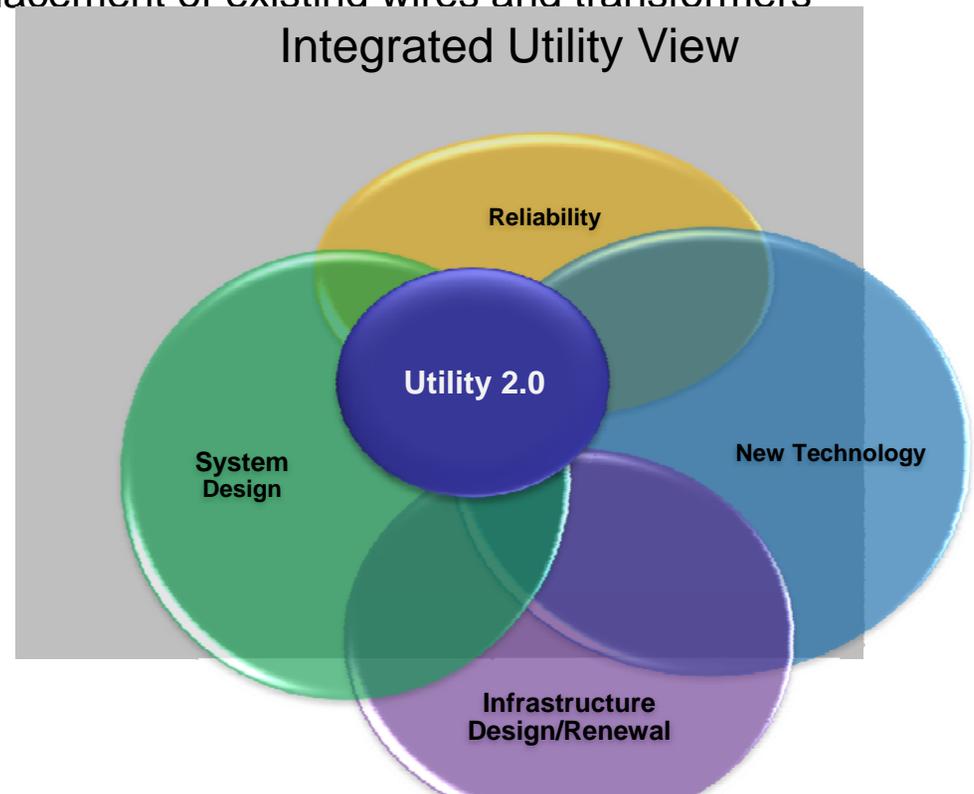


January 2013

# Pepco Plans for Continuous Grid Modernization

# Grid Modernization and Utility 2.0

- Bring new advanced meters, sensors, communications equipment, automation and computers to the existing grid to improve customer experience, power quality, reliability and security
- Provide valuable energy information to customers to help them to make choices regarding their energy usage and costs
- Modernize the grid without premature replacement of existing wires and transformers
- Create opportunities for innovation
- Enable advances in load management, customer service, outage detection, service restoration, and system planning
- Facilitate deployment of renewables
- Facilitate microgrid deployment



# Utility 2.0 - Focus Areas and Opportunities

People

Workforce of the future

- Cyber Security
- Quantitative Analysts
- Communications Systems Engineers
- Digital Power Systems Engineers
- Linemen of the Future

Process

Regulatory

- Cost Tracker
- Innovative Rate Structures

Business

- Customer Engagement
- HAN
- Apps
- Engaging Demand
- Services

Technology

Big Data

- Advanced Analytics Capabilities

Grid Awareness

- Sensors and Passive DA

Grid Management

- Active DA
- Renewables
- Electric Vehicles
- IVVC

Microgrid / DG

- Solar / Wind
- Fuel Cell
- Hydrogen<sub>2</sub>
- V2G

# Utility 2.0 – Technology View

Puts decision making in the hands of customers

- Provides information, programs and pricing options to allow customers to make informed energy choices
- Provides customers increased information about their energy usage

Automatically accommodates changing system conditions

- Fault isolation, automatic restoration, advanced grid sensors
- Reroute power flows, improve voltage profiles
- Automatic notification of corrective actions and pricing signals

