

the Energy to Lead

Natural Gas in a Smart Energy Future

Presented by:

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Gas Technology Institute (GTI)

- > Not-for-profit research, with 70 year history
- > Facilities
 - 18 acre campus near Chicago
 - 200,000 ft², 28 specialized labs
 - Other sites in Oklahoma and Alabama
- > Staff of 250
- > Market opportunities are creating substantial growth
- > 1,200 patents; 750 products



Offices
& Labs



Flex-Fuel
Test
Facility

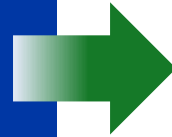


Energy & Environmental Technology Center

“Smart Grid” Evolves to “Smart Energy Grid”

“Smart Grid”—Electric Centric

- > Offers increased customer involvement, integrated clean electricity, enhanced reliability and energy security
- > In 2009, DOE awarded \$3.4 billion to initiate deployment of electric smart meters, infrastructure, and consumer technologies



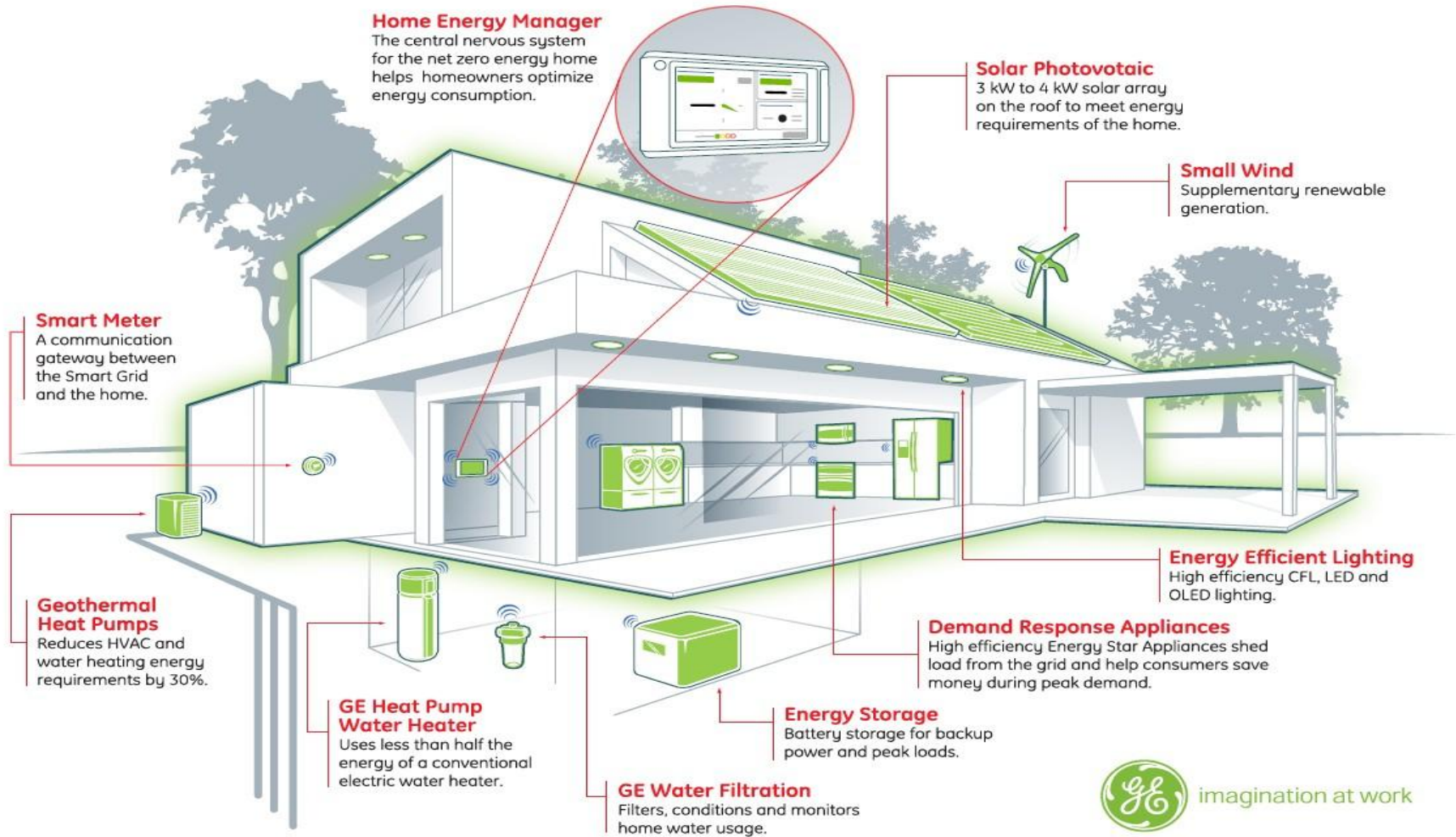
“Smart Energy Grid”

