Customer Automation Technology

NARUC Webinar

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Webinar Objectives

- Highlight the status of smart appliance and device development activities for Smart Grid
- Address regulatory issues that impact security and privacy, cost, standards, interoperability, and implementation options.

Webinar Agenda

1. Setting the stage
2. Available Technologies
3. Regulatory Issues
4. Summary
5. References

1. Setting the Stage

Why Should Regulators be Interested ?

Customer Automation Technology

- Improves the magnitude and persistence of customer response
- Is necessary to support the dispatch of day-ahead and day-of demand response
- Is necessary to support the integration of electric vehicles, local renewables, and Smart Grid operations
- Provides consumers with "set it and forget it" energy management capability.

Frequently Asked Questions

1. Are customer automation technologies (products and services) available today? — Yes
2. Are there options to address interoperability and future proofing? — Yes
3. Can implementation proceed before the NIST standards have been completed? — Yes
4. Can security and privacy be addressed? — Yes
5. Is there a viable market for customer automation technologies — Not Yet

2. Available Technologies*

Technology is not the problem.

* Available technologies are provided as examples not as endorsements for any individual product or service.

What is Available ?

- Communicating Thermostats
- Smart Appliances
- Plug-load devices
- In-home Displays
- Energy Management Systems / Services

Communicating Thermostats -1

Honeywell UtilityPro PCT

- Utility cost estimated $200 wholesale
- Primary Market: Utility programs
- ZigBee enabled
- Designed for utility demand response functions
- Web programmable

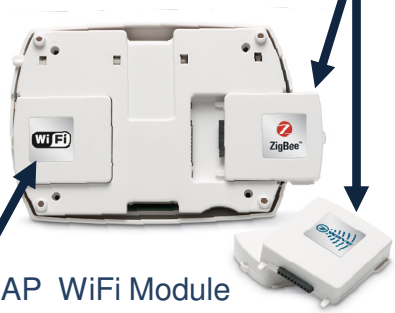
Ecobee Smart Thermostat

- Approximate Cost $470 retail
- Utility cost estimated $200 wholesale
- Primary Market: Retail
- WiFi and ZigBee enabled
- Touch screen
- Remote sensors available
- Price response capability
- iPhone / Web aps provided

Communicating Thermostats -2

3M Filtrete Smart Thermostat

USNAP Modules for
- WiFi
- ZigBee
- Zwave
- FlexNet, ERT, …



USNAP WiFi Module

- Approximate Cost $99.95 Retail
- Primary Market: Retail
- WiFi enabled
- USnap Modules (2) capable
- Grid status indicators
- Price response capability
- iPhone / Web aps provided
- Multiple product options to > $200

Communicating Thermostats - 3

3M Filtrete Smart Thermostat

Home Depot Retail Blister Pack

Sample iPhone / Web Screens

Smart Appliances - 1

Embedded Demand Response Strategies

- Delay operation, defrost cycle
- Modify peak run time
- Reduced Peak features
- Low Power mode
- Temperature shift
- Listen for price / event signals

Plug Load Devices

thinkeco modlet

- Automatically turns off if not in use *
- Being developed to remotely control window AC, other loads **

Enmetric Power Port

- Wireless communication
- Demand Response capable
- Analytics and reporting

* http://www.triplepundit.com/2010/10/thinkecos-modlet-makes-easy-save-energy/
** http://thinkecoinc.com/data/ThinkEco_ConEd_2011_01_05.pdf

In Home Displays

- Separate physical devices
- Additional investment and implementation cost
- Functionality available in computer, phone, and integrated devices
- Studies indicate that separate devices have limited market / value.

Source: List of Energy Monitoring Tools, Devices, Software and Home Automation, http://blog.mapawatt.com/2009/10/07/list-of-energy-monitoring-tools/