Enables system operation with greater efficiency

- Improved asset management by optimizing grid design and investments
- Optimization of the grid, reduce losses
- Increased reliability and security

Promotes green energy initiatives and enables participation of intermittent load and generation

- Electric Vehicles and Vehicle to Grid
- Renewable Energy - Solar and Wind
- Microgrids

Provides future flexibility, resiliency and compatibility

- Adheres to Open Standards
- Includes Advanced Cyber Security
- Increased Network Operations Monitoring

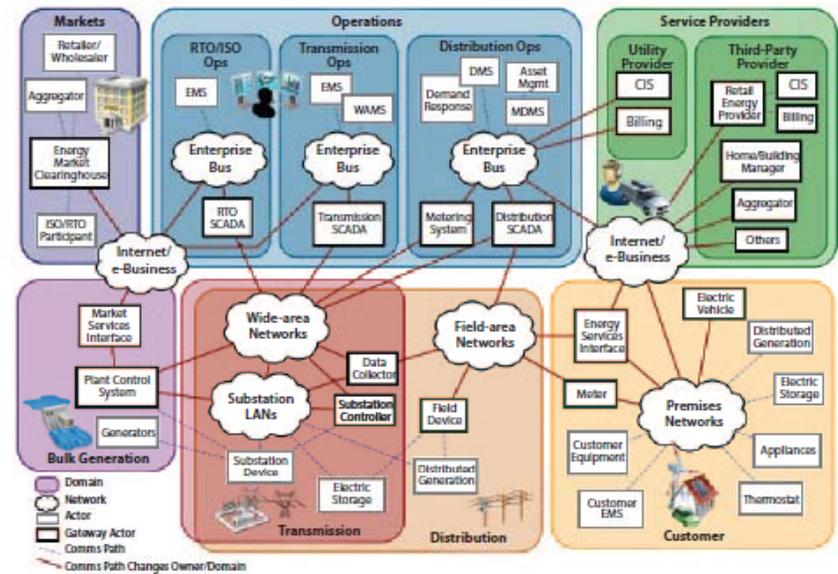


# Advanced Communications

**“Over the next 20 years, the growth in percentage terms of data flowing through grid communications networks will far exceed the growth of electricity flowing through the grid”.**

*The Future of the Smart Grid – Massachusetts Institute of Technology, 2011*

- The key to the evolution of Utility 2.0 will be the establishment of a reliable and robust communication system for quickly transporting large volumes of data
- Communication systems will need to interface with a variety of grid components and will consist of:
  - Private utility owned wide-area networks
  - Public communications networks
  - Commercial communications networks
  - Home and commercial premises networks



Source: National Institute for Standards and Technology, *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0*, special publication 1108 (Washington, DC: U.S. Department of Commerce, 2010), 35, [http://www.nist.gov/public-affairs/releases/upload/smartgrid\\_Interoperability\\_final.pdf](http://www.nist.gov/public-affairs/releases/upload/smartgrid_Interoperability_final.pdf).

- Using “open standards” will ensure that investments are realized over a longer life and that alternatives can be easily considered as they arise
- Security is very important for reliability and protection from unwanted intrusion

# Smart Grid initiatives are accelerated through DOE funding...

	<b>Pepco-DC</b>	<b>Pepco-MD</b>	<b>ACE-NJ</b>
	-280,000 smart meters -20,000 DLC devices -17 ASR schemes -Dynamic pricing -Enabling comms	-570,000 smart meters -168,000 DLC devices -62 ASR schemes -Dynamic pricing -Enabling comms	-25,000 DLC devices -20 ASR schemes -158 Capacitor banks -Enabling comms
<b>Total Cost</b>	<b>\$89.2M</b>	<b>\$209.6M</b>	<b>\$37.4M</b>
<b>DOE Funded</b>	<b>\$44.6M</b>	<b>\$104.8M</b>	<b>\$18.7M</b>

*Benefits to Customers*

- Acceleration of installation of meter and thermostats
- Acceleration of benefit for customers to manage their energy use
- Modernization of the electric system to reduce outages, better manage the operation of the system and reduce losses

# DE AMI results achieved during Hurricane Irene (Aug 2011)

## Background

- Approximately **445,000 customers** were **without power** at the height of the storm
- Overall in Delaware, there were **~1,900 outage events** according to the Outage Management System (OMS)