- > Requires the intelligence and efficiency of the full energy resource mix to reach its full potential
 - Integrates renewable energy resources and natural gas generation to reduce carbon emissions
 - Improves the efficiency and carbon footprint of energy end users
 - Contains the cost of energy for end customers

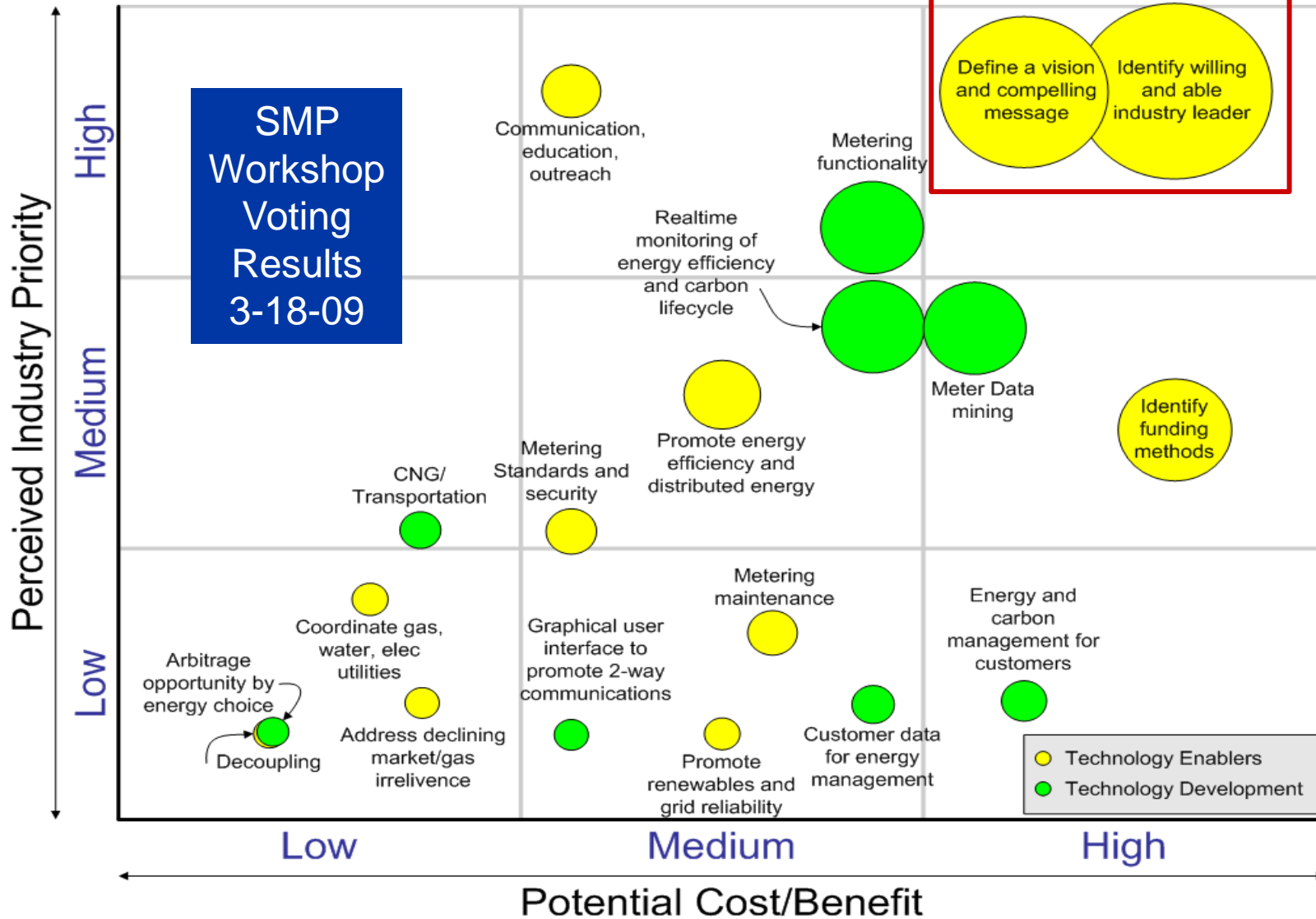
Natural gas is a critical component

Here is One Vision

GE Targets Net Zero Energy Homes by 2015



Getting Started



Context and Objective of our Vision Study

- > Smart Grid and smart energy have largely been defined in terms of electricity in the political, commercial, and public sectors without consideration of the value of natural gas and its infrastructure
- > What is the role of natural gas in these discussions? Depends on whom you ask
- > The Need – An industry-aligned Vision that can be easily articulated to provide the basis for industry policy and funding decisions (Phase 1)
 - Guidance for R&D, infrastructure investment, and customer experience enhancements
 - Justify support from provincial and federal agencies, legislators and state regulators
 - Identify mechanisms for long-term job creation