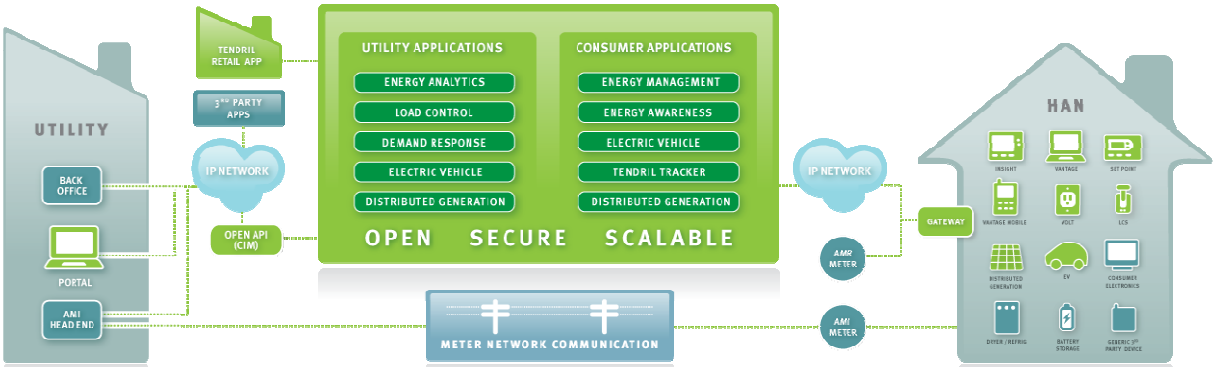
Energy Management Systems / Services - 1

TENDRIL™ Energize

Finding: ***"Consumers prefer existing technology over dedicated systems."***

3rd-party integration

user experience & interactions



enterprise integration

communication agnostic

device management

http://tendrilinc.com/press-releases/tendril-energize-revolutionizes-how-energy-providers-connect-with-customers/

Energy Management Systems / Services - 2

ECO FACTOR

Smart Thermostat

- Cost: Thermostat neutral
- Primary Market: Consumer
- WiFi enabled
- Comfort optimization
- iPhone / Web aps provided

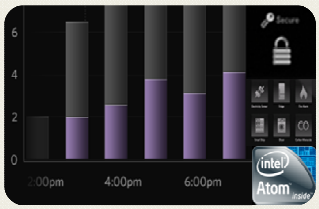
ECOFACTOR-ENABLED THERMOSTAT	& SERVICE	PROGRAMMABLE THERMOSTAT
Manually adjust temperature on thermostat	✔	✔
Time of day programming	✔	✔
Day of week programming	✔	✔
Average annual savings	Up to $400	Unkown
Average optimization adjustments per day	20-30	✖
Automatically adjusts settings based on expected weather	✔	✖
Remote access via the internet	✔	✖
Monitor your energy and cost savings	✔	✖

Oncor Program:

- $19.95 one time installation
- $8.99 / month monitoring fee

Energy Management Systems / Services - 3

Intel® Home Dashboard - Reference Design Kit



Rich Consumer Experience
- Simple home management
- Personalized Recommendations
- Significant energy savings
- Accurate budgeting
- Set goals, earn rewards, share results

Clear Utility Benefits
- **Integrate with utility smart energy systems**
- **Enable demand response savings**
- **Leverage existing smart grid and meter investments**
- **Drive customer loyalty**

Open, Extensible Platform
- **Integrate via open standards with 3rd party products and services like thermostats, security, home appliances, etc.**
- **Extend via open APIs with application store and 3rd party apps**

3. Regulatory Issues

Are there regulatory policies and actions that impact the potential success or failure of consumer automation technologies and services?

Regulatory Issues

1. Technology Framework
2. Security and Privacy
3. Standards
4. Interoperability
5. Future Proofing

Technology Framework

Smart Grid use cases emphasize a utility rather than a customer perspective.

Utility Centric ⟷ **Customer Centric**

- Utility command and control
- Smart Meter premise gateway
- Lack of integration with
  - Customer systems
  - Distributed resources
- Value primarily to the utility
- Utility centric business models

Vendors

- Customer value
- Need a market
- Leverage existing standards
- Share infrastructure

- Price drives customer action
- Integration Necessary
  - Internet Services
  - Embedded controls
  - EE / DR
- Value primarily to the customer
- Non-exclusive business models

The features, availability, and cost of smart grid consumer automation technologies depend on the stakeholder's point of view.