## AMI Outage Detection

- As they were losing power, DPL Delaware **AMI meters sent “last gasp” messages**, which were **processed by the OMS** similar to a customer call
- **Last gasp messages** help to **predict the location and extent** of outages
- Company personnel can determine if there is **line side power at the customer’s meter** by **“pinging”** the meter
- **30 percent of the 1,900 outage events** were **cancelled** as a result of the meter pings
- As a result of the cancellations, **calls back to customers** or **truck rolls** to the affected event area to verify power restoration were **eliminated, allowing focus on actual outages**



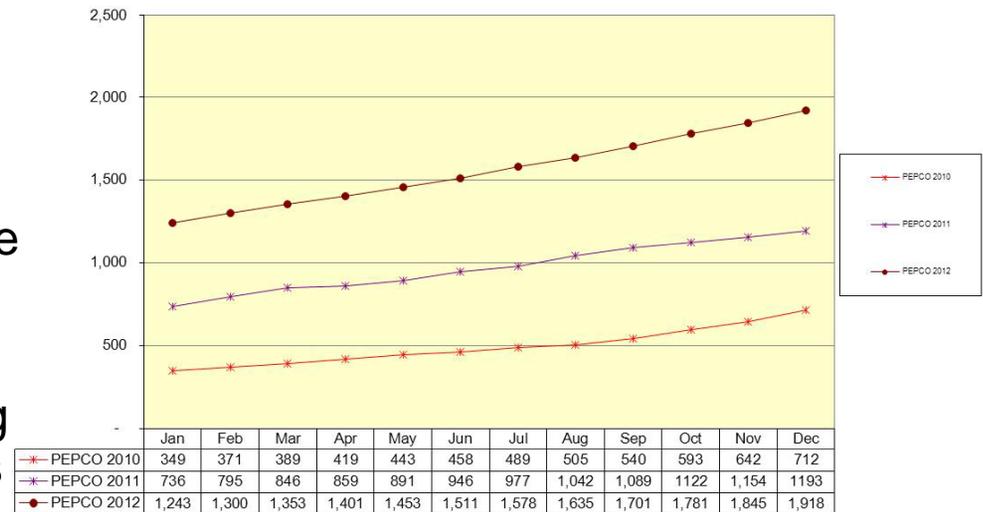
*In Delaware, AMI outage detection proved useful during restoration efforts from Hurricane Irene as data eliminated the need to dispatch crews to hundreds of outage locations*



# Renewable Integration and Microgrids

- Pepco has successfully completed the interconnection of over 1,900 customer renewable energy systems
- Pepco is working on an advanced modeling program to rapidly provide the studies necessary to safely connect these systems to the grid
- Pepco is an industry leader in addressing the effects of interconnection renewables and actively participates in standards development efforts

NEM Customer Growth by Year



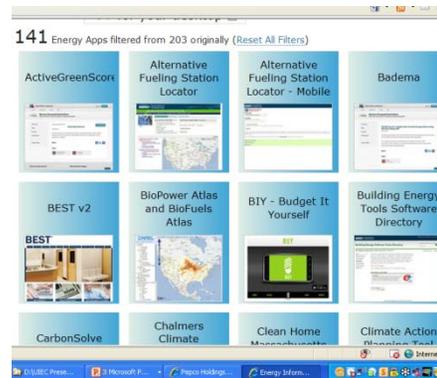
- Pepco now is working on using advanced inverter designs that communicate with the grid and allow a higher level of voltage control than was ever available before
- Advances in sectionalizing equipment increases microgrid options

***It is critical to integrate distributed and renewable generation in ways that do not compromise system reliability, power quality or safety***

# PHI is a leader with Green Button Initiative



- White House / industry initiative
- Common-sense idea that electricity customers should be able to download their own energy usage information in a consumer- and computer-friendly format
- A common experience, from provider to provider, setting clear expectations that their information is theirs to have – and share if they want to
- A contest was recently held for developing Apps that could collect, analyze and present this data
- Low barrier to consumer access



## Implementing/Committed Utilities

- PG&E
- SDG&E
- SCE
- City of Glendale
- Oncor
- Pepco Holdings (MD, DC, DE, NJ)