Phase 2 will create the strategies and implementation plans to realize this vision

Bringing the Industry Together

- > American Gas Foundation
- > APGA Research Foundation
- > Canadian Gas Association
- > Natural Gas Supply Association
- > INGAA Foundation
- > Operations Technology Development, NFP
- > Utilization Technology Development, NFP
- > Sustaining Membership Program

The Vision

Strategic Resource for Electricity

Smart Resource for Homes and Businesses

The Vision for Natural Gas in a Smart Energy Future

Natural gas is an abundant, domestic, low-carbon resource for electricity, and a smart energy source for homes and businesses. Smarter natural gas systems result in a secure, reliable and efficient energy infrastructure for North America, and enable smarter electric grids.

Supply

Improved communication between supply and electric generation, including variable renewable resources, is effectively used to enhance responsiveness and operation of the electric grid.

Delivery

Communications and intelligent field devices are effectively used to enhance safety and efficiency of the network and accommodate new end uses and supply sources.

End Use

Comparable attributes of various energy sources are established and made available to consumers, allowing them to make informed decisions and better choices about energy use.

The Game Changer

As concerns of:

- > Long-term supply
 - > Price volatility
 - > Environmental impacts
 - > Energy security
- are addressed



Power Generation and Grid Interoperability

Why it Matters:

- > Largest and fastest growing sector since 2006
- > 900 of the next 1,000 plants to be natural gas
- > Retire or convert 10-75GW of coal by 2020

What Size (Billions):

- > \$24B in capital spend 2011

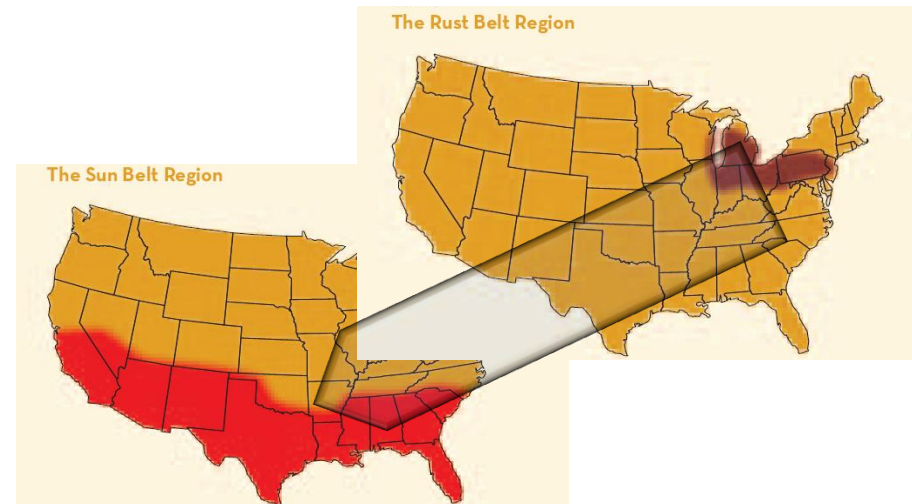
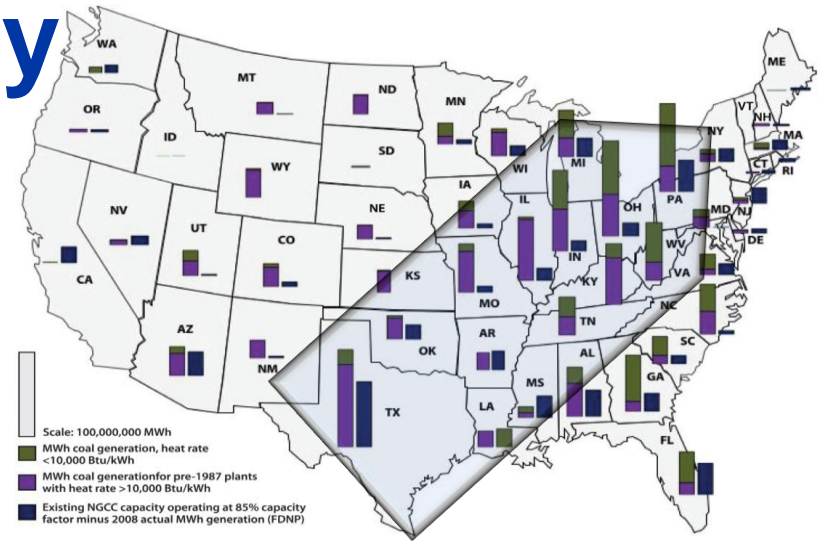
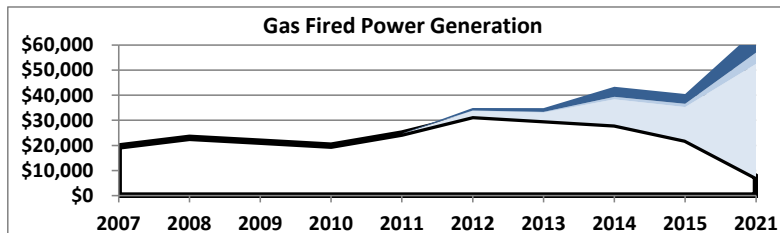
What Accelerates:

- > Old coal fleet with high heat rate
- > Low cost and stable natural gas prices
- > Shale gas proximity to old coal fleet

What Obstacles:

- > Lack of comprehensive energy policy
- > EPA position on Hydro-Fracturing

What Timeline:



Recommended Actions – For Industry

Enhance or Create Capabilities for Supply to:

- > Create and expand real-time communications between the gas and electricity grids
- > Manage natural gas supply for fast-ramping generation to complement variable renewable resources and provide ancillary services
- > Resolve the issues related to developing shale gas as a long-term energy source

Recommended Actions – For Industry

Overarching Emphasis on Safety

Enhance or Create Capabilities for Delivery to:

- > Meet the needs of all current and future end-uses
- > Accept and distribute a wide range of renewable gas sources
- > Accommodate emerging technologies, peak demand, energy efficiency programs, and new sources of supply
- > Improve natural gas asset utilization on a real-time basis

Recommended Actions – For Industry

Enhance or Create Capabilities for End Use to:

- > Moderate peak electricity demand by using natural gas cooling in commercial applications and DG/CHP on an aggregated basis or as part of a microgrid for residential and/or commercial consumers
- > Advocate the use of DG/CHP systems at industrial and commercial applications
- > Develop hybrid electric/renewable/natural gas appliances
- > Provide customers information to make educated choices about their energy usage and energy appliance selections

Recommended Actions – For Policymakers

Research and Development/Budget

- > Optimize common infrastructure by including natural gas in advanced metering infrastructure
- > Ensure federal funding for Smart Grid encourages and allows dedicated natural gas projects and combined electric/natural gas projects
- > Develop a technology roadmap for natural gas
- > Increase governmental funding for basic and applied research in natural gas safety, reliability and smart energy infrastructure technology
- > Establish a governmental public-private research, development and deployment program similar in size to the electric Smart Grid programs

