Presentation Slides: U.S. Natural Gas Markets and Perspectives

Bill Liss, GTI

the Energy to Lead

U.S. Natural Gas Markets and Perspectives

>Bill Liss
Managing Director
End Use Solutions

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GTI Overview

>Non-profit research, development, demonstration organization with 70 year history

>Facilities
— 18 acre campus
— 200,000 ft²
— 28 specialized labs

>Staff of 250

Flex-Fuel Test Facility

Offices & Labs

Energy & Environmental Technology Center

2

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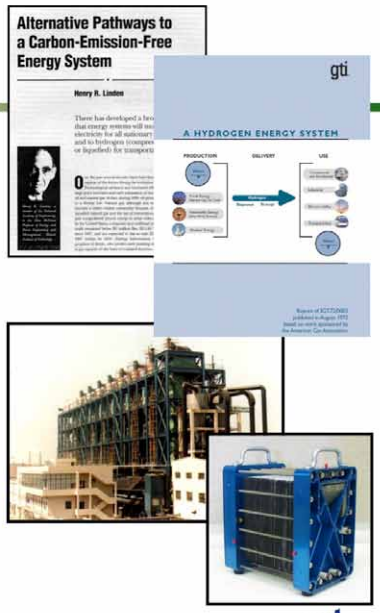
GTI's Hydrogen History

>Significant history with hydrogen as alternative energy carrier
- Dr. Henry Linden
  Dr. Derek Gregory
- Long-term vision of energy market

>40+ years of RD&D on hydrogen, fuel cells, fuel processing, gasification

>Over 250 hydrogen publications



3

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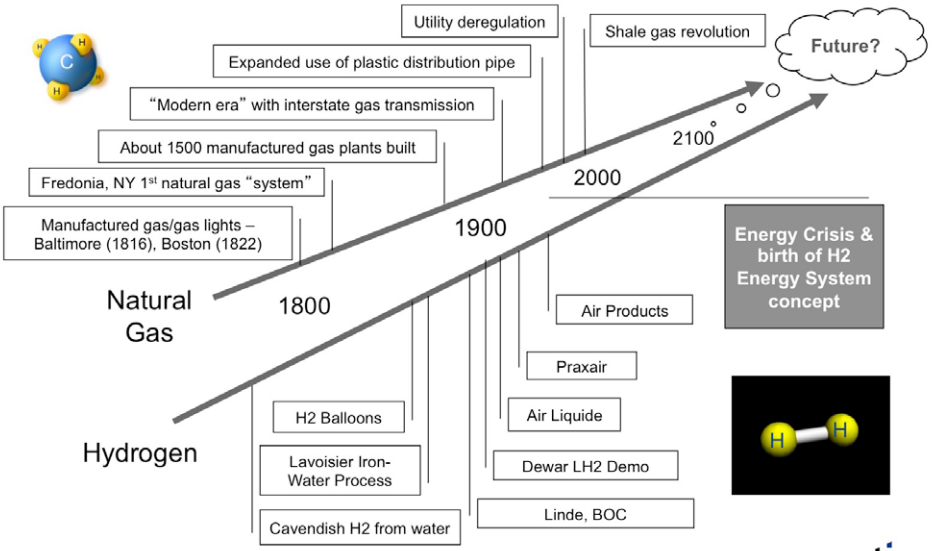
Natural Gas & Hydrogen Timelines



4

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Natural Gas Industry Segments

- Exploration
- Production
- Transmission
- Storage
- Distribution

5

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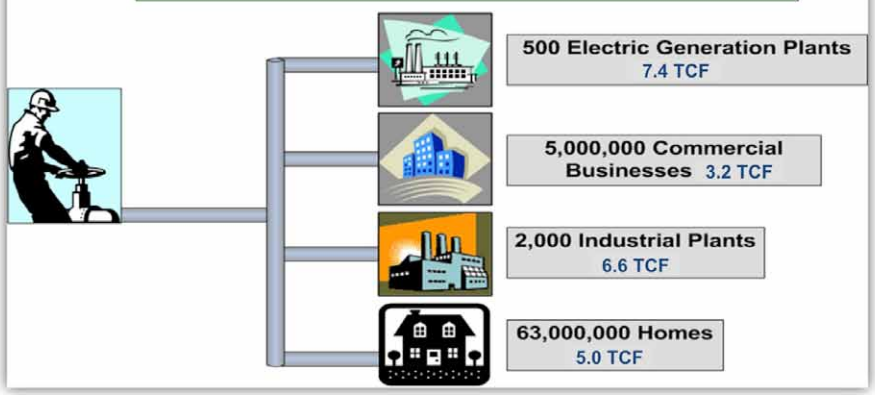
U.S. Gas Infrastructure

