

AMI and HAN Systems

Integrated Resource Plan Stakeholder Meeting

Megan Pomeroy, The United Illuminating
Company

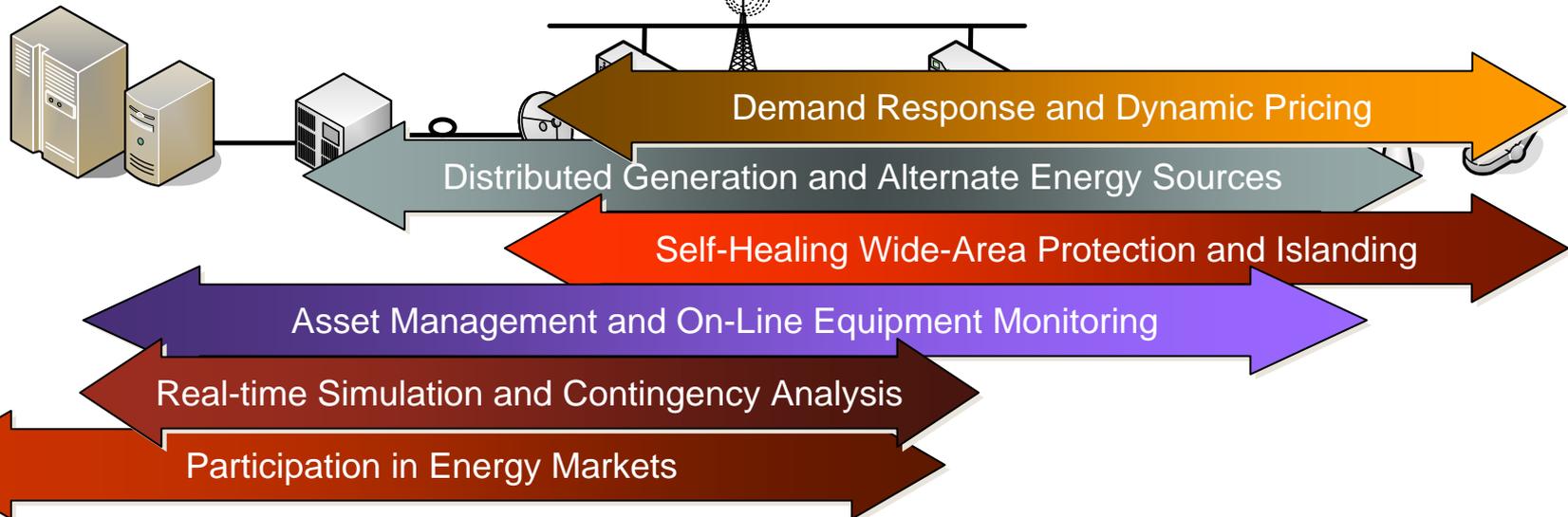
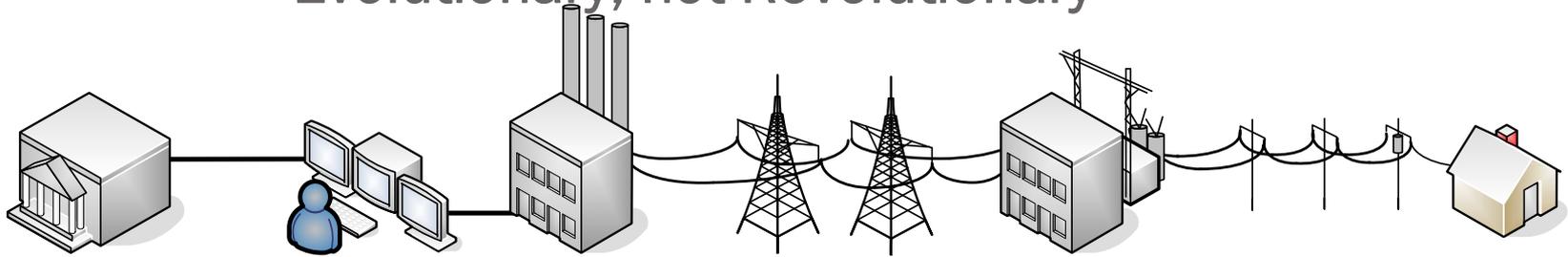
Monday, October 17, 2011

History

- Majority of today's power systems are largely based upon technology from the 1950s and installed over the last 40-50 years.
- Utility companies have had to send workers out to gather much of the data needed to provide electricity.
- Most of the devices utilities use to deliver electricity have yet to be automated and computerized.