## Implementing/Committed Vendors

- OPower
- eMeter
- Tendril
- Aclara
- Itron

**The smart grid provides more energy use information and more choices for customers on how to use it**



# PHI Current Efforts with EVs

- Completed our participation in EPRI / Ford Escape PHEV Program
- Continue to evaluate 10 Chevy Volts in fleet
- Continue Testing of installed Charging Stations

– Level 2	Level 1
• 3 Edison Place	5 at Edison Place
• 1 NCRO	1 at NCRO
• 1 Bay Region	
• 1 ACE	
• 1 Rockville	
• 1 Forestville	
• 1 Benning	

- Testing EVSE communication & DSM mini pilot using the Chevy Volts and AMI communications system
- Submitted a proposal for an EV program in MD
- Established EV Leadership
  - Board Member of Electric Drive Transportation Association
  - MD Electric Vehicle Infrastructure Council
  - MD PSC EV Working Group
- Continue to support standards as well as State regulatory and legislative efforts to prepare for PEVs



# Home Area Network and Demand Response



- Studies have shown that customers who get frequent information on their energy use may additionally conserve up to 15%
- Typical smart in-home display shows:
  - Power consumed since last bill
  - Estimated bill since last bill
  - Current price of power
  - Price Signal Information
  - Other Messaging
- Traditional utility direct load control programs are used infrequently because they are designed for providing reliability under emergency conditions or peak shaving on a small number of hours per year
- The untapped potential for reducing electricity usage is likely to lie in residential behavioral changes
- The Home Area Network will be a key medium for engaging demand and providing new benefits to customers



## SMART APPLIANCES WORK – WE PROVED IT

In 2006, Whirlpool, in partnership with Pacific Northwest National Laboratory (PNNL) and others, ran a successful year-long field demonstration of GridWise technology and was able to show better grid utilization and improved system efficiency.



95%

When a PNNL grid sensor observed an event, the 150 demand response dryers reduced their power from 5,700W to 280W - a 95% reduction in under 400ms

### Minimal Customer Impact:

- Heating element turned off,
- Residual heat and tumbling continued
- Dryer control system and sensors remain active to ensure the drying process is still managed
- Automatically extended drying time if required

**Project participants:** Portland General Electric, PacifiCorp, Pacific Power, Clallam PUD, Mason County PUD No. 3, Bonneville Power Administration, Pacific NW National Laboratory, GridWise Alliance, Invenisy, Whirlpool Corporation, IBM, and Sears.



**Deployment of AMI and complementary technologies enhances potential demand response to supply conditions and may enable improved energy efficiency and conservation. The Future of the Smart Grid**

# Innovations in Regulation – Pepco Heeds Maryland’s Grid Resiliency Task Force

- Pepco takes new steps to improve customer service and reliability
  - Accelerate next four-year tree-trimming cycle to complete the cycle in three years
  - Upgrade an additional 12 feeders a year for two years (on top of the four dozen feeders already being done each year)
  - Underground six distribution feeders (three in Montgomery County and three in Prince George’s County), to significantly improve reliability in both day-to-day and storm conditions
- Because Pepco is proposing to accelerate investment and receive timely recovery of costs, it is also proposing to accelerate the reliability standards it has to meet
- Pepco has proposed performance-based ratemaking that rewards Pepco if the accelerated reliability standard is achieved and credits customers if the accelerated reliability standard is not met

# Pepco Rate Case No. 9311

- Filed November 30, 2012
- Decision anticipated July 1, 2013
- Proposed \$60.8 million increase in base distribution rates to help pay for reliability investments
  - Feeder improvements
  - Distribution automation
  - Substation improvements
- Proposed Grid Resiliency Charge
  - Full PSC review of project prudence
  - Covers only accelerated projects
  - Would take effect on Jan. 1, 2014
  - Expected to extend for about three years
  - Total cost of accelerated projects estimated at \$180 million
  - Only a portion of the accelerated projects to be recovered through the grid resiliency charge
  - Balance of costs will be included in a future rate case and collected over the remaining life of the assets, roughly over 30 years

