Understanding and Maximizing AMI Benefits for Utilities

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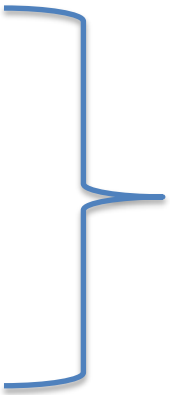
Structure of Today's Workshop

- Review basic frameworks & definitions
  - What is Advanced Metering Infrastructure (AMI)?
  - Solutions, tools, and applications
  - Regulatory compact
- Disruptive solutions and pressures on the electric business
  - AMI as a tool to help shape business
  - Does AMI become a cost of doing business?
  - Is it necessary to remain viable?
- Calculating the costs & direct benefits
  - AMI as a tool for process improvement
  - Total cost of ownership
  - Measured activities/benefit areas
  - Net Present Value (NPV) and Return on Investment (ROI) analysis
- Defining AMI requirements
  - Outline your needs vs. providing network specifications



The classical AMI cost-benefit analysis (NPV and ROI)

Discussion

- Why are you in business?
  - Today?
  - Tomorrow?
- What business are you in?
  - Today?
  - Tomorrow?

Framework and Definitions

What is AMI?

- There is neither a standard definition nor common industry set of requirements that describe AMI.
  - Many definitions describe AMI as an enhanced Automatic Meter Reading (AMR) system, with the most common distinction between AMR and AMI being the network's ability to support on-demand readings directly from a meter or other distribution device.
  - Other definitions provide a general statement of functionality and cost.

AMI is a subset of distribution monitoring, control, and analysis

What is AMI?

- A key function of AMI is to provide a foundation (communication and data integration) for broader demand side management and distribution automation efforts.
  - It is critical to consider the complete range of utility automation attributes for the long-term—not just what is needed for information exchange at the time of the initial deployment.
  - Meter readings may evolve to become more “real-time”, and any AMI implementation must provide the ability to cost-effectively migrate to this “real-time” information exchange.

Remember every AMI solution is proprietary – and the “functionality” acquired at implementation is often what you have for the life of the network.

Driving Value - Some Definitions

- A ***Solution*** is the resolution to a business problem.
- A ***Tool*** is a product, system or process that can serve as a stand alone solution or as part of a solution.
- An ***Application*** is the means by which a tool is applied.
- An ***AMI System*** is a tool. They vary in performance and functionality.
- An ***AMI Application*** is one that requires an AMI system. It may serve as a stand alone solution or as a part of a solution.

The breadth of "applications" supported will be critical in the selection of the AMI solution – cost, performance, and benefits.

What is the Value of AMI?

- AMI is a tool. The value of the tool is not in having it but in how it is used and applied.
- The ultimate value is driven by process and organizational change as it applies to consumers, utility operations, and management of power supply.

Not all value is directly measureable.

Obtaining AMI Value

- How did businesses initially cost-justify the cost of a Personal Computer (PC)?
  - It was a comparison of the time it would take to produce a letter on a PC vs. a typewriter.
  - The “benefits” were based on the time reduction of producing the final document (easier corrections and edits).
  - The real long-term benefits were not realized until the organization process and operations evolved.

AMI business cases based solely on labor and efficiency savings often fall short of showing a positive NPV/ROI

Example of Indirect AMI Value

- AMI can increase consumer satisfaction, empower consumer choices, and assist in consumer conservation and cost control. These indirect benefits not only impact consumers but utility employees as well.
- Empowerment of staff with current, timely, and accurate information can resolve issues quicker and with less conflict. This empowerment increases the quality of employee work life and consumer satisfaction.

Regulatory Compact

- You are guaranteed a monopoly service area. In return:
  - Regulated by utilities board or city council
  - Obligation to serve
  - Obligation to conserve (new)
- Today
  - Sell and distribute electricity
- Future
  - Manage consumer consumption and costs while providing comfort and convenience
  - Position the business to address social, economic, and environmental issues and perspectives
  - Support? Encourage? Deploy? ….renewable energy sources

AMI can assist in meeting new operating objectives, driving consumer and utility value, and support disbursed generation and other evolving business strategies

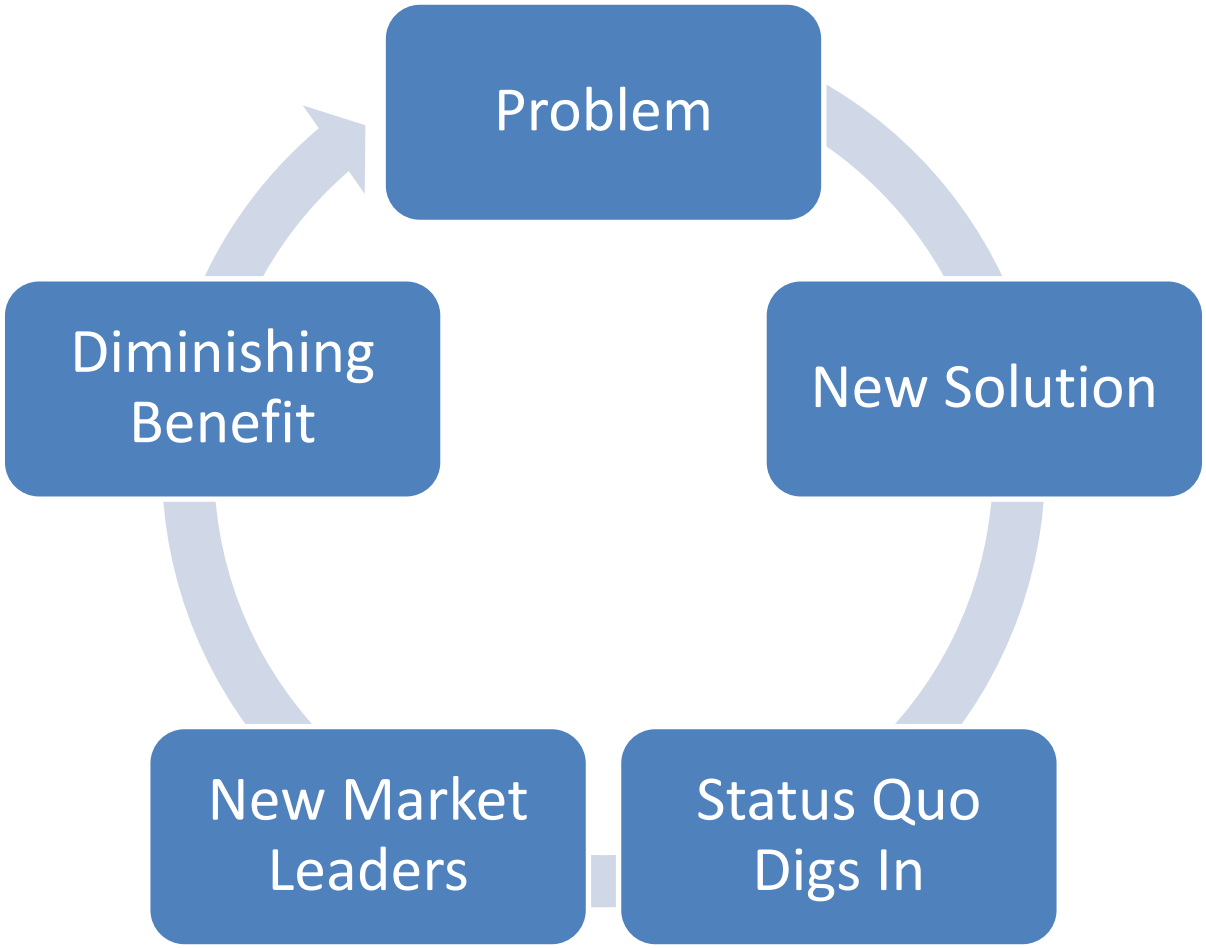
Disruptive Solutions and Pressures on the Electric Business

Topics and Disclaimers

- Direction of the industry as impacted by:
  - Competitors
  - New technology
  - Consumer preferences
- Disruptive Solution Cycle – impacts to your business
  - Higher rates for those who are left
  - Impact of a host of 3rd party providers
  - Loss of load
  - Decline to general fund
  - Complexity to manage (lot's of distributed generation)
  - Customer confusion.
  - More….
- The future…the next 5-15 years

DISRUPTIVE SOLUTIONS

Disruptive Solution Cycle



Example One – Pony Express

- On Oct. 24, 1861, after 112 days of construction, Western Union completed the first transcontinental telegraph, rendering the 18-month old Pony Express obsolete.

