Presentation of

Active Energy Management
Ahead of the meter and behind the meter

Presented by

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Our Goals

- Energy Background
  - Micro
  - Macro

- Energy Supply Management
  - The Players
  - 7 Steps & Technology
  - Visibility

- Sustainable Energy Community

- Questions
Energy – Micro Discussion
Projected Natural Gas Storage

Working gas in underground storage compared with the 5-year maximum and minimum

Source: U.S. Energy Information Administration
YTD Storage Position

Working gas in underground storage compared with the 5-year maximum and minimum

billion cubic feet

Source: U.S. Energy Information Administration
Extreme Weather Recovery

<table>
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<tr>
<th>Year</th>
<th>BCF</th>
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<th>Weeks</th>
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<td>2015</td>
<td>1461</td>
<td>4009</td>
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</tr>
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Source: EIA
Transmission Cost Impact

- Capacity
- Transmission
- Obsolete Asset Cost Recovery

Figure 2: Example of New York Capacity Tag for Two Customers on the Peak System Demand Day.

Even though the industrial manufacturer has a higher peak demand than the government building for the day, its load curve is more flexible. It can reduce its load during the grid's peak hour in response to a Capacity Tag alert. Thus, it is able to reduce its ICAP tag below that of the government building, which has a more fixed consumption level during the day.
Energy – Macro Discussion
Pipeline Gas Expansion

1,500,000 Dths/day

Source: Dominion Transmission

The Trend

Source: Bloomberg Energy
Significant increase in export volumes beginning in 2018 and by 2019, US will become the 3rd largest exporter of LNG in the world, behind Qatar and Australia.

Source: EIA
Coal Retirement

Between 30 – 70 Gigawatts

Projected retirements

Source: EIA
Coal Retirement BCF Impact Winter Summer

Fundamental impact to natural gas market

Source: EIA
Daily Usage in BCF

Significant impact to pipeline operations and storage

Source: EIA
Summer Injection Last three years

Fundamental impact to natural gas market

Source: EIA
Energy Supply Management
Procurement Players and Strategies

- Suppliers
  - Fixed
  - Floating with Index/Fixed Components
  - Pricing advice is a conflict of interest

- Traditional Brokers
  - Point in Time
  - Dependent on Suppliers for pricing
  - Emotional
Consultancy Plus Technology
An Active Energy Management Strategy

- Risk Tolerance
- Benchmarking
- Contract Structure
- Supplier Selection
- Market Indicators
  - Define Buys
  - Hedge Process
  - Budget Setting & Tracking
- Execution
- Reporting & Greenhouse Gas Emissions

Pennoni OPTICS
Visibility

- Market
  - Commodities
  - Trend Analysis
  - Understanding Market Structure
Visibility Leads to Feasibility

- Access to quality data reduces cost
- Speeds up the process
- Proper financial evaluation is easier
Sustainable Energy Community

- A “Sustainable” technology is one which is:
  - Environmentally friendly
  - Economically viable
  - Beneficial to Society

- A “Sustainable” Energy Community is one which is:
  - No longer depends on natural gas utility or interstate pipeline
  - No longer depends on power utility or grid
  - Has continuous energy production and generation
Problem Statement

- 3 billion tires in landfills and storage sites in the US
- U.S. and Canada generate 300 million scrap tires annually
- Current reuses
  - Relocate tire materials
    - Rubber mulch, crumb rubber for play fields/ground (now being banned), sandals... etc
  - Produce CO2
    - Burning or incineration
Previous Technology Failures

- **Types**
  - Incineration
  - Plasma-thermal oxidation
  - Gasification
  - Digestion

- **Issues**
  - Toxic waste & CO2
  - Maintenance
  - High costs
Thermolyzer

- Continuous energy
  - Natural gas
  - Hot water
  - Steam
  - Chilled-water
  - Electricity
Heating Value

![Bar chart showing energy content (BTU/ft²) for different feedstock materials.]

- Tires: 1067
- Methane: 1012
- Plastics: 770
- MSW: 701
- ASR: 652
- Landfill gas: 457
- Wood: 385

Feedstock Material
Why

- Cleaner than natural gas
- CO2 benefit
- Behind the meter
  - Avoid utility distribution and grid transmission costs - $$$ Savings
  - Self-funded projects > avoid energy costs
- Solves an environmental issue
- Removes dependency of utility and grid infrastructure for gas and power
Questions?
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