Utility - Customer Perspectives - 1

Frameworks that Influence Technology Development / Deployment

Technology Framework	Utility Centric	Customer Centric
Equipment / Service providers	• utility contracts with 1-2 vendors	• Many vendors • Viable market
Automation Technology Features	• Utility functionality • Limited supply – higher cost • Limited integration with customer systems	• Customized functionality • Open supply – lower cost • Integrated into existing systems / transparency
Customer Participation	Limited by usage level or appliance ownership	All customers
End-uses, load targeted	Primarily HVAC	All load
Purchase and Installation	Utility provided.	Incentives, rebates to accelerate
Customer Incentives	Participation or event based payments	Time varying price differentials
Integration of EE and DR	Not usually addressed	Integration necessary
Control strategies	•Utility selected •Emphasis on shedding	•Customer selected •Shedding, shifting, optimization

Utility - Customer Perspectives - 2

Key Challenges

- **Utility programs**
  - Typically don't support inexpensive or customized customer automation technologies.
  - Contracting process locks in preferred vendors
  - Development efforts often reinvent technologies and products that already exist.
- **Customers**
  - Want clear, reasonable incentives to invest.
  - Don't want single-purpose energy related products.
  - Need sustainable long-term education and implementation models.

Utility - Customer Perspectives - 3

Key Challenges

- **Vendors**
  - Get mixed signals – who is the customer?
  - Need a value function to support market development.*

Essential Requirements*

1. **Pricing** must provide incentives to manage energy use more efficiently and enable consumers to save money.
2. **Communication Standards** must be open, flexible, secure, and limited in number.
3. **Consumer Choice & Privacy** must be respected; the consumer is the decision maker.

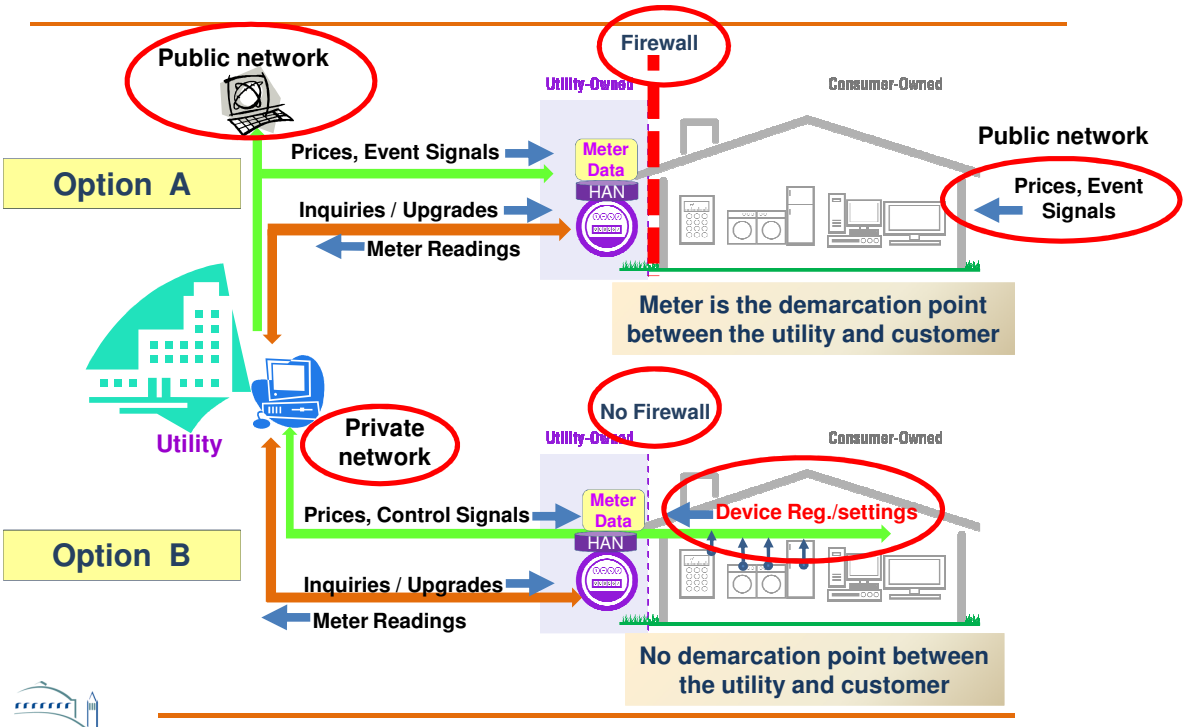
* Smart Grid White Paper, The Home Appliance Industry's Principles & Requirements for Achieving a Widely Accepted Smart Grid, AHAM, December 2009, http://www.aham.org/ht/a/GetDocumentAction/i/44191

Utility - Customer Perspectives - 4

Potential Solutions

- Establish a clear demarcation point (logical fire wall) between the utility and customer (the meter).
- Consider alternatives to exclusive bundled utility programs for delivering customer smart grid automation technology, services, and education.
- Consider collaborative market models, where:
  - Utilities provide price, reliability, and event signals.
  - Utilities may provide rebates, screening and referral resources to encourage the market.
  - Customers acquire, own, and operate automation technologies
- Examine rates that provide price signals and incentives to support customer investment and behavior change.