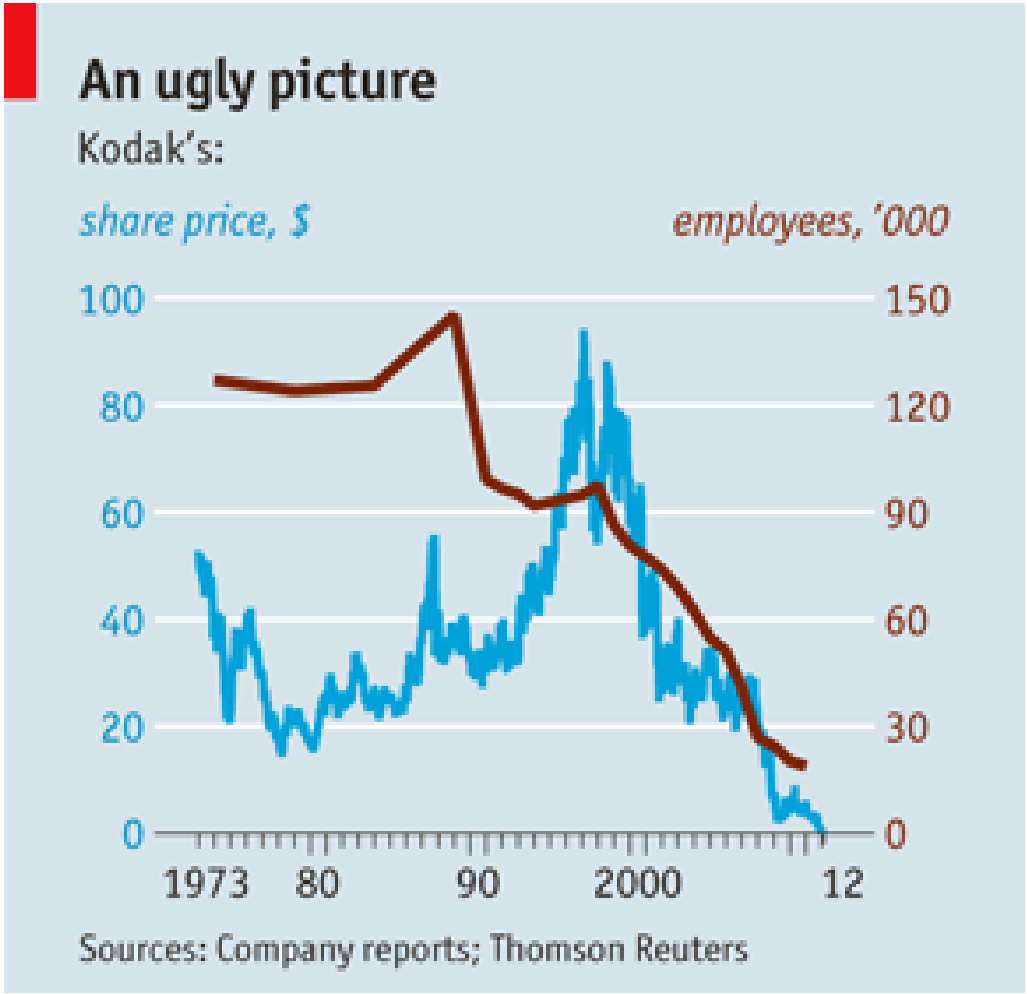
- The Problem: Expensive, Slow, Dangerous
  - New Solution?
  - Challenge Status Quo?
  - New Market Leader?
  - Did it last?

What did Western Union do with the telephone? Cellular telephone?

Example Two – Newsweek

- In December 2012, Newsweek printed it's last issue on paper. Forbes called it "Funeral for a Friend"
  - The Problem: Expensive, changing consumer preferences, substitute products
    - New Solution?
    - Challenge Status Quo?
    - New Market Leader?
    - Did it last?

Example Three - Kodak



Example Four – Ocean Liners

- 1900-1950 was the golden age of ocean liners. Enter commercial aviation and the industry essentially died in a ten year period.

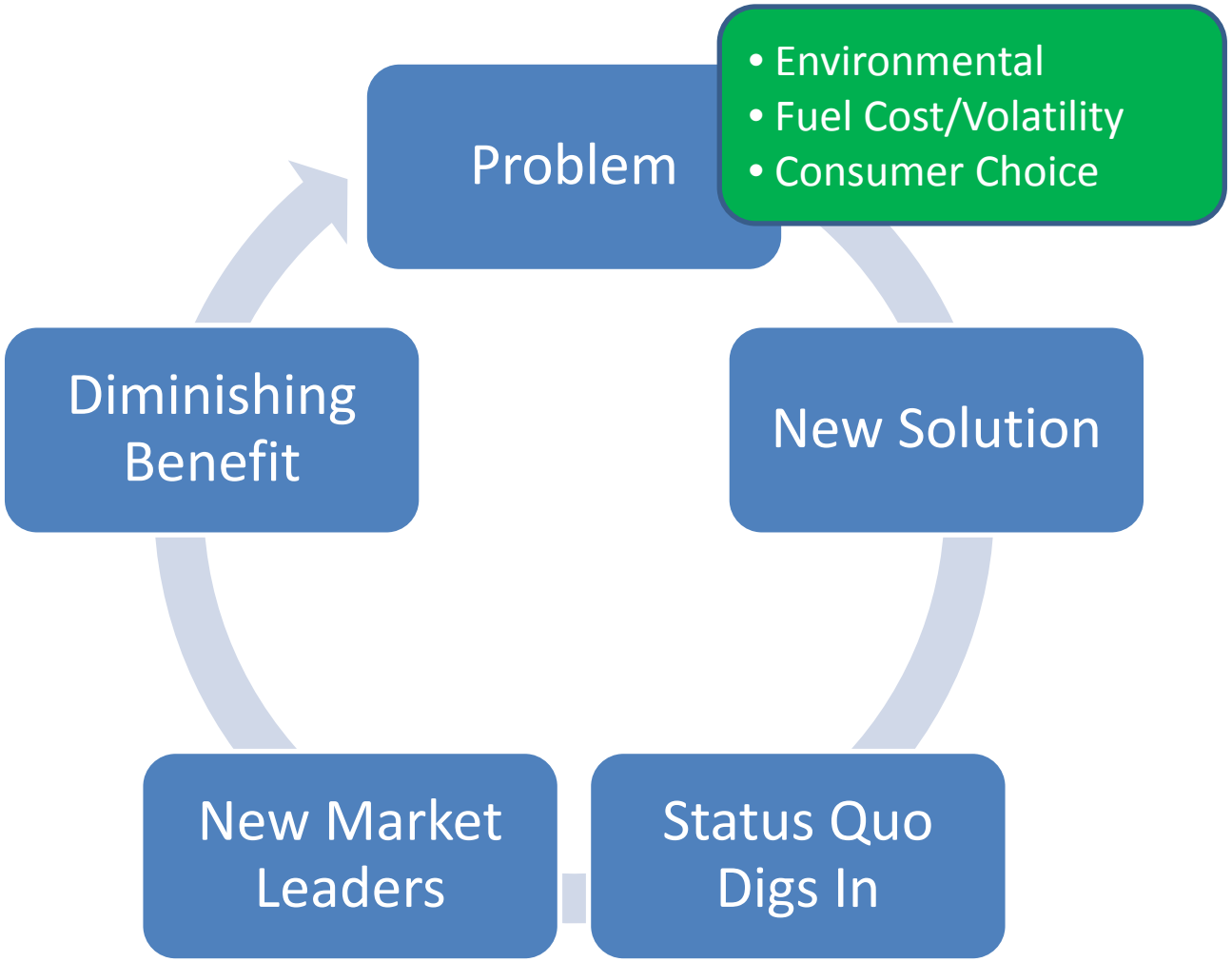
- The Problem: Slow, Expensive, High Capital Costs
  - New Solution?
  - Challenge the Status Quo?
  - New Market Leader?
  - Did it last?