- 11,000 Delivery Points
- 305,000 Miles of Transmission Pipelines
- 5,000 Receipt Points
- 1,400 Interconnects
- 400 Gas Storage Fields
- >2,000,000 Miles of Distribution Pipelines
- Carrying 22,000,000,000,000 cu. feet of gas annually



6

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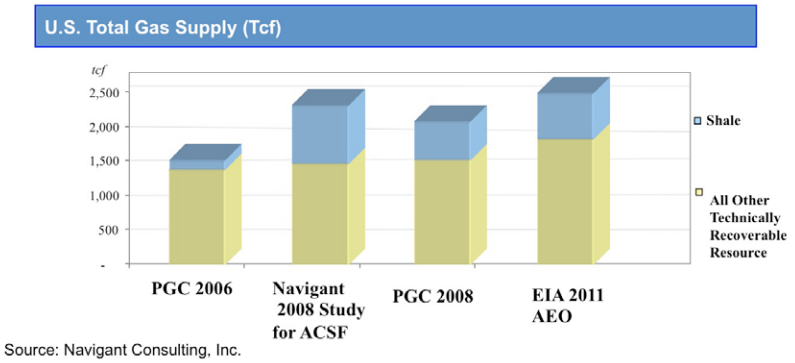
Today's Big Story: Robust and Expanding Gas Supply Estimates

>Substantial natural gas supply additions in past five years (over 100x annual consumption)



Source: Navigant Consulting, Inc.

7

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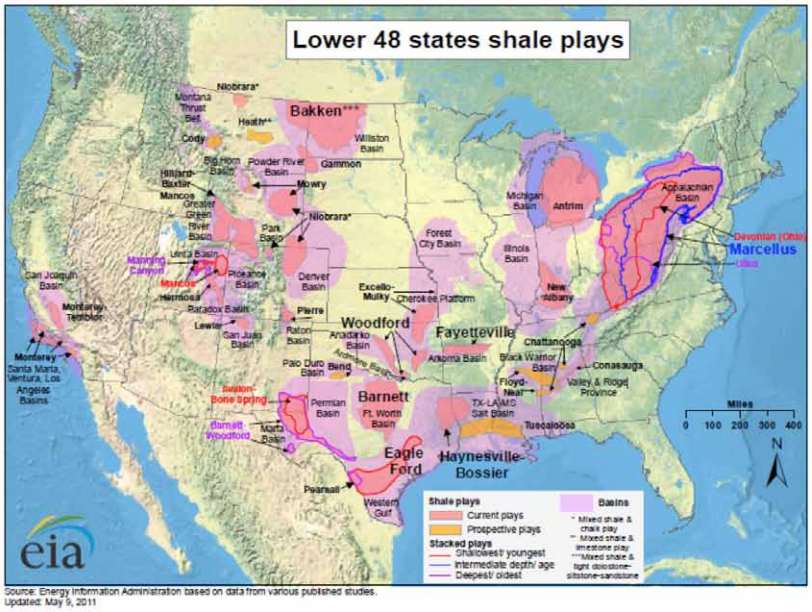

Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

8

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Interstate Pipeline Investments of $6-10 billion annually (INGAA/ICF)

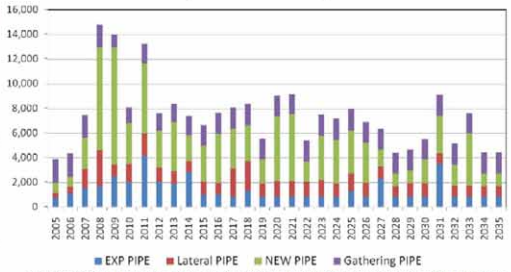
Capital Expenditures for New Gas Pipeline

Million dollars (Real 2010$) Spent Each Year, Including the Cost of Compression

ICF INTERNATIONAL

- Between 2005 and 2010, pipeline expenditures averaged $8.8 Billion per year in real 2010 dollars.
- Annual pipeline expenditures are projected to be between $4 and $13 billion per year between 2011 and 2035.
- Of the $178 billion of projected investment between 2011 and 2035, roughly 50 percent is for new transmission lines.
- Capital expenditures for the new pipeline infrastructure projected here average about $7 billion per year in real 2010 dollars.
- If upstream gathering lines are excluded, average annual capital expenditures for new pipeline are $5.5 billion per year in real 2010 dollars.

Total Natural Gas Pipeline Expenditures By Year [1]
(Million Real 2010$)



1. Pipeline project costs are represented in the year the project enters service. While in actuality, pipeline investment costs are generally spread over one or more years leading up to a project entering service.