Smart Grid Applications

“Evolutionary, not Revolutionary”

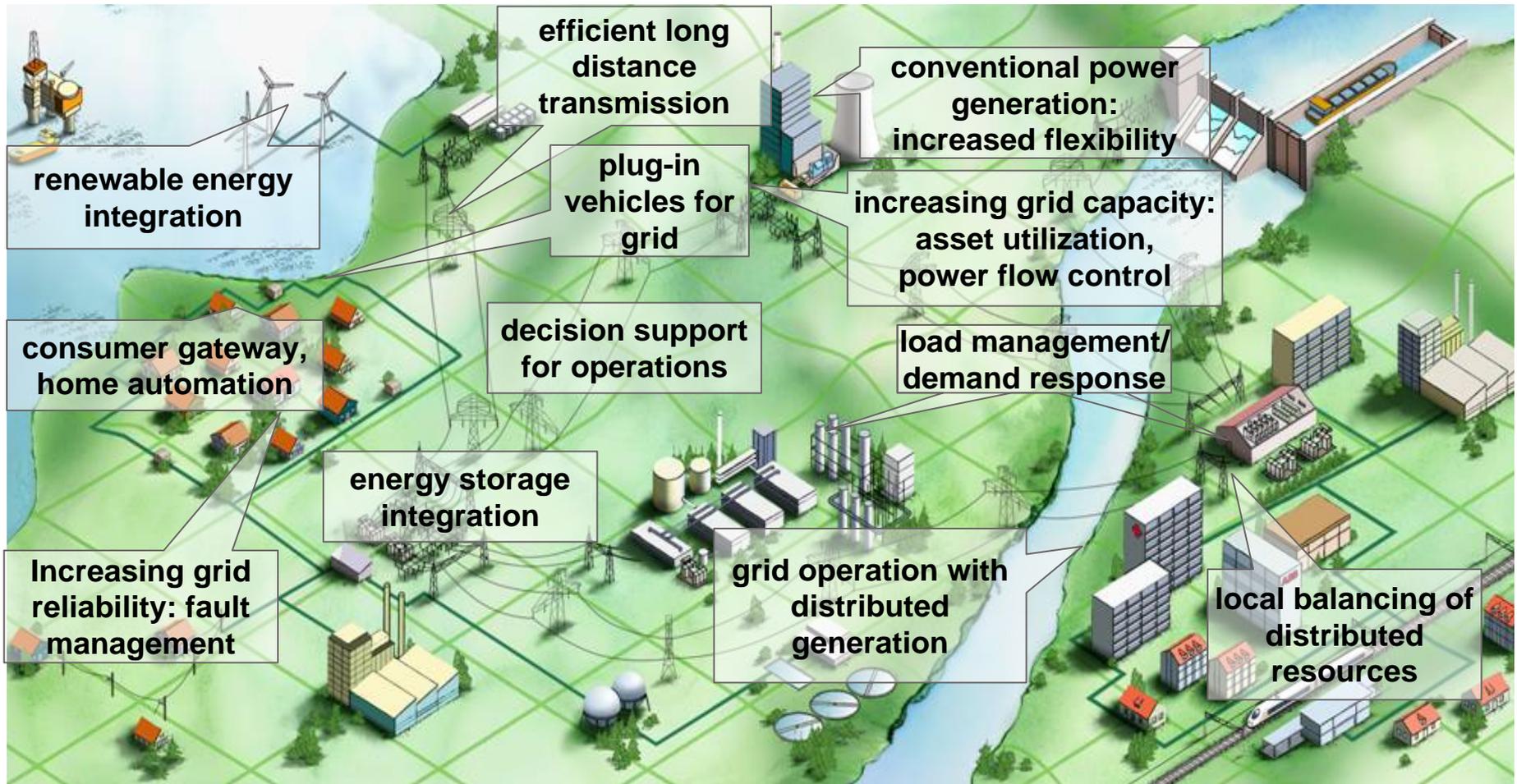


Shared Information – Continuously Optimizing – Intelligent Responses!