THE PROBLEM(S)

The Problem(s)

- Environmental impact of bulk power grid dominated by fossil fuel
  - Perception not politics
- Fossil fuel cost volatility – consumer risk
- High base-load capacity power plant costs – significant investment risk
- Frustrated consumer – few options

Disruptive Solution Cycle

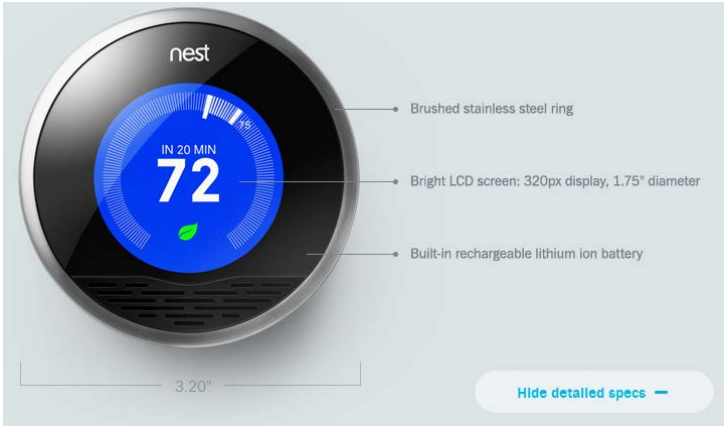


Disruptive Solutions – Energy Market

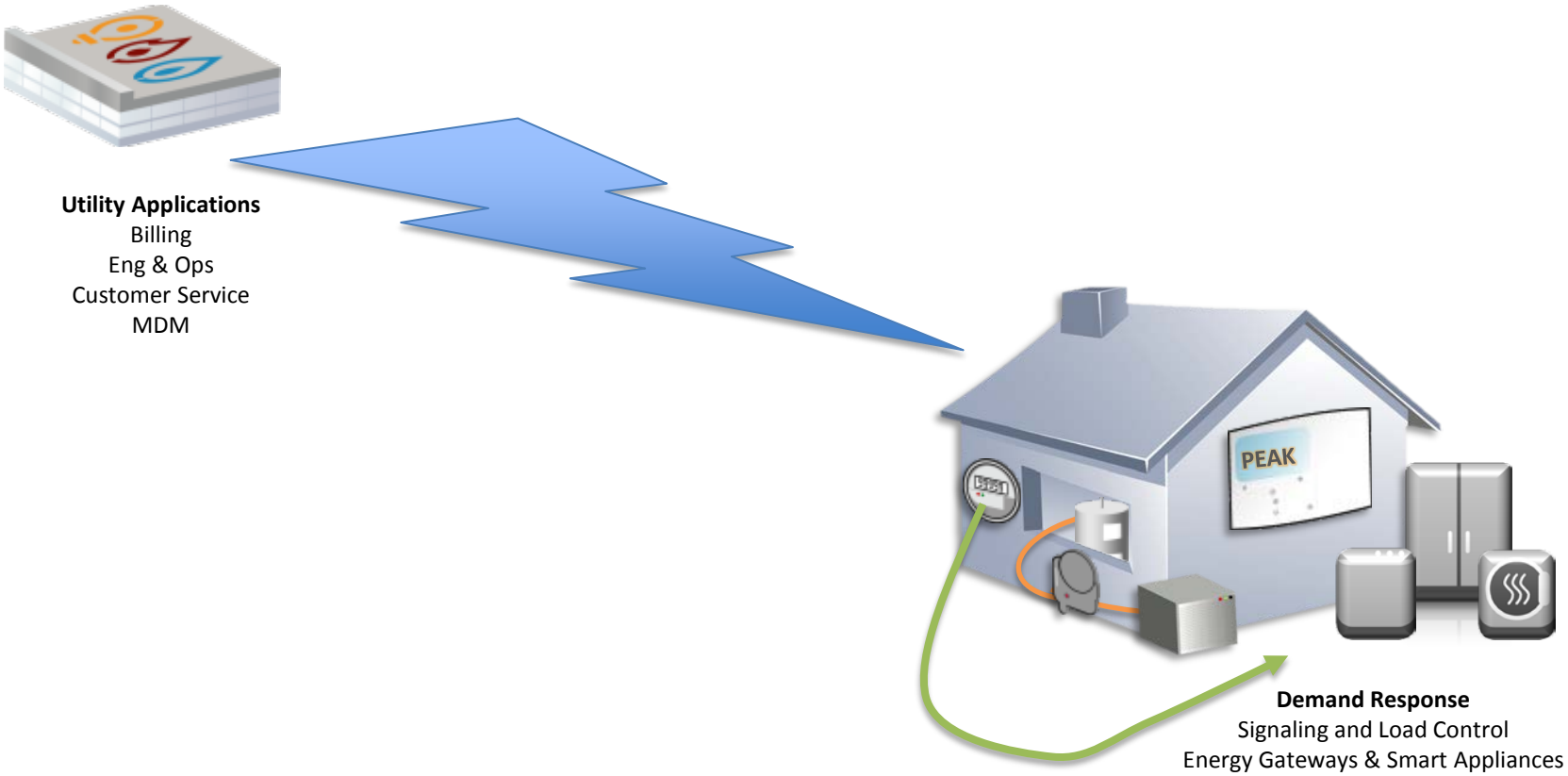
- Example: Four companies directly impacting the utility business (and our energy consumers) today.
  - What problems are they addressing, attempting to solve or solving?
  - Which markets are they disrupting?
  - What is the potential impact on your utility?
  - How does this impact the problems your trying to solve?

Disruptive Solution One – Nest Thermostat

- Most people leave the house at one temperature and forget to change it. So Nest learns your schedule, programs itself and can be controlled from your phone. Teach it well and Nest can lower your heating and cooling bills up to 20%. (From website)
- Stats and Info
  - Buy at Home Depot, Amazon
  - $200 and dropping



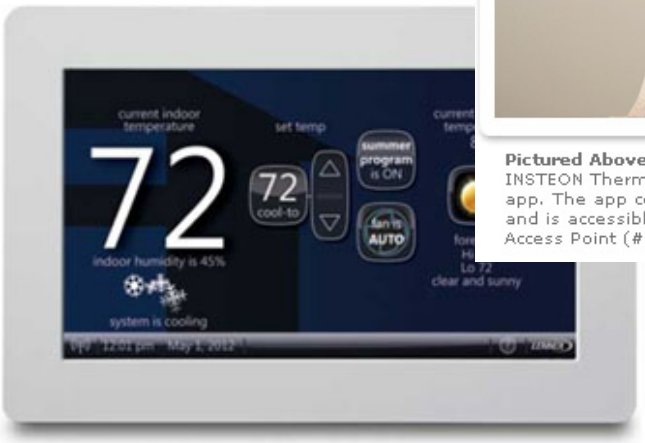
Demand Response – Utility Controlled



Utility Applications
Billing
Eng & Ops
Customer Service
MDM

Demand Response
Signaling and Load Control
Energy Gateways & Smart Appliances

Demand Response – Consumer Driven



Pictured Above
INSTEON Thermostat (#2441TH) controlled by an iPhone running INSTEON app. The app communicates to SmartLinc (#2412N) connected to a router and is accessible from home or anywhere in the world. Setup also requires Access Point (#2443).

