
- Allow for additional characteristics
- Fashions and needs change over time—what characteristics will be important in 3 years? 5? 10?
- Extensible models are required

# Broader Markets

- Price-sensitive equipment
  - Building automation systems
  - Energy storage management
  - Devices
- Consumer investments in generation and storage
- “Whole Foods markets” for energy

A consistent model reduces costs of each implementation

# Profiles for different markets

- Light-weight profile for managed energy
- Extensible profile for operation of buildings and micro-grids
- High-speed profile for market trading and compound transactions

# Standard Information Exchanges

- eCommerce approaches and standards
- Price information
- Bid information
- Time for use or availability
- Units and quantity to be traded
- Deal/Bid/Acceptance confirmations
- Characteristics of what is to be traded

# Microgrids

- Local collaboration
- Local markets
- Currency may vary
- Design for Price and product definition
  - To
  - From
  - And within microgrids
- For more on microgrids see the [Galvin Electricity Initiative](#)

# What is OASIS?

- Organization for the Advancement of Structured Information Standards ([OASIS](#))
- World's leading XML and Web services standards developing organization
- [OASIS Standards](#) include
  - eBusiness
  - Emergency Management
  - Health Care
  - Open Building Information Exchange (oBIX)
  - OpenDocument
  - And many more including those that are also ISO, ITU, and IEC standards



# Microstandards

- One of a group of OASIS smart grid standards
- Seldom seen in the wild
  - QuarkStandards?
- Used as data elements of messages
  - Not protocols, just part of information exchanged
- Others include
  - [UnitsML](#)
  - WS-Calendar (in formation)

# Standardization in Progress

- OASIS Energy Market Information Exchange Technical Committee ([EMIX](#))
  - First meeting October 15, 2009
  - Clarified at Clasma's GridEcon Conference 2009-03
  - Part of [NIST Priority Action Plan 3](#)
  - Priority Action Plan [email list](#) available
- OASIS Energy Interoperation Technical Committee ([EITC](#))
  - Based on OpenADR (Lawrence Berkeley Labs)
  - Interoperation protocol and patterns
  - Demand response and Distributed Energy Resource signals, including price signals
  - Part of [NIST Priority Action Plan 9](#)

# More Information

- Toby Considine's blog [The New Daedelus](#)
- [William Cox's web site](#) collects papers and presentations on energy and Collaborative Energy
- NIST [Smart Grid Collaborative site](#)
  - Domain Expert Working Groups are open to all
  - These and related issues are frequently discussed in
    - [Building to Grid](#) (B2G)
    - [Industry to Grid](#) (I2G)
- The NIST DEWG will transition to the [Smart Grid Interoperability Panel](#) in late 2009

# Questions

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