Costs Benefits

- The Electric Power Research Institute (EPRI) released a broad assessment of the costs and benefits to modernize the U.S. electricity system and deploy what has become known as “the smart grid.”
- Factoring a wide range of new technologies, applications and consumer benefits the investment needed to implement a fully functional smart grid ranges from **\$338 billion to \$476 billion and can result in benefits between \$1.3 trillion and \$2 trillion.** (April 7, 2011)

Smart System.... ...supports the entire electricity supply chain



Mesh Network – AMI Systems



Host System

Other Applications

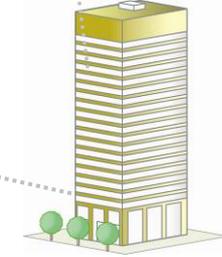
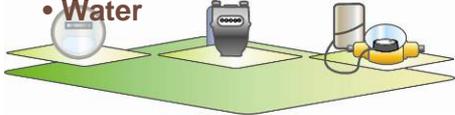


- Distribution Automation
- Home Automation
- Load Management



Transmit-Only

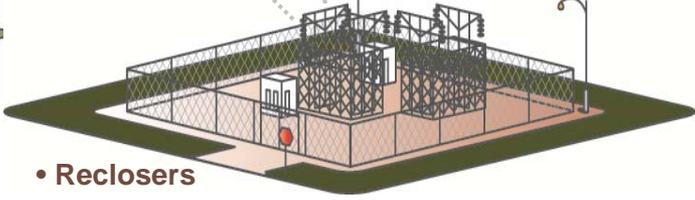
- Gas
- Water



• High-Rise Solution

• Water/Wastewater Applications

- Reservoir Management



- Reclosers
- Switches
- Sectionalizers
- Capacitor Bank



Residential Products:

- Smart Thermostat
- Load Management

Tracking AMI

Coincident Visualization & Analysis Tool™

Electric Utility Advanced Metering Projects

Mapped: Total Planned Residential Installations, Region: US & Canada

Map Legend

Planned Smart Meters

- 10M+
- 1M-10M
- 100K-1M
- 1-100K
- None

[more options...](#)

Data Filters

On Off

Project Type

- Pilot
- Permanent

Planned Timeline

Start: Finish:

2015 -	Any -
2014 -	2015 -
2013 -	2014 -
2012 -	2013 -
2011 -	2012 -
2010 -	2011 -
2009 -	2010 -
Any -	2009 -

Utility Ownership

select all | none

~ 160 Million Electric Meters

90% Residential

~10% AMI Deployed (electric)

~35% In Play

Accelerated by \$4.3B in Federal Funding

An Evolution, No End-State

AMI/Smart Metering Projects

157 Utilities, 52,598,114 Smart Meters

By Utility By Location

Utility/Project Name	Planned Meters
▶ Allegheny Energy, Inc.	1,140
▶ Alliant Energy	925,000
▶ Ameren Corporation	538,000
▶ American Electric Power	4,614,000
▶ Arizona Public Service	800,000
▶ Atikokan Hydro	1,450
▶ Austin Energy	234,000
▶ Baltimore Gas & Electric	1,200,000
▶ Bangor Hydro-Electric	120,000

Missing AMI Project? [Tell us about it.](#)

Texas

Country: US
Region: Texas
Region Type: STATE
Region Code: US-TX
Total Households: 9,166,849
Smart Meters Planned (Residential): 6,822,000
Households Covered: 74.42%

Regional Deployments:

Utility Name	Planned Meters
Austin Energy	234,000
CenterPoint	2,400,000
AEP Texas	900,000
Southwestern Electric Power Company (TX)	148,000
Onor	3,000,000