# Closing Thoughts

- Customer benefits and customer satisfaction drive grid modernization
- Smart Grid technology is revolutionizing how utilities operate, and allowing unprecedented customer choices
- Key to success will be a constant scan of developing technologies that can be safely integrated into the grid without adversely affecting, and hopefully improving, reliability
- Pepco is implementing technologies that improve service reliability, speed power restoration, and provide customers with new options
- Opportunity exists for partnerships with telecom companies, internet businesses and others to develop new customer services
- As recognized by Maryland's Grid Resiliency Task Force, regulatory policies also need to change

# Questions?

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*Also connected with our customers through:*

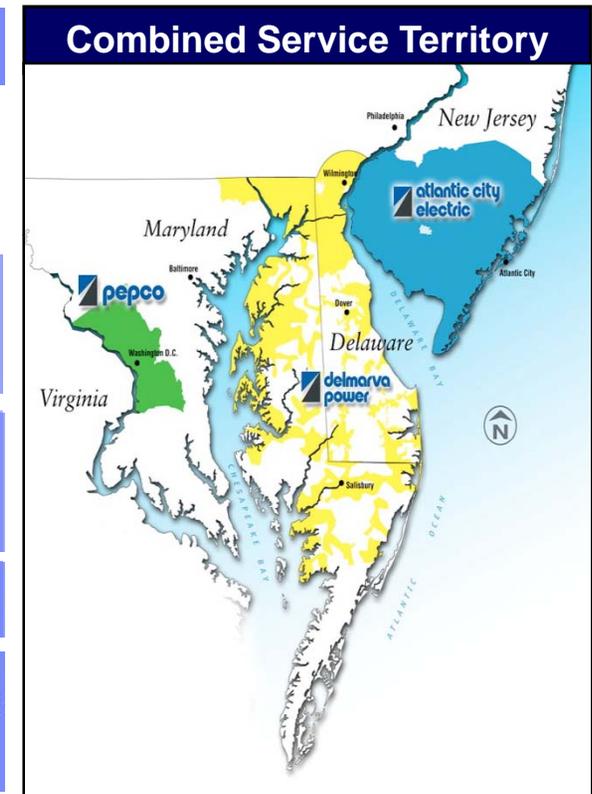




# APPENDIX

# PHI is an electric and gas utility serving almost 2 million customers in New Jersey, Delaware, Maryland and Washington D.C.

Operating Company	Service	Customers	GWh	Bcf	Service Area
 A PHI Company	Electric	787,000	27,665	N/A	640 square miles – District of Columbia, major portions of Prince George's and Montgomery Counties in Maryland
 A PHI Company	Electric	500,000	12,853	N/A	5,000 square miles – Delmarva Peninsula 275 square miles – Northern Delaware
	Gas	123,000	N/A	19	
 A PHI Company	Electric	548,000	10,165	N/A	2,700 square miles – Southern one-third of New Jersey
<b>Regulated Utility Totals</b>		<b>1,958,000</b>	<b>50,703</b>	<b>19</b>	<b>8,340 square miles</b>
	Energy Services Business	Various Large Government & Institutional	N/A	N/A	Develops, installs, operates, and maintains energy efficiency, renewable energy, and combined heat and power projects; Business represents 5% - 10% of operating income