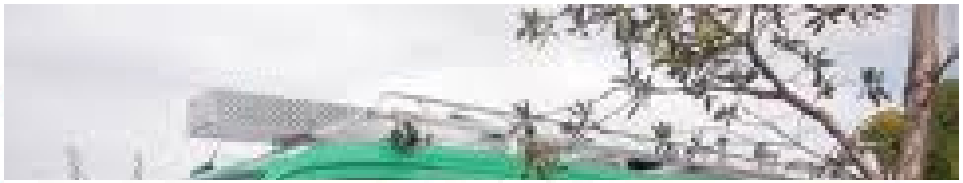
Nest Thermostat - Utility Impact

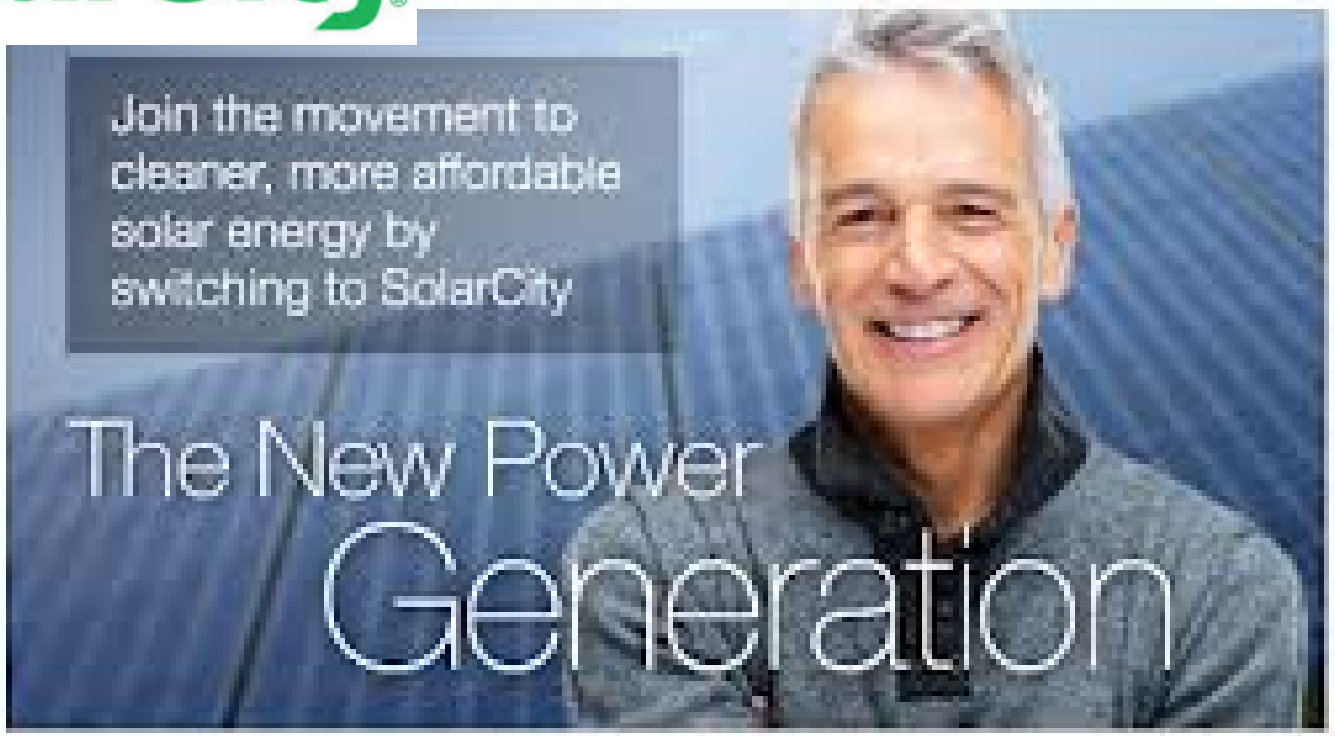
- What problem are they trying to solve?
  - Power Supply Cost/Environmental
  - Customer Offer (Satisfaction)
- What does it mean to utilities?
  - What is the utility role in consumer-driven DR?
  - What part will be owned by the consumer market?
  - If it's long path, how do we integrate consumption/pricing signals into third-party consumer portals?
  - What are communication performance requirements from the meter?

Disruptive Solution Two – Solar City

- Solar City is a provider of energy services to homeowners, businesses and government/non-profit organizations. Among its primary services, the company designs, finances and installs solar energy systems, performs energy efficiency audits and retrofits and builds charging stations for electric vehicles. (wiki)
- Stats
  - 1,600 employees
  - Operating in 14 states
  - 31 Distribution centers
- Customers (from website)
  - Solar City's customers include thousands of homeowners, more than 100 schools including Stanford University, government agencies such as the U.S. Armed Forces and Department of Homeland Security, and well-known corporate clients, including eBay, Intel and Wal-Mart.
- Net/Net?
  - **They take traditional utility customers off the grid.**

SolarCity





A Cleaner, More Affordable Alternative to Your Utility Bill

Solar City - Utility Impact

- What problem are they trying to solve?
  - Power Supply Cost/Environmental
- What does it mean to utilities?
  - What happens to obligation to serve?
  - What happens to fixed costs for other utility customers?
  - Power supply planning - uncertainty
  - Distributed generation (grid stability)
  - Communication requirements (AMI)
  - Net metering
  - Rate impact
  - Etc.

Wal-Mart

- Points from Smart Grid News:
  - Produce or procure 7 billion KWh of renewable energy every year (up 600% from 2010 levels!)
  - Reduce the energy intensity of its buildings by 20% compared to 2010 levels
  - Install solar on at least 1,000 rooftops by 2020 (it has 200 in place or in development now)
  - Increase LED usage indoors and outdoors
  - Be supplied 100% by renewable energy by 2020
- Mike Duke Quote:
  - "When I look at the future, energy costs may grow as much as twice as fast as our anticipated store and club growth," Duke said. "Finding cleaner and more affordable energy is important to our every day low cost business model and that makes it important to our customers' pocketbooks. Our leadership in this area is something our customers can feel good about because the result is a cleaner environment. And savings we can pass on to them."

Electric Vehicles (EV's)

- A few stats
  - 2009 - Battery cost per kWh - $1000
  - 2010 – Battery cost per kWh - $500
  - 2012 – Predicted to soon drop below $200 kWh
  - Expected sales by 2020 – 3.8 million units/year (Pike Resea
  - Some predict up to 20 million units/year by 2020

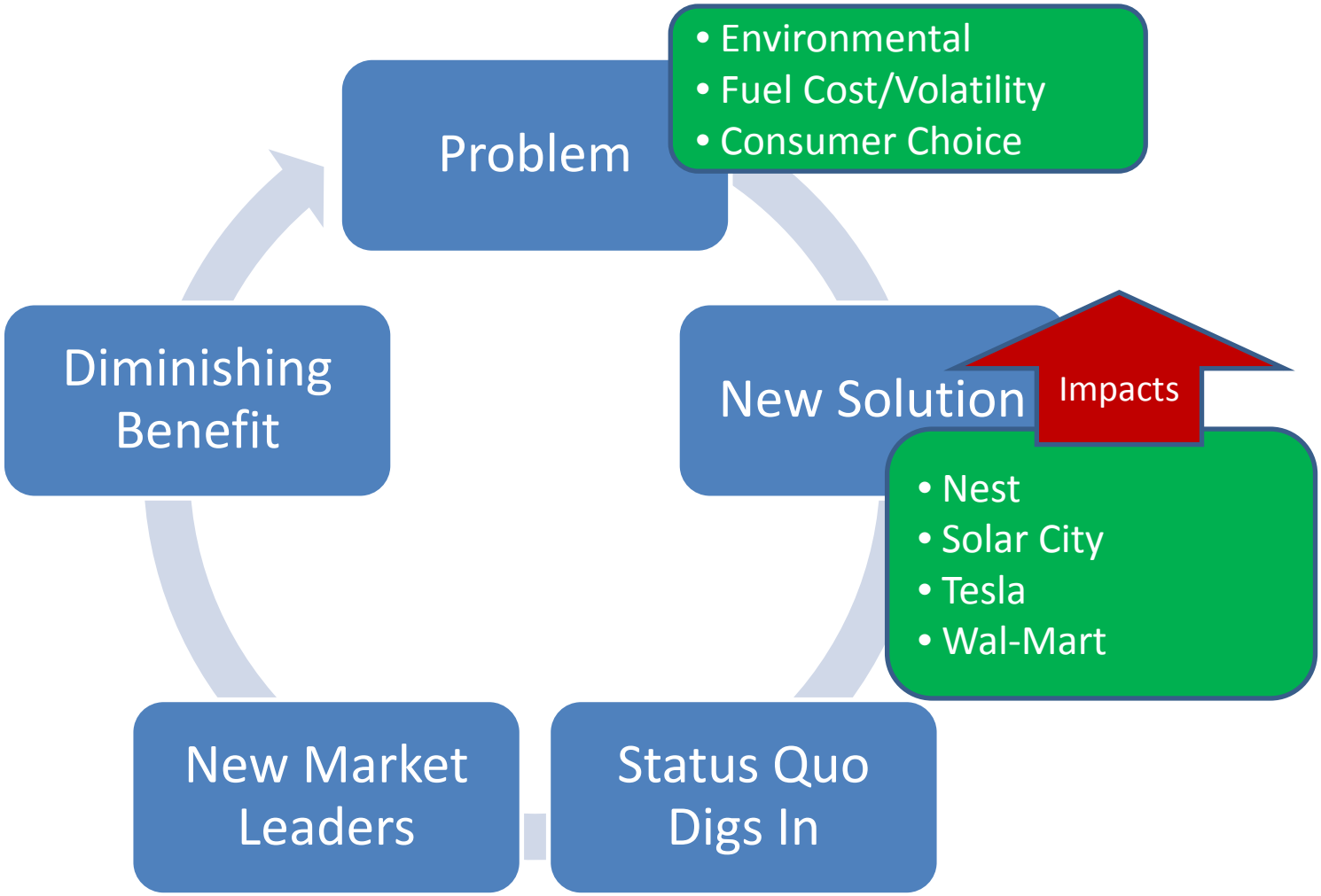
Disruptive Solution Three – Tesla Motors