Map from: <http://www.coincident.com/smart-meters/main.html>

Energy Management – HAN Systems

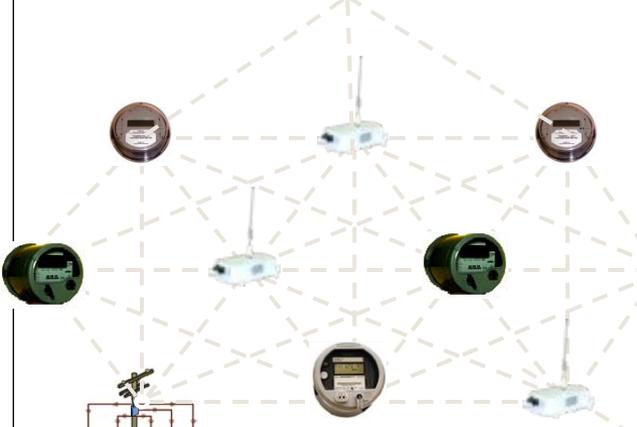


AMI Host Software



HAN Software

AMI Network



AC Load Control



Wireless Outlet Dimmer



ZigBee™
Wireless Control 1



Wireless Thermostat



Wireless Dimmer Wireless Switch Wireless Keypad Wireless Switch Wireless Dimmer



Direct Load Control



Home Heartbeat™
Wireless Water Sensor



Home Heartbeat™
Wireless Contact Switch



InHome™
Wireless Contact Switch



Home Theater Controller



Wireless Remote



Wireless Display

HAN Systems – Suppliers' Devices

Tendril



EnergyHub



HAN Systems – Suppliers' Portals

DASHBOARD | EXPLORE | HOME NETWORK | EVENTS | USER PROFILE

ACCOUNT STATUS

jenny's Home
in obrien

86° F **Program:** NO_TOU **Rate:** Fixed 10.00¢ / kWh

MESSAGES

Monday, June 28, 2010 8:12 PM **Importance: NORMAL**

WELCOME to the control center for your new TREE Energy Management System - Tendril Vantage. From the Vantage web portal you can now monitor and control your energy consumption, as well as manage each of the smart devices in your home. Thank you for choosing TREE and 21st century energy efficiency!

TODAY'S USAGE

ESTIMATED BILL

Bill Cycle: June 01 to July 01, 2010

Estimated Total Bill: \$132.48
Estimated Bill to Date: \$122.58
Today's Cost: \$3.35

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My Dashboard

Energy Meter

Your Present Use: **1386 W**

Messages

7/29/09: From Subject Please subscribe to our Residential Demand Response program.
7/18/09: From Subject Find out four ways to beat the heat this summer.
7/14/09: From Subject Your bill is now ready.

Thermostat

73° Inside Temp: 75° Outside Temp: 85°
Desired Temp A/C: On Fan: Auto

Mode Control

Home Away Goodnight

Overview

Monthly Summary as of July 31, 2009

Month to Date	\$181
Projected Cost	\$186
Energy Use to Date	1292 kWh
Carbon Footprint	1112 lbs

Top 3 Appliances

1. Air Conditioner	\$103.87
2. Refrigerator	\$30.54
3. Television	\$23.87

My Data

Energy Use by Appliances

Appliance	Current	Projected
Window A/C	\$50	\$65
Refrigerator	\$22	\$32
Laptop	\$12	\$16
Lamp	\$8	\$10
TV	\$6	\$8
Stereo	\$4	\$6

Did you know...

Appliances account for about 17% of the average household's energy consumption, with refrigerators, clothes washers, and clothes dryers at the top of the list.

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BILLING HISTORY

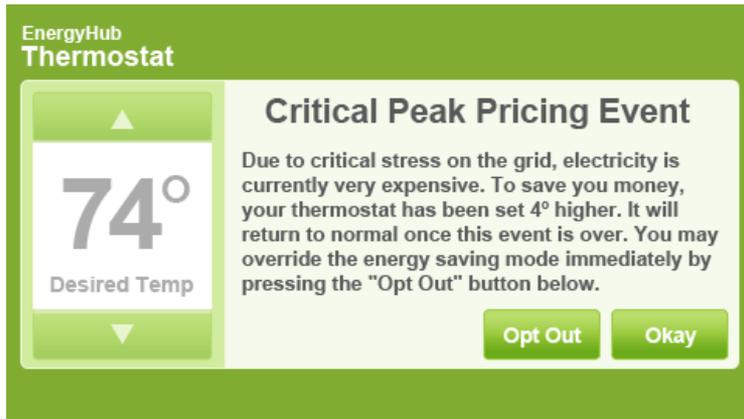
WEEKLY COMPARISON

HOUSEHOLD USAGE / COST

June 28, 2010

ENERGY CONSUMPTION

Demand and Price Response



- Potential residential load response programs and dynamic pricing
- Communicate with Customer through HAN systems what's going on and why
- Network-agnostic
- Measurement & Verification