Recommended Actions – For Policymakers

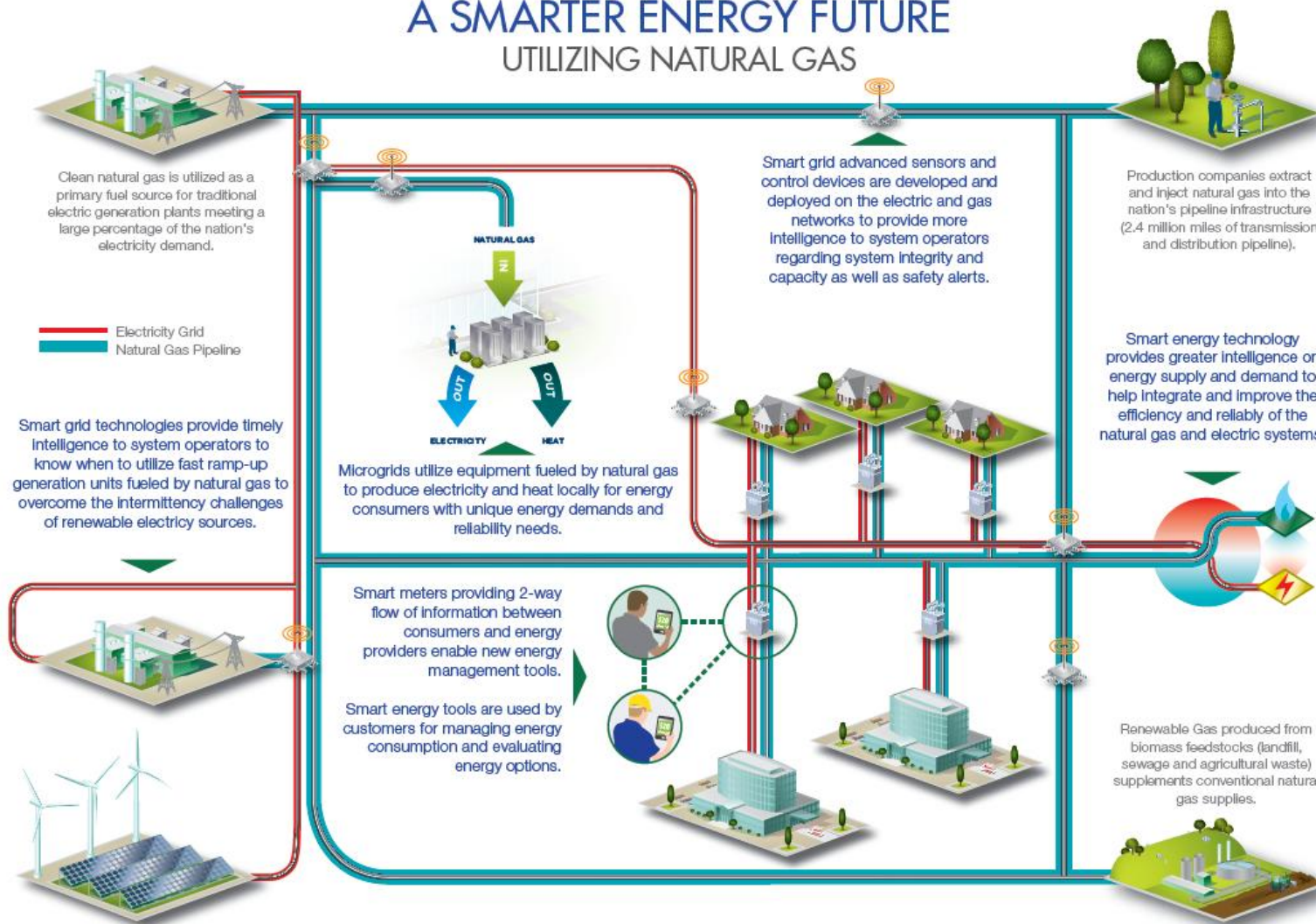
Regulatory

- > Expand the use of source energy standards and incorporate full-fuel-cycle analysis in all conservation and energy efficiency standards
- > Include natural gas in ongoing Smart Grid standards development
- > Provide information about energy usage and energy appliance selections so consumers can make educated decisions
- > Modify the International Green Construction Code so every new building has access to natural gas service where available
- > Modify market rules for direct communications between pipeline and electric grid operators
- > Promote real-time communications between the gas and electricity grids
- > Approve projects in a timely manner
- > Make energy efficiency programs energy neutral

Forward Focus

- > Optimize the AMI Backbone
- > Deploy Microgrids/DG/CHP
- > Use Full-Fuel-Cycle Analysis for Energy and Emissions Efficiency
- > http://media.godashboard.com//gti/Natural_Gas_in_a_Smart_Energy_Future_01-26-2011.pdf

A SMARTER ENERGY FUTURE UTILIZING NATURAL GAS



EFFICIENT. SAFE. CLEAN. SECURE.

Evolution of the Intelligent Infrastructure

2011
Current Status

Mid-Term Goal

2030
Long-Term Goal

Today's Process

- Paper/clipboard, charts
- Experience-based judgment
- Limited automation/first level data collection
 - AMR
 - Paging technology

Infrastructure Transition

- Sensors w/ two-way communications
- Models to create knowledge from data
- Automated or remote control response
- Improved safety and efficiency
- Serve new end uses and supply sources

Optimal System

- AMI communications backbone
 - Redundancy
 - Security
 - Inter-operability of components
- Grid interoperability with gas, water, electric, thermal
- Asset optimization
 - Capital deployment
 - Useful life
 - Capacity utilization
 - Load forecasting
 - Customer care

GTI's Initiatives – Intelligent Utility Systems

Integrating Communications and Intelligent Field Devices

- Data collection automation
- Streamlined data transfer and access – no manual handling
- Data management and analysis
- Asset management
- GIS optimization



GTI Center of Expertise

Creating and/or Improving Sensing, Monitoring, and Controlling Technologies

- Single point of contact
- Reference materials
- Technical advisor
- Standards development/advisor
- Concept development and deployment

Thank You for Your Attention

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