- $57,400 (before tax credits)
- 265 miles on a charge
- 0-60 - 4.4 seconds
- Limit of 6,500 reservations – sold out

EV - Utility Impact

- What problem are they trying to solve?
  - Power Supply Cost/Environmental
- What does it mean to utilities?
  - Planning for high additional spot loads
  - Resellers
  - Distributed generation (Grid stability)
  - Communication Requirements (AMI)
  - Net metering
  - Rate redesign
  - Etc.

Disruptive Solution Cycle



STATUS QUO DIGS IN …….

The Status Quo – Change Resistant

Can coal be cleaned before it's burned?

Yes . inside and out!

Washing coal with ordinary water is nothing new.

But now – after thorough pilot testing – we are pioneering a much better and a more economical way to wash coal.

And clean it deeply, too.

The process is quite simple:

Raw coal is crushed, exposing more of its natural inner impurities.

The crushed coal is passed through a bath of heavy liquid. The lighter "cleaned" coal floats to the top and the heavier impurities sink to the bottom.

Test results have been so promising we are building a demonstration plant to process 125 tons an hour of tenaciously dirty coal.

Our objective is coal not angel-clean, but deep cleaned. Cleaner, certainly, than it could be with present washing methods.

And it will burn better as well as cleaner.

We expect this pioneering to make abundant Eastern high-sulfur coal more usable from an environmental standpoint. And more efficient from an operational standpoint.

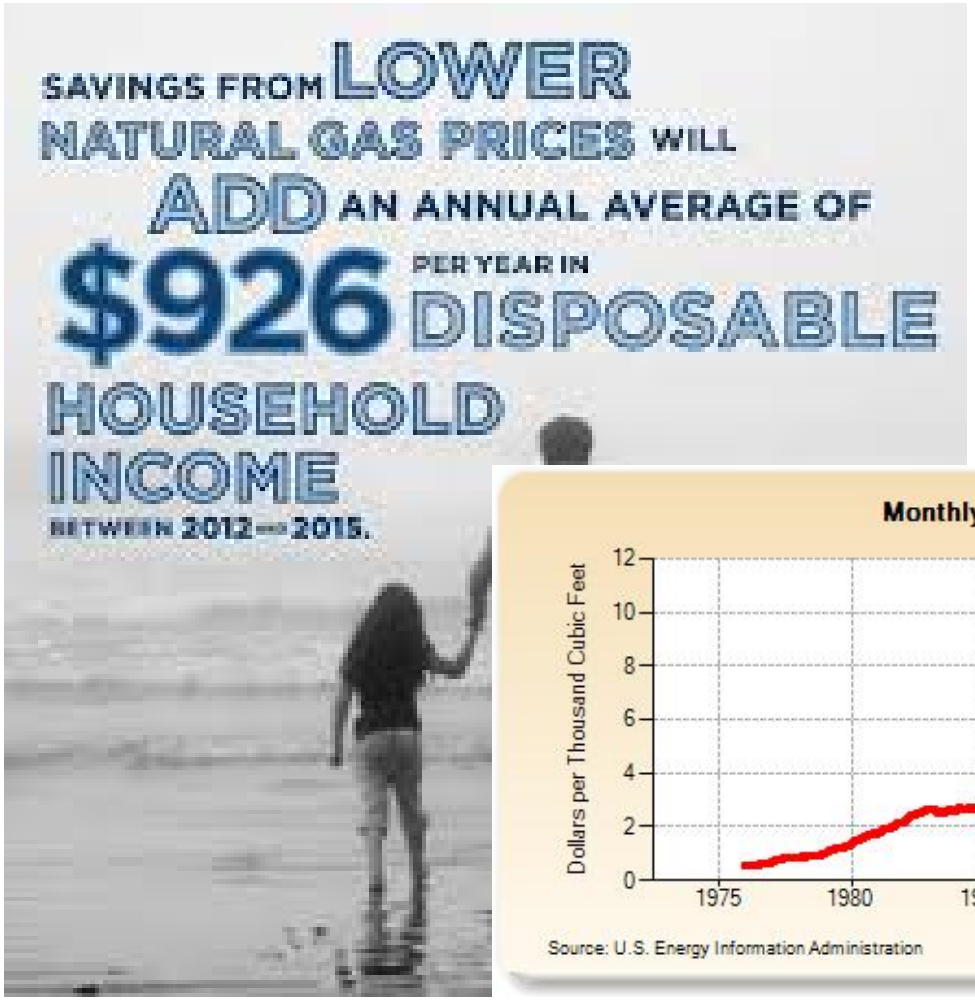
Cleaner coal. It will help make the America we see ahead a better America.

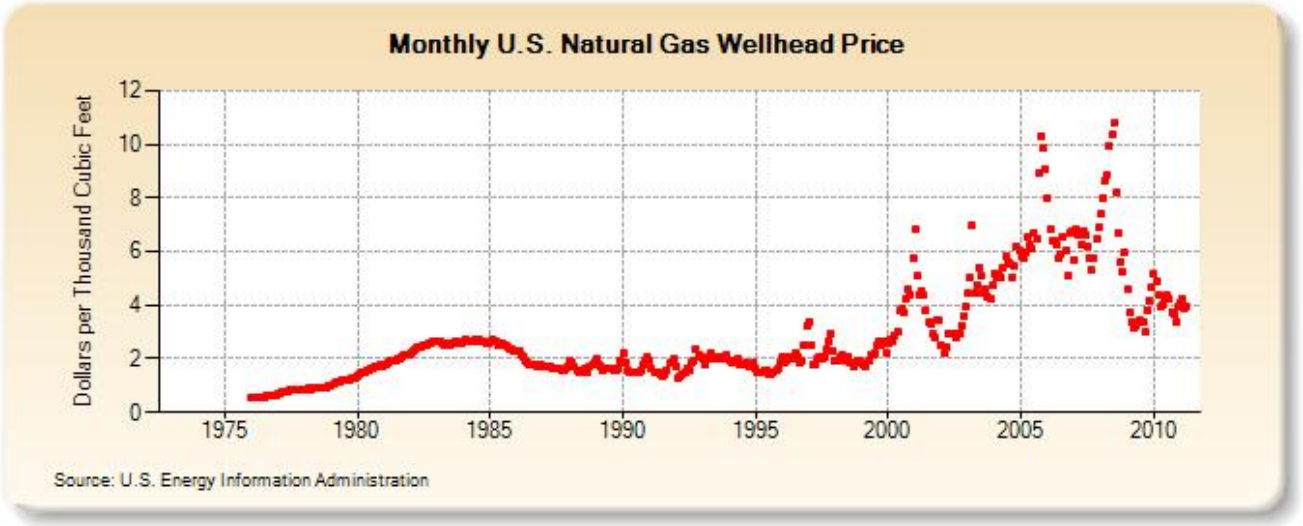
American Electric Power
we see a busier, better America

Serving in Ohio, Indiana, Michigan, Virginia, West Virginia, Kentucky, Tennessee.