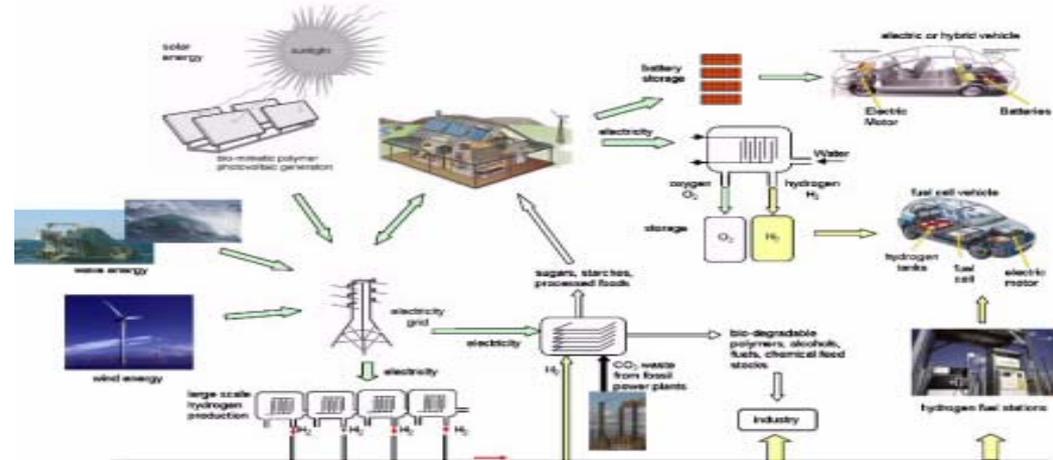
Benefits of AMI and HAN Systems

Smart Grid Benefit	Nature of Benefit		Primary Beneficiary		
	Service	Cost	Customer	Utility	Society
Customer Participation					
Smart meters & home automation	✓	✓	✓	✓	
Accommodation of plug-in hybrid electric vehicles	✓	✓	✓		✓
Facilitation of demand response		✓		✓	✓
System Reliability & Efficiency					
Improved customer service	✓		✓	✓	
Enhanced grid reliability	✓		✓	✓	✓
Optimization of network performance	✓	✓		✓	
Reduce system losses, operating expense		✓	✓	✓	
Asset Utilization					
Equipment monitoring & reduced risk of failure	✓		✓	✓	
Optimization of asset utilization		✓	✓	✓	
Prioritization of system enhancements, repairs	✓	✓	✓	✓	
Environmental Benefits, Renewable Energy, Energy Storage					
Reduced carbon footprint					✓
Wind, solar, biomass integration	✓	✓		✓	✓
Facilitate distributed generation		✓	✓	✓	✓
Enabling micro-grids		✓	✓		