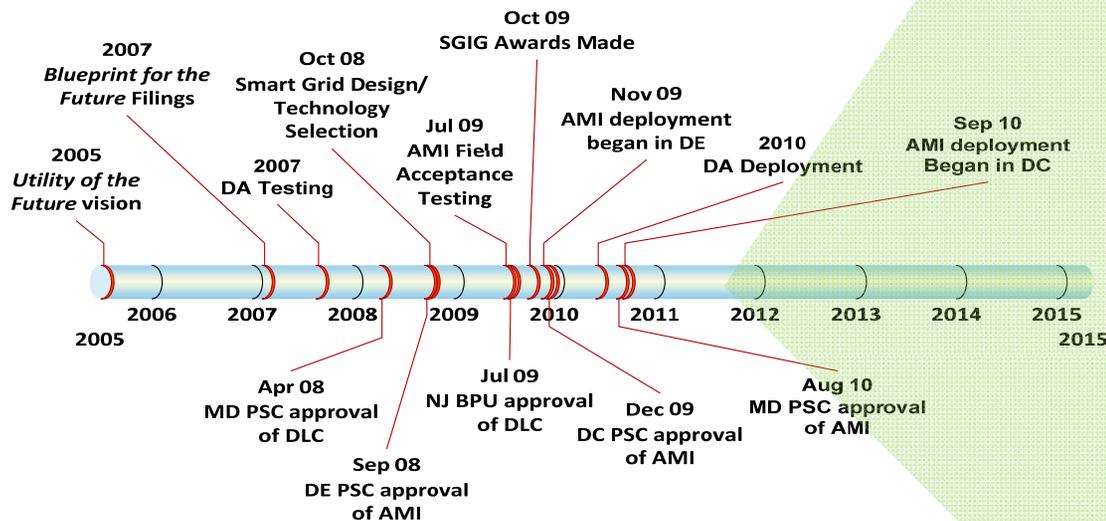


# PHI's Path to the Smart Grid

*PHI began its Smart Grid planning in 2005 and has been progressing rapidly in its Smart Grid implementation with the Smart Grid Investment Grant (SGIG) awards.*

## PHI received 3 grants from US DOE

- \$168m for Smart Grid;
- \$700K for Synchrophasor deployment;
- \$4.4m Workforce Training.



## • AMI Meters Installed

- DE Complete
- MD 255,016
- DC 268,088

## • Communications Installed

- DE Completed
- MD 118 APs / 272 Repeaters
- DC 65 APs / 69 Repeaters

## • Phase One AMI Benefits

- Over the Air Meter Reading
- Interval Data on Web and Bill
- Outage Detection
- On-demand meter reads

## • Peak Energy Savings Credit (Critical Peak Rebate)

- 7,000 customers in Delaware
- 5,000 customers in Maryland

## • Advanced DA Schemes Installed

- MD 1 Commissioned / 4 in progress
- DC 3 in progress

## • DGA Transformer Monitors

- MD 8 Installed / 4 In progress
- DC 10 Installed / 4 In progress

## • Residential URD Monitors

- MD 84 Field Devices Installed / 116 In Progress

## • Green Button now available

# PHI Current Grid Awareness and Management Projects

- **Automatic Sectionalizing & Restoration (ASR) Schemes**
  - ASR entails the installation of advanced devices that are designed to work together to identify distribution feeder faults, automatically isolate identified faulted area, and reroute electricity supply to segments of the outage feeder un-impacted by the fault. This will reduce the number and length of electric system outages, resulting in increased reliability and customer satisfaction.
- **Dissolved Gas Analysis (DGA) Monitors on Substation Transformers**
  - This on-line system will continuously monitor eight critical fault gases and other transformer insulating oil key parameters for a timely assessment of transformer conditions to schedule maintenance and help prevent failures.
- **URD Fault Detectors System –FDS**
  - This system will identify the location of faulted URD transformers by conveying a signal back to the control center in order to reduce time spent by crews in locating faults.
- **Network Transformer Protector Remote Monitoring System - RMS**
  - This system will provide real time remote control/monitoring capability as well as power quality information such as phase currents, transformer loading, power factor, etc. to network transformers through implementation of two way communication and installation of intelligent sensors for an enhanced reliability of the network system.
- **Capacitor Bank Automation**
  - This project will add feeder capacitors that have two way communications for supervisory control capability and visibility. This will allow remote control of feeder reactive power (VAr) and resolution of high/low voltage issues.