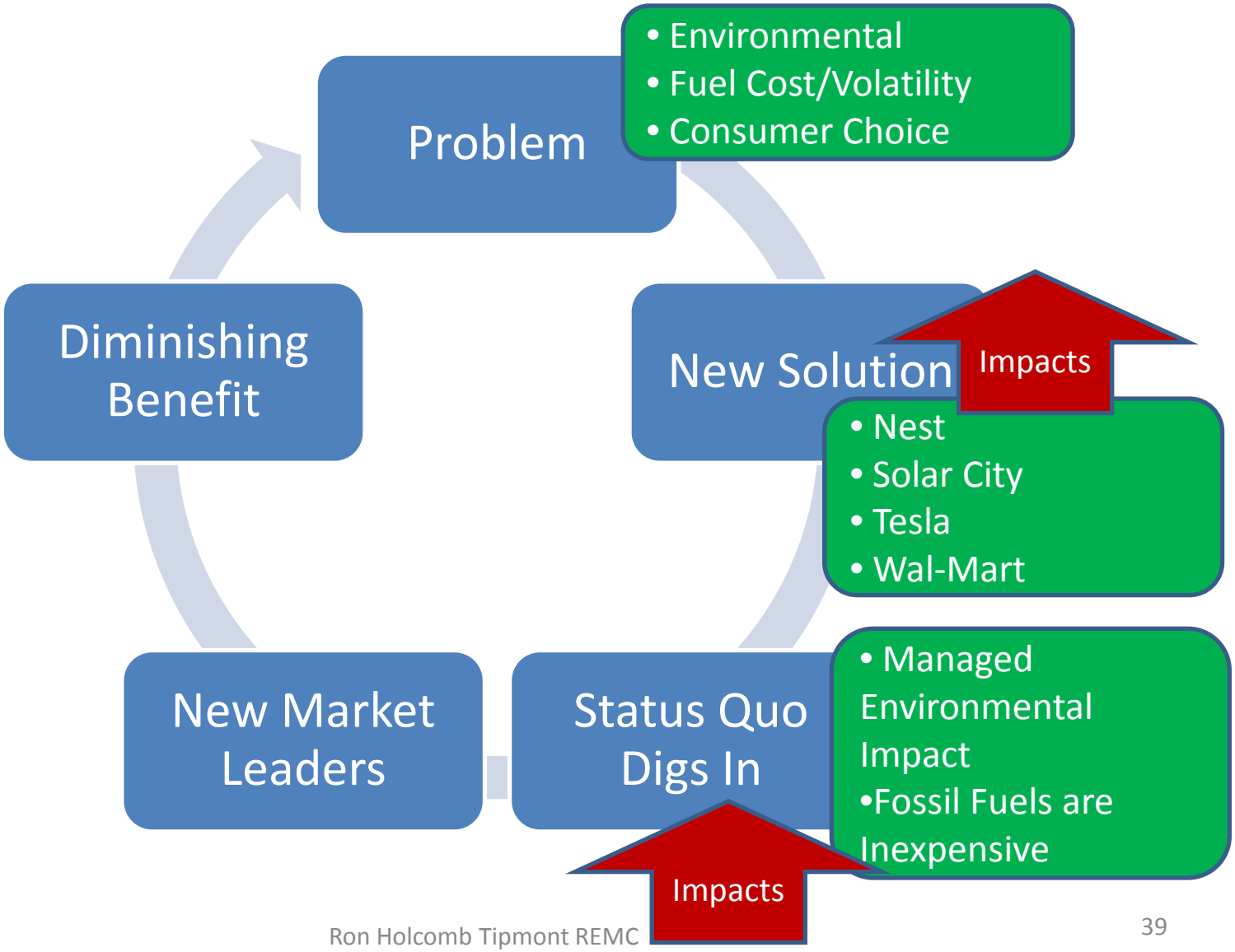
The Status Quo – Change Resistant

Status Quo – Change Resistant





Disruptive Solution Cycle



NEW MARKET LEADERS

New Market Leaders

- Market leaders will:
  - Give the customer what they want
    - At a price their willing to pay
    - When they want it
    - How they want it
- So…how do utilities thrive in this new world?

Be Leaders (examples)

- Understand energy technologies in the consumer marketplace
  - Leverage and partner
- Design business models that deliver electric energy to EV market
  - Retail
  - Sub metering
  - Pricing Options
  - Storage

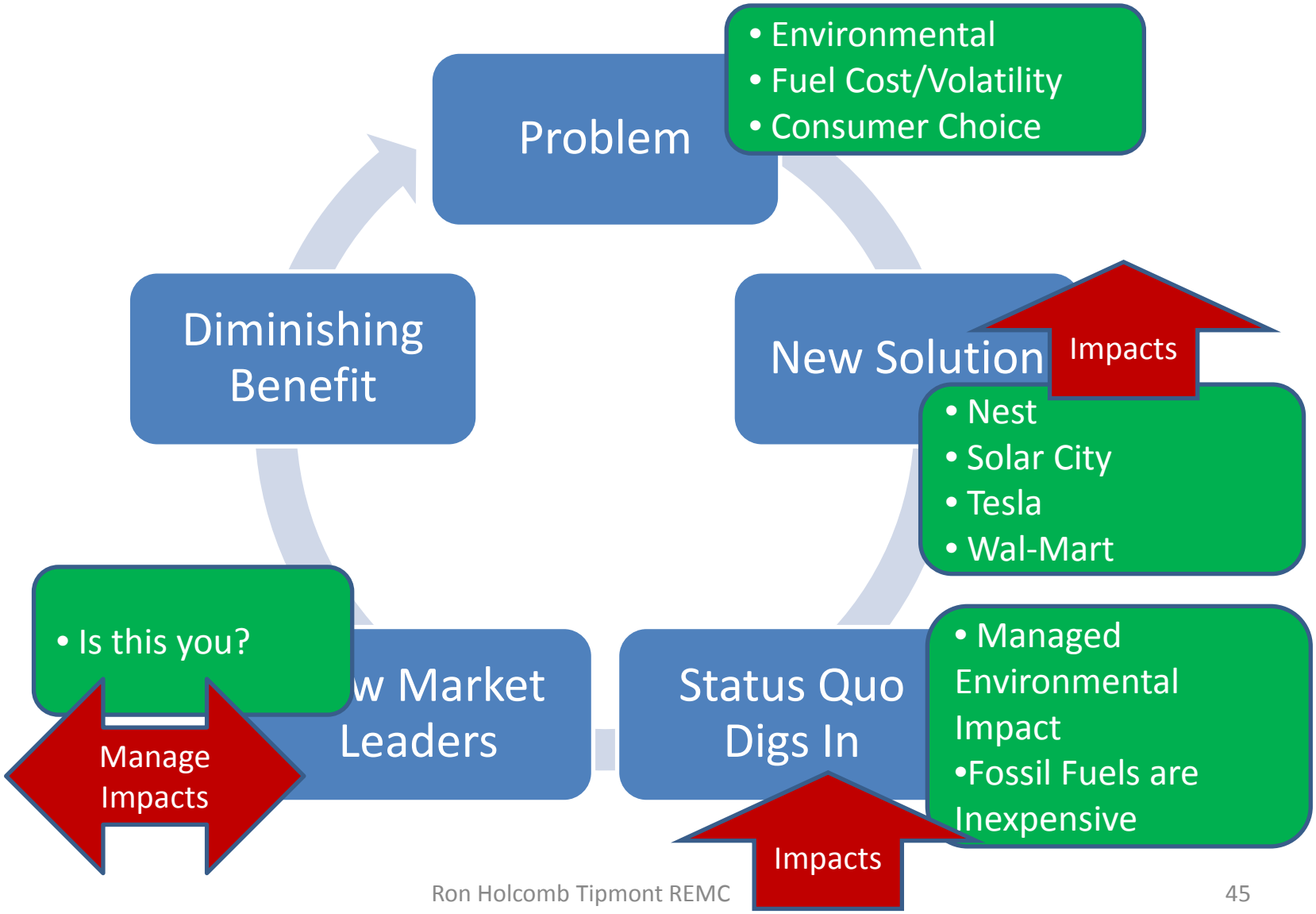
Be Leaders (examples)

- Build renewable generation for your customers that want it
  - Avoid market erosion
- Build high capacity, low latency communication networks to tie distributed supply to loads
  - Think micro-grid
  - Optimizing schemes