Demand Side Integration And Load Management



Solar Sites



Distributed Generation Sites



Electric Vehicles

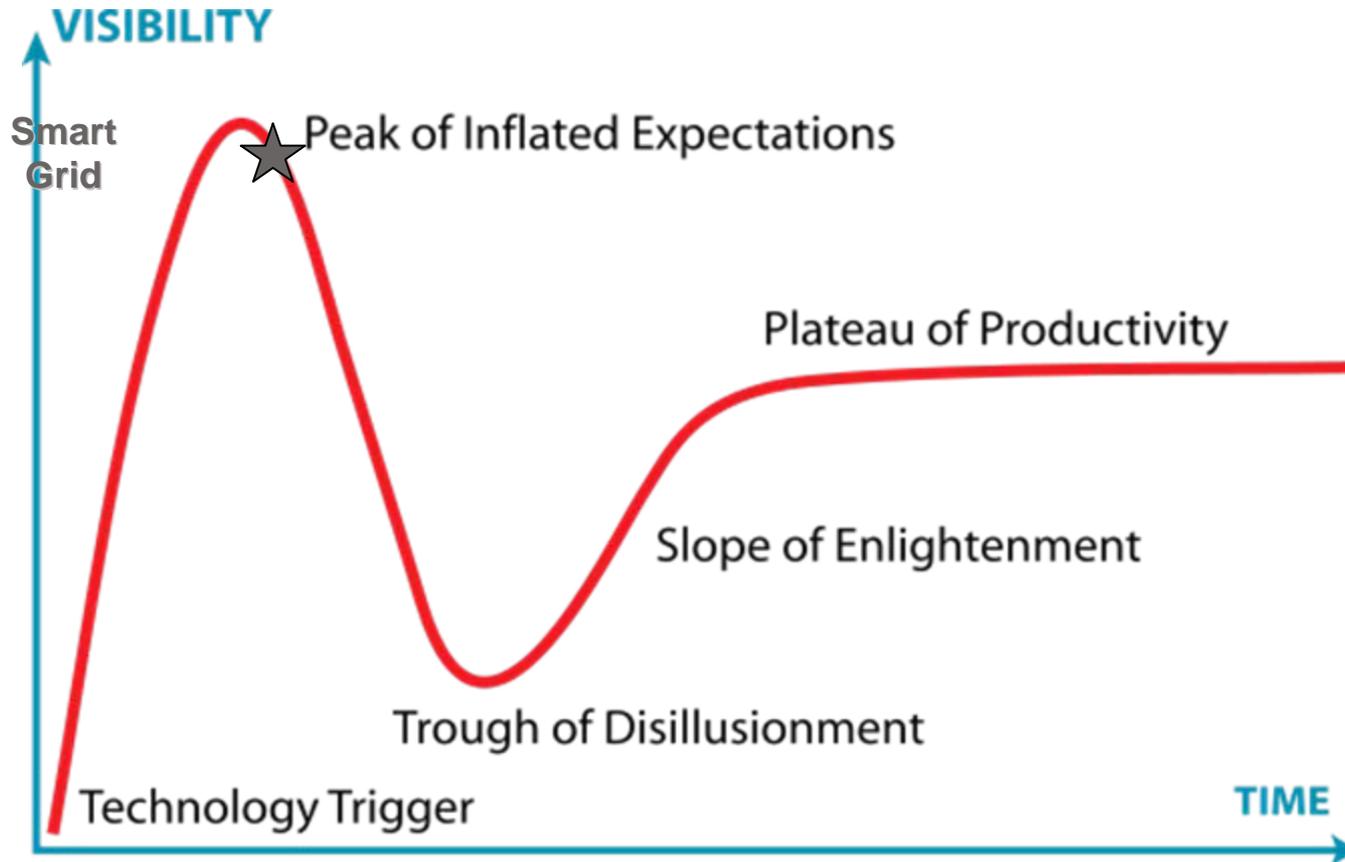


Water Heater
Load Control Devices

Drawbacks of AMI and HAN Systems

- Customer recruitment, engagement, installation
- High HAN install costs – Cost Benefit Analysis
- Negative connotation of smart meters
 - Meter Accuracy
 - RF Health Effects
 - Privacy
- Energy Industry Communication Standards not keeping up with Technology Advancements
- Bandwidth availability of AMI versus Internet
 - Internet Market (~77% nation wide by 2012)
- Thermostat compatibility
 - 37% of customers in UI service territory have central AC

Drawbacks of AMI and HAN Systems



Hype Cycle – *Gartner Group*

CMEEC – ConnSmart Program

- By March 2013 ConnSMART will:
 - Deploy approximately 45,000 smart meters (100% deployment across five municipal service territories, all rate classes);
 - Deploy 3 AMI communications networks and 3 MDM systems; and
 - Upgrade substations and implement new distribution control systems.
- By March 2015 ConnSMART will pilot:
 - Residential and Commercial cost and use website presentment (target availability: 24,000 customers);
 - Residential and Commercial time-of-use rates (target volunteer enrollment of ~100 customers); and
 - Residential direct load control program (target volunteer enrollment of ~300 customers).

UI's Efforts of AMI and HAN Systems

- Mesh Network – RF, Fiber, Concentrators, Collectors
- 81,000 two way or Advanced Meters deployed by 2012
- Meter Data Management (MDM) – store data and interface with SAP
- Helo Pilot – 1,000 households
- HAN Devices deployed (In-home display, programmable t-stats, controllable plugs, load control devices)
- Explore potential programs (Residential Demand Response, Dynamic Pricing, and Behavioral Component)



Summary

- AMI deployment level still low nationally
- Flexibility required in integrating customer devices
- AMI performance is trending upward to support ancillary functions
- Value of historical AMI data is immediate, real-time data use is emerging, direct sharing of the AMI network is uncertain
- Level of customer engagement in price responsiveness and demand response will determine AMI and HAN potential to decrease peak load.