Utility - Customer Perspectives - 5



Security and Privacy - 1

Definition of Privacy*

Under GAAP**, privacy is defined as "the rights and obligations of individuals and organizations with respect to the collection, use, retention, and disclosure of personal information."

Key Areas

1. Collection
2. Use
3. Retention
4. Disclosure

* NIST Framework and Roadmap for Smart Grid Interoperability Standards Release 1.0 (Draft), http://www.nist.gov/public_affairs/releases/smartgrid_interoperability.pdf

** Generally Accepted Accounting Principles

Security and Privacy - 2

Can security and privacy be addressed?

- Establish a clear demarcation point (logical fire wall) between the utility and customer (the meter).
  - Customers responsible for ensuring privacy for data collected within their premise.
  - Utilities responsible for maintaining privacy of all collected revenue meter data.
  - Physical firewall implementations will vary
- Existing broadband networks already address privacy and provide utilities with critical infrastructure communication services.

Standards - 1

Can implementation of customer automation technologies proceed before the NIST standards have been completed?

- ☑ Yes
- ☑ Maybe
- ☑ No

- The NIST process provides guidance for the development of standards.
- It is possible the NIST process will not result in a set of mandated, enforceable standards.
- It is likely that standards will be adopted by the 'market' based on product performance, value, and customer acceptance

An Alternative Question

Can you implement now and provide: (1) interoperability and (2) future proofing?

- Leverage existing standards and existing infrastructure.

Standards - 2

- De facto vs. de jure
- Hardware vs. software interoperability
- Networks (LAN, HAN, FAN, WAN, …)
- Protocols (communications, 7-layer model)
  - Zigbee vs. WiFi, HomePlug, Z-wave vs. …
- Data Models
  - OpenADR vs.
  - SEP 1.0, 1.x, 2.0 (in facility vs. to facility)
- Utility back office vs. cloud computing

Standards - 3

Comments from the FERC Proceeding

- "… prescribing solutions through regulations runs the risk of stifling innovation, tying the pace of new Smart Grid developments to the speed of the regulatory process." (AT&T)*
- "This process is best driven through industry-led standards efforts and conformance/certification programs, free market dynamics, and the cooperation between utilities, industry and other smart grid stakeholders. " (Intel)**
- "The Commission has clearly stated on a number of occasions that it does not believe EISA gives it the authority to mandate or enforce smart grid standards …. I infer that the Commission's goal is to provide forward looking guidance to insure realization of smart grid functionality and interoperability as envisioned by EISA." (NIST)***

* FERC Docket No. RM11-2-000, Supplemental Notice Requesting Comments, Smart Grid Interoperability Standards, Comments of AT&T, March 8, 2011.
** Ibid, Intel, March 17, 2011.
*** Opening Remarks by George W. Arnold, National Coordinator for Smart Grid Interoperability, National Institute of Standards and Technology, FERC Technical Conference on Smart Grid Interoperability Standards, January 31, 2011.

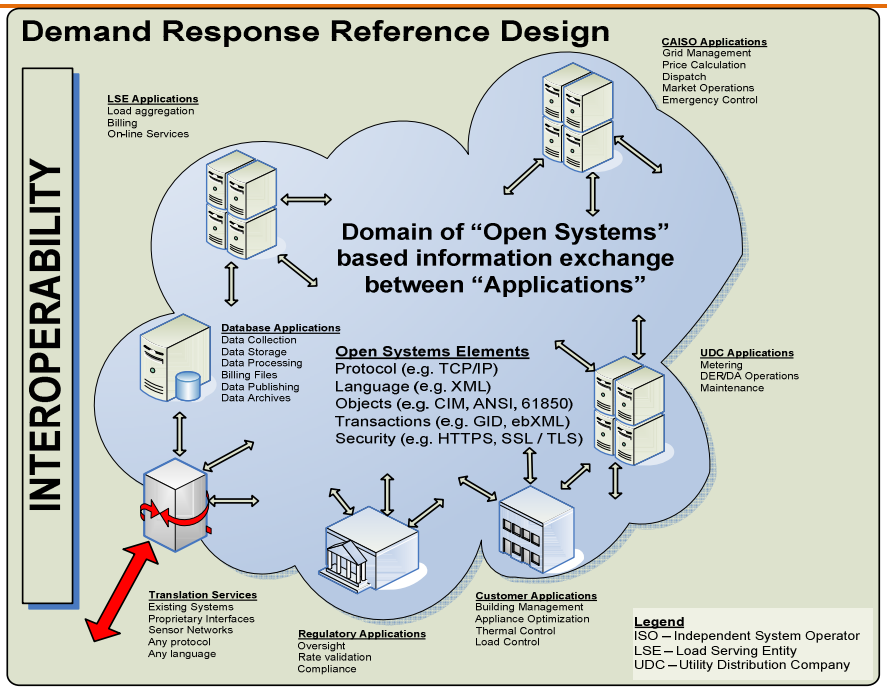
Interoperability and Future Proofing - 1