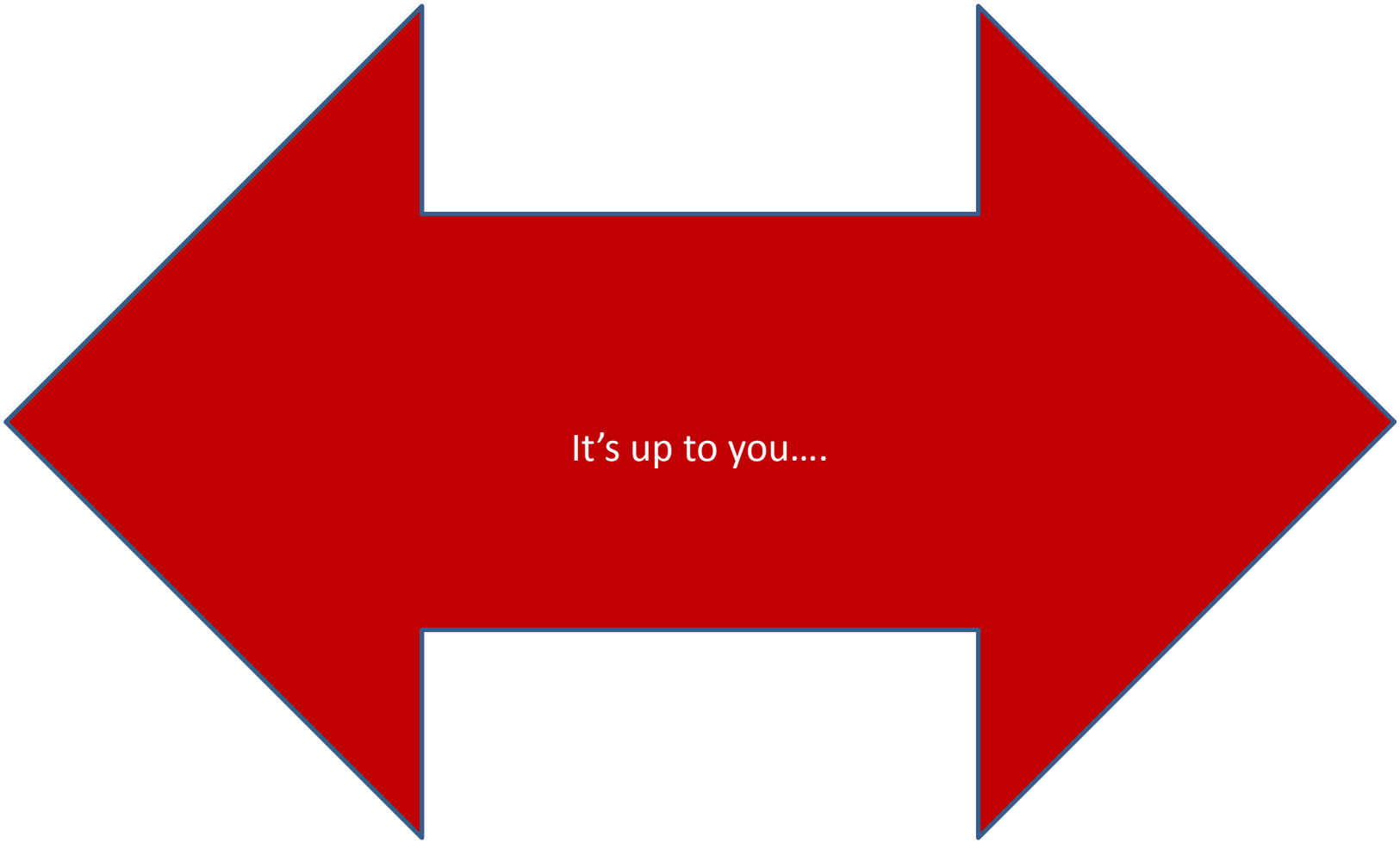
Be Leaders (examples)

- Get involved with thought leaders
  - Google
  - Wal-Mart
  - Smart Grid Developers
  - Solar City
  - Verizon
  - EcoFactor
  - Comcast
  - ……..

Disruptive Solution Cycle



So…Managing the Impacts?



Electric Utility - What, How & Why

- Manage for today (downside)
  - What business are we in today?
  - How is it managed?
- Manage for tomorrow (upside)
  - Why are we in the business?
  - What business are we in tomorrow?

Short Term vs. Long Term Perspective and Focus

Electric Utility - What, How & Why

- What business are we in today?
  - Distribution & centralized energy supply
- How is it managed?
  - Attributes such as
    - Affordability
    - Quality
    - Reliability
- What business are we in tomorrow?
  - Distribution only?
  - Distribution and dispersed generation?
- Why are we in the business?
  - Manage supply and resources?
    - Renewables
    - Distributed generation
    - Next phase of energy
- How is it managed?

Downside Management

Upside Management

Discussion

- Why are you in business?
  - Today?
  - Tomorrow?
- What business are you in?
  - Today?
  - Tomorrow?
- How does AMI fit?
- Is AMI a key to managing "for the customer”
- Does AMI become a cost of doing business?

Break

Return by 3:15

Calculating the Costs & Direct Benefits

Utility Challenges

- Customer: Manage end-customer service offerings and revenue.
- Operations: Increase operational efficiency and improve system reliability.
- Power Supply: Manage and reduce power supply costs.

AMI can deliver value to each of the challenges - including direct and indirect benefits to the utility.

AMI – Cost Components

- Implementation
- Operation & Maintenance (O&M)

Need to determine total cost of ownership, including: vendor maintenance and support fees, equipment replacements, and added staffing for the breadth of applications being considered.

Each AMI vendor has a different "pricing" strategy which greatly impacts the cost of ownership calculation

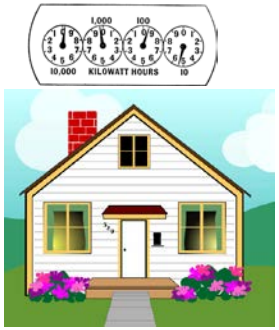
AMI Block Diagram

AMI Server
MDMS
Outage Management
GIS
CIS
SCADA
DA
Other

Wide Area Network (WAN) – Fiber, Cellular, WiMAX, Other

Local Area Network (LAN) – 900MHz radio, WiFi, PLC, Other

An AMI vendor will typically provide only a sub-set of the required elements – the cost analysis needs to include all elements including installation.



AMI Meter (E,G & W)
Home Gateway
Load Control
Smart Thermostat
Home Display

AMI – Implementation Cost Components

- Servers and Software (AMI, Meter Data Management System (MDMS), Load Management, DA, other)
- AMI Network
- AMI Meters & Endpoints
  - Electric
  - Water
  - Gas
- Installation Support Services
- Spare Parts and Special Equipment
- Year 1 License Fees and Technical Support
- Training

AMI – O&M Cost Components

- Annual Vendor Fees
  - License
  - Support

Annual license and support fees vary greatly by set of applications acquired and from vendor to vendor

- Battery Change Out
- Server Replacement (material and labor)
- AMI Network Maintenance
- AMI Electric End-Point Maintenance
- AMI Water Node Maintenance
- AMI Gas Node Maintenance
- Staffing

AMI – Cost of Ownership

Review of Cost Estimation Tool

Why vs. What & How

- Today (the downside management)
  - Process improvement
  - Reliability improvement
  - “Measured” savings
  - NPV/ROI based
- Future (the upside management)
  - Benefit measurement
    - Cost of keeping and evolving the business
  - Leap-of-faith based

Mitigate Risks vs. Politicizing Threats

AMI - Value Components

- Utility: reduce or eliminate existing or future utility costs
- Consumer: reduce or eliminate existing or future charges on energy/water bill.
- Societal: reduce impact of existing and future environmental and other societal costs

AMI is typically not justified on the elimination of meter readers.