9

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Distribution Infrastructure Investment

>Natural gas distribution industry investing significant resources on infrastructure

>2010 Investments

— **$8 billion repair/replace**

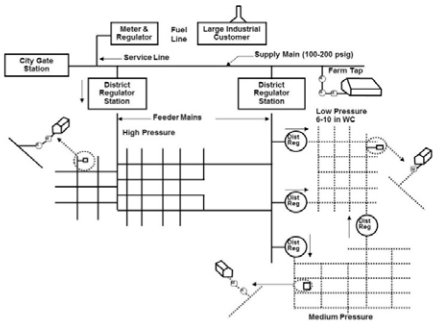
> 17,600 miles of new mains

> 19,300 miles of new service

— **$4 billion new construction**

> 14,400 miles of new mains

> 13,300 miles of new service



10

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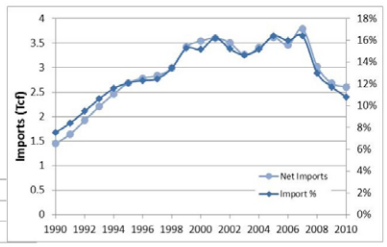
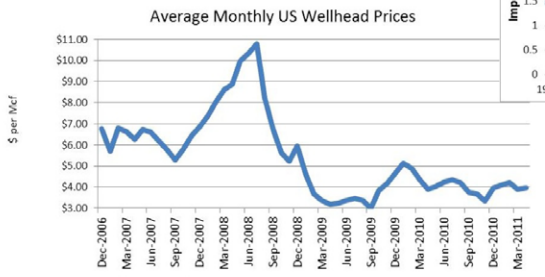
Short Term Implications of Expanding Supply

> $40-100 billion consumer savings from lower prices





Source: U.S. Energy Information Administration

> Greater U.S. energy security; reduced import reliance

> $5-10 billion trade balance benefit and growing

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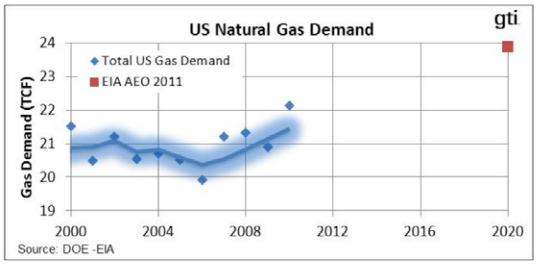
Mid-Term Implications of Expanding Supply

> Growth in price-sensitive, energy-intensive segments
  - > Power generation
  - > Industrial (esp. chemicals, petrochemicals)
  - > Transportation

> Demand at all-time high in 2010
  - > 2011 will set a new record high
  - > On track to 24+ Tcf by 2020



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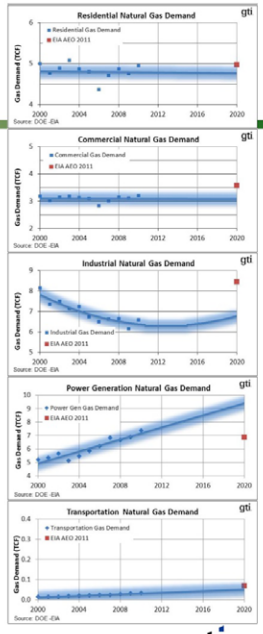
Natural Gas Demand Outlook

- >Growth led by expanding use in power generation
  - —Displace older coal power plants
- >Industrial sector rebound
  - —Onshoring; improved logistics and reduced shipping costs
- >NGV interest growing sharply
  - —Price differential to gasoline/diesel
- >Stable residential/commercial use
  - —Smart, efficient use; source energy policies



13

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New Announcements for Multiple Major Projects and Expanded Use

Power, petrochemicals, manufacturing: major plans

Natural Gas Boom Helps Petrochemical Industry
The petrochemical industry is benefiting from the recent boom in U.S. natural gas supplies, which has lowered feedstock costs. "Capital investment is now being reconsidered," said Kevin Swift, chief economist with the American Chemistry Council.

Natural Gas Taking America's Electric Power Sector by Storm
Currently, natural gas-fired generators constitute 39% of America's total electric generation capacity. Natural gas is a newer player-- 65% of America's natural gas-fired capacity has been added since 1980.

Nucor's Natural Gas Direct Reduced Iron plant
Over the next several years, Nucor Steel will be building what could be one of the most significant industrial projects in Louisiana history. The first phase, a 2.5 million tons-per-year iron-making facility, will convert natural gas and iron ore pellets into direct reduced iron for Nucor's steel mills

14

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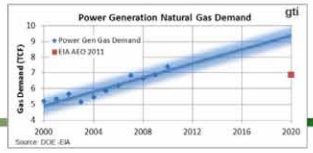