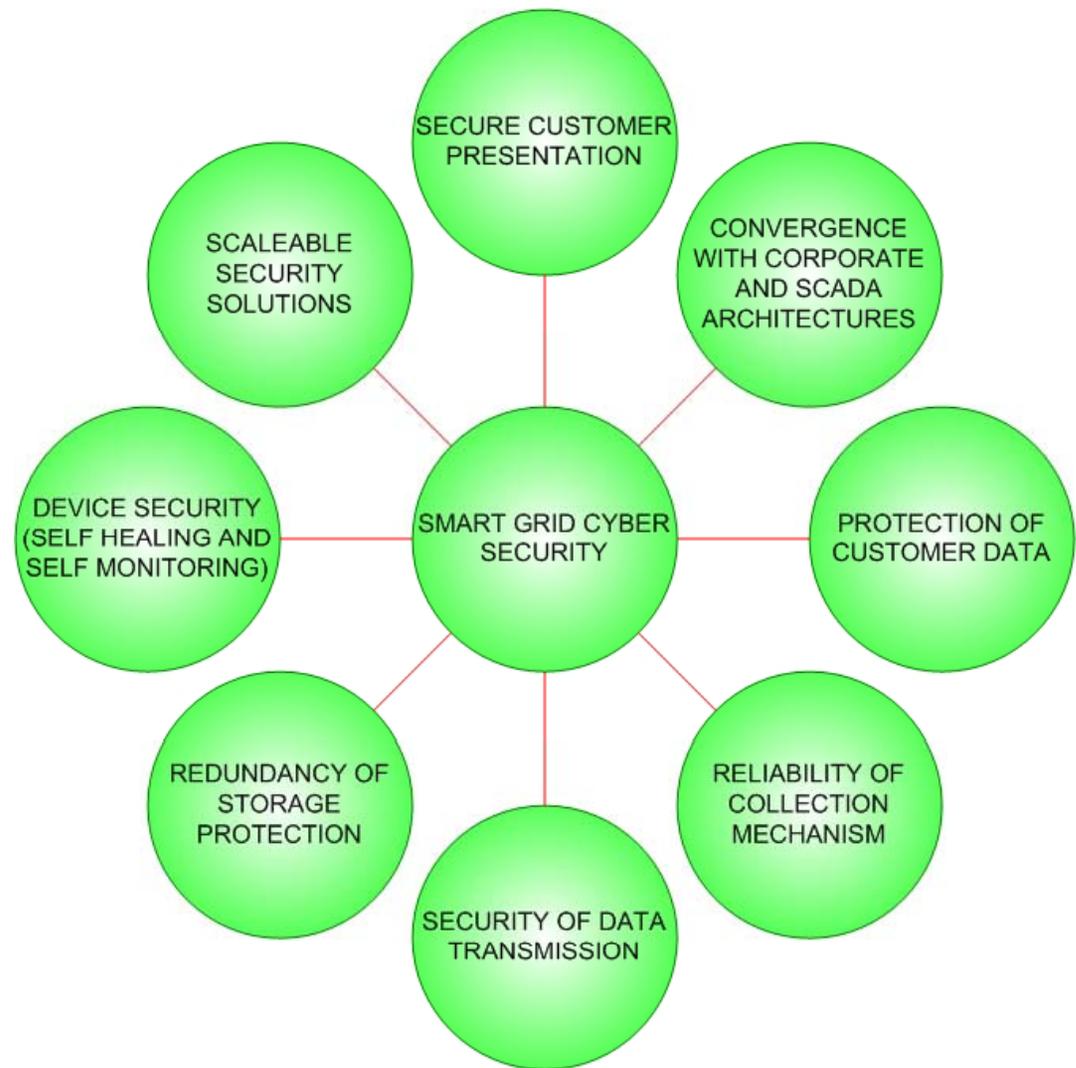
# Smart Grid CyberSecurity Challenges

Need to protect Interval or usage data from non-authorized users

Need to protect meters from being abused as control channel into grid operations

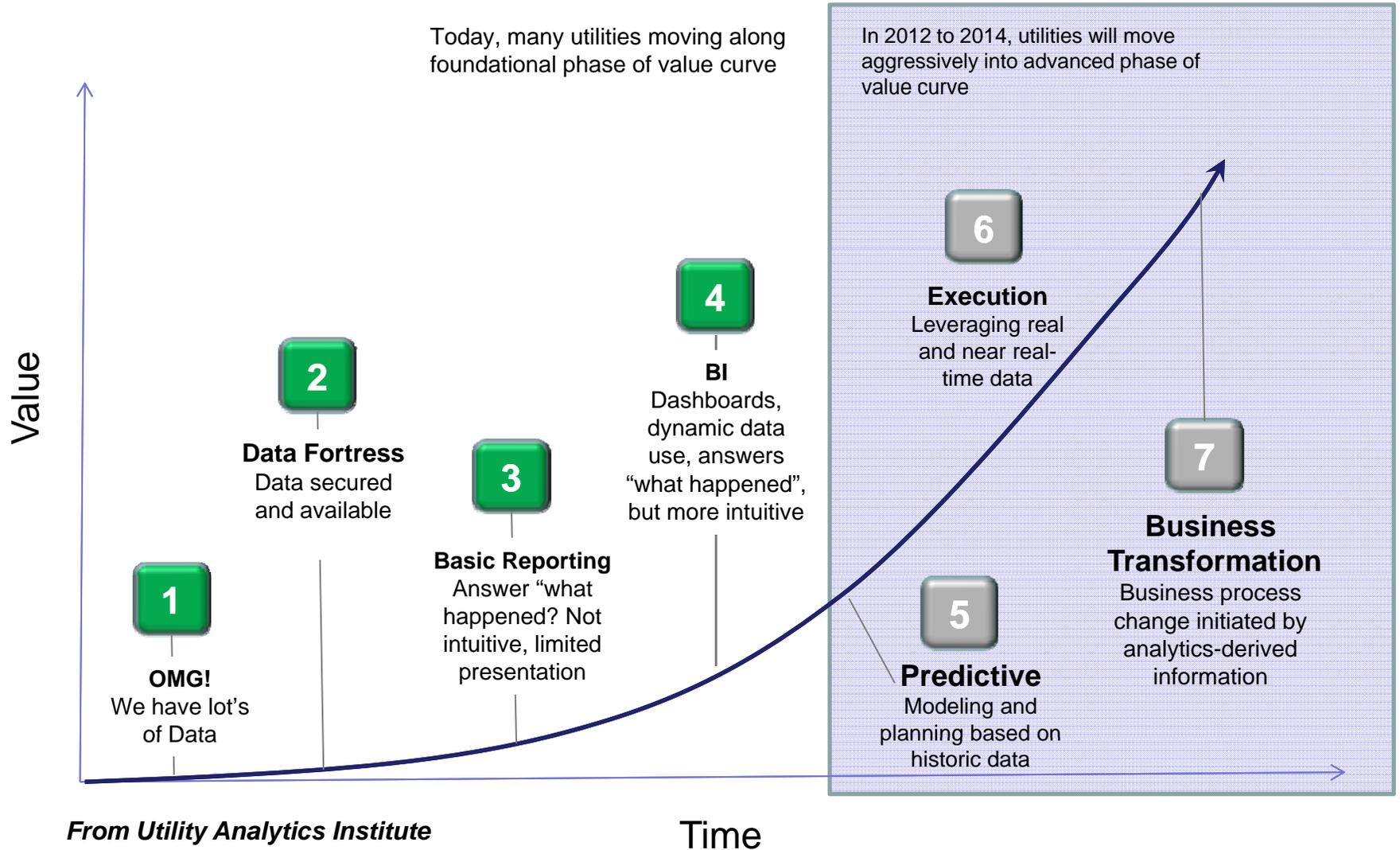
Need to protect future two-way communications for meter activity

Need to ensure future control capability is secure



# Utility 2.0 Data Analytics Vision

## Data Analytics Will Become More Dynamic Over Time



From Utility Analytics Institute

# PHI Deployment of Direct Load Control

Path to activating the Home Area Network and engaging demand

## Energy Wise Rewards NJ

- Comverge selected as vendor
- Smart Thermostats and Outdoor switches
- Program Currently Underway
- 25,000 Devices total
- Over 16,000 Device installed to date

## Energy Wise Rewards MD

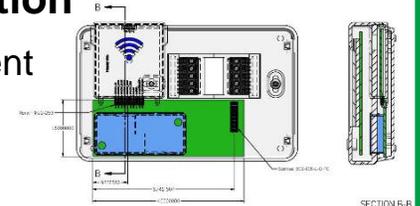
- Comverge selected as vendor
- Smart Thermostats and Outdoor switches
- Program Currently Underway
- 222,000 by Devices by 2013
- Compatible with AMI
- Over 100,000 Devices installed to date

- *PHI is planning a pilot of HAN devices in conjunction with PTR Pilot and rollout in MD*
- *PHI will wait for SEP 2.0 before considering full deployment of HAN Devices*



## Comverge Intellitemp Solution

- Changed platform from segment touch screen to dot matrix and keeping same font size of key elements
  - Flexibility & capability
  - Built-in IHD
  - More user friendly
- Full remote firmware upgradability
  - Ability to migrate to future Smart Grid functions
- U-SNAP swappable communication module option



# Benefits and Costs flow to Customers through both the Delivery and Energy components of the bill . . .

## Approximate Residential Customer Bill Breakdown