AMI Drivers

- Legislative and regulatory
- Business case
- Vision

Benefit calculation focuses on the "Business Case" using measured direct benefits

Benefit Categories

- Efficiency
- Environmental
- Reliability
- Safety
- Security

Benefit Categories

- Efficiency
  - Leverage of assets
    - Sizing and loading of transformers
    - Deferred generation costs
    - Reduced congestion
    - Reduced ancillary service costs (spinning reserve)
  - Capital savings
    - Deferred investments
    - Reduced equipment failures

Benefit Categories

- Efficiency (Continued)
  - Operations & maintenance savings
    - Reduced equipment maintenance
    - Reduced distribution system operations cost
    - Reduced meter reading costs
  - Unaccounted for losses
    - Reduced energy and water theft
    - Reduced electric system losses
    - Reduced water system losses

Benefit Categories

- Efficiency (Continued)
  - Electricity cost savings
    - Reduced energy consumption
    - Reduced demand charges

Benefit Categories

- Environmental
  - Air emissions
    - Reduced CO_2 and other emissions
- Reliability
  - Power interruptions
    - Reduced sustained outage
    - Reduced major outage
    - Reduced restoration costs
  - Power quality
    - Reduced momentary outages
    - Reduced sags and swells

Benefit Categories

- Safety
- Security
  - Energy security
    - Reduced oil usage
    - Reduced widespread blackouts

AMI – Cost of Ownership

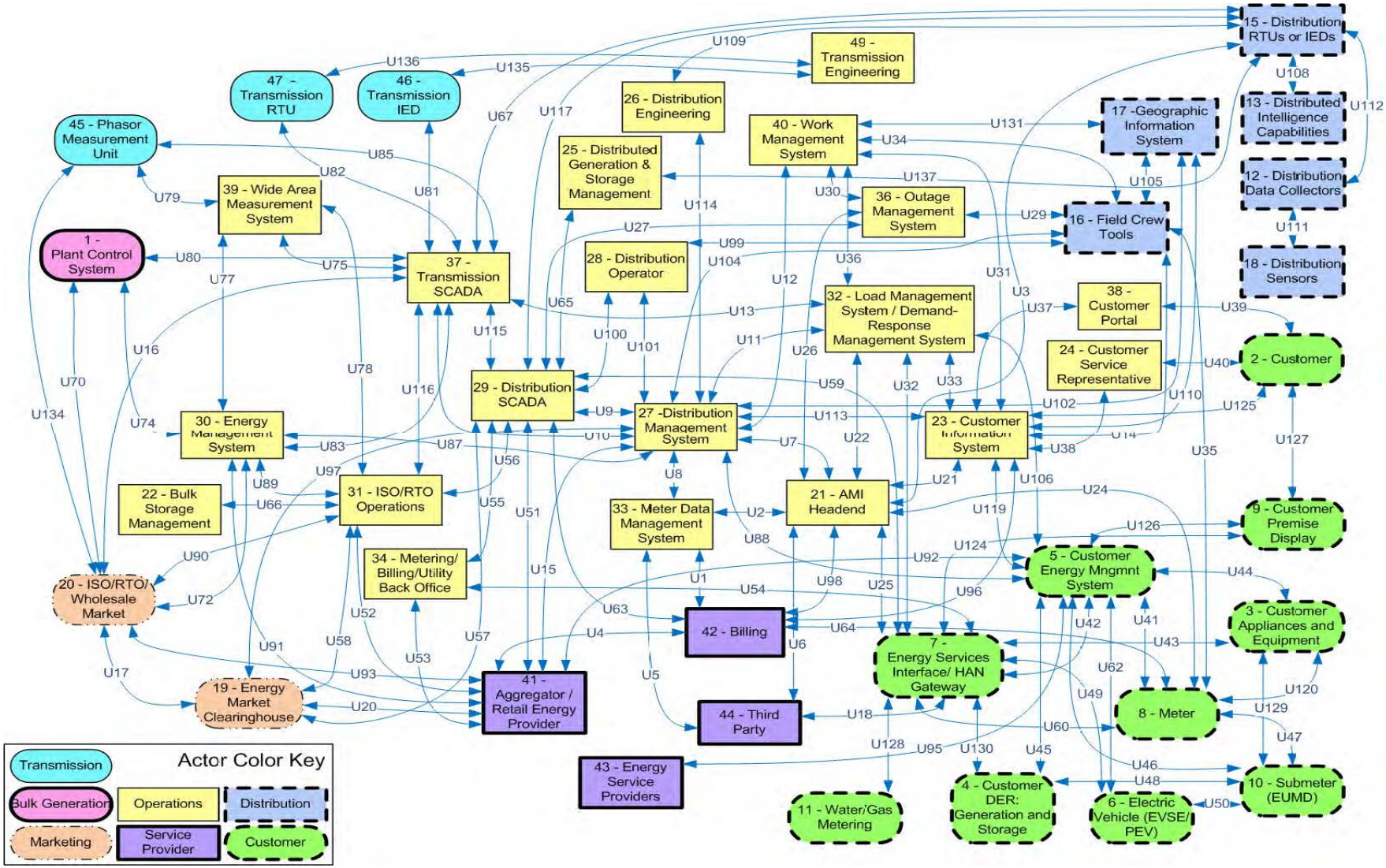
Review of Value Estimation Tool

Defining AMI Requirements

Why is an RFP is Important?

- Vendors will provide you a template……..
  - Provides you a tool but needs vetting
  - Positions their solution as the only one to meet RFP requirements
  - Defines your requirements to fit their solution
  - Attempts to change your needs to fit their solution
- **Your RFP needs to**
  - Outline your requirements – performance and operation
  - Outline your data flow – role of the AMI server and if MDM is planned
  - Defines your desired applications today and tomorrow
  - **Get vendors to define and explain how their solution fits or does not fit your requirements**

AMI Data Flow



AMI – Analysis Tool Requirements

- Distribution analysis
  - Distribution system design
  - Transformer sizing
  - Weak asset identification
- Demand management
  - Conservation voltage reduction (CVR)
  - Load management
    - Air conditioner control
    - Electric water heaters
    - Dual fuel
- Utility management
  - Meter alerts (email/text)

AMI – Analysis Tool Requirements

- Billing data
  - Commercial billing demand (kW)
  - Commercial demand billing (KVA)
  - Coincident demand reporting KVA, kW, kVAR
  - Provide energy consumption and demand data for cost of service/rate design

AMI – Reporting & Control Requirements

- Power quality
  - Flicker source identification (blinks)
  - Outage notification
  - Outage restoral notification
  - Power factor monitoring
  - Power quality monitoring
  - Sag/swell alarms
  - System voltage reporting
- Consumption data
  - Net metering
  - Coincident demand reporting KVA, kW, kVAR
  - Load research

AMI – Reporting & Control Requirements

- Consumer support
  - Retail peak alert notification - pricing
  - Billing and rate options
    - Aggregated billing
    - Real time pricing
    - Residential demand
    - Time-of-Use billing
    - Critical peak pricing/rebate
  - Customer energy use reporting
  - Customer portal
  - Pre-payment
  - Smart phone - consumption display (commercial)
  - Smart phone - consumption display (residential)

AMI – Reporting & Control Requirements

- Customer delivery
  - Remote connect/disconnect
  - Remote on-demand meter reading
  - Customer generation status
  - Alerts (pricing, other)
  - Tamper detection
- Distribution system
  - Distributed generation monitoring
  - Fault indicator monitoring
  - Recloser management
  - Recloser monitoring
  - Capacitor bank monitoring and control (VAR control)
  - Street light monitoring

Summary - Obtaining AMI Value

- How did businesses initially cost-justify the cost of a Personal Computer (PC)?
  - It was a comparison of the time it would take to produce a letter on a PC vs. a typewriter.
  - The “benefits” were based on the time reduction of producing the final document (easier corrections and edits).
  - The real long-term impact was not realized until the organization process and operations evolved.
- AMI is a tool. The value of the tool is not in having it but in how it is used and applied.
  - AMI value is driven by process and organizational change

Summary - Obtaining AMI Value

- Do you view AMI as a disruptive technology or just a replacement of the meter reader?
- AMI can have a impressive NPV/ROI if you can take advantage of the potential breadth of indirect and direct benefits.
  - Utility: reduce or eliminate existing or future utility costs
  - Consumer: reduce or eliminate existing or future charges on energy/water bill.
  - Societal: reduce impact of existing and future environmental and other societal costs
- AMI is just one part of the solution - transformation to an IT based organization
- Business cases based solely on labor and efficiency savings often fall short of showing a positive NPV/ROI

Questions

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Thank You