- What is interoperability? (hardware vs. software)
- What are the key strengths / weaknesses?
  - existing utility vs. customer centric models
  - ZigBee SEP 1.0, SEP 2.0 vs. the Internet
- What are the options to address interoperability?
  - Reprogrammable logic, layered architecture
  - USNAP, integrated gateways

Interoperability and Future Proofing - 2

- What is future proofing?
- What are the key strengths / weaknesses of existing utility vs. customer centric models?
- What are the options?
  - Hardware: USNAP vs. USB
  - Software: horizontal vs. vertical interfaces
- Drawing boundaries and control volumes

Interoperability and Future Proofing - 3



Interoperability and Future Proofing - 4

Are there options to address interoperability and future proofing?

- Software :
  - Remote upgrades
  - Layering
- Hardware
  - Module flexibility (USNAP)
  - Gateways and mapping

4. Summary

- **Utility vs. consumer-centric views can be harmonized with proper metrics that focus on long-term rather than short-term**
  - Cost and innovation opportunities
  - Infrastructure versus separate, add-on devices
  - Expanded industry participation in customer education
- **Regulatory decisions.**
  - Technology and products exist
  - Interoperability models exist
  - De facto standards exist
  - Security and privacy can be addressed
- **Markets for customer automation products and services need time-varying pricing to establish a value function**

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V. References

References - 1

	Title	Link
1	Comments of the National Cable & Telecommunications Association on NBP Public Notice #2, FCC GN Docket No. 09-47, 09-51, o9-137, November 13, 2009	http://www.google.com/#sclient=psy&hl=en&safe=off&rlz=1R2ADRA_enUS410&q=COMMENTS+OF+THE+NATIONAL+CABLE+%26+TELECOMMUNICATIONS+ASSOCIATION+ON+NBP+PUBLIC+NOTICE+%232&aq=&aqi=&aql=f&oq=&pbx=1&bav=on.2,or.r_gc.r_pw.&fp=a4cc8d06c4568ecd
2	Smart Grid White Paper, The Home Appliance Industry's Principles & Requirements for Achieving a Widely Accepted Smart Grid, AHAM, December 2009	http://www.aham.org/ht/a/GetDocumentAction/i/44191
3	Energy Management, A Mass Market Consumer Opportunity	http://ase.org/sites/default/files/BBY%20Energy%20Management%20White%20Paper.pdf
4	Get Smart, IEEE Power & Energy Magazine, May/June 2010	http://www.ieee.org/organizations/pes/public/2010/may/current.html Note: Available to IEEE members.

References - 2

Vendor Technology Information / Videos*

	Title	Link
1	Our Home Spaces	❑ http://dl.dropbox.com/u/2117050/OHS%20OADR%20Solution.mp4 ❑ http://dl.dropbox.com/u/2117050/OHS%20OADR%20Products.mp4
2	Enmetric	http://www.enmetric.com/docs/enmetric-brochure.pdf
3	People Power	http://www.peoplepowerco.com/
4	Tendril	http://tendrilinc.com/products/
5	Radio Thermostat of America	❑ http://www.radiothermostat.com/, http: ❑ //www.radiothermostat.com/filtrete/
6	GE Appliances	http://www.geappliances.com/home-energy-manager/
7	Honeywell	https://buildingsolutions.honeywell.com/Cultures/en-US/Markets/Utilities/
8	Ecobee	http://www.ecobee.com/product/smart-thermostat-features/
9	EcoFactor	http://www.ecofactor.com/
10	Intel	http://edc.intel.com/Applications/Energy-Solutions/Home-Energy-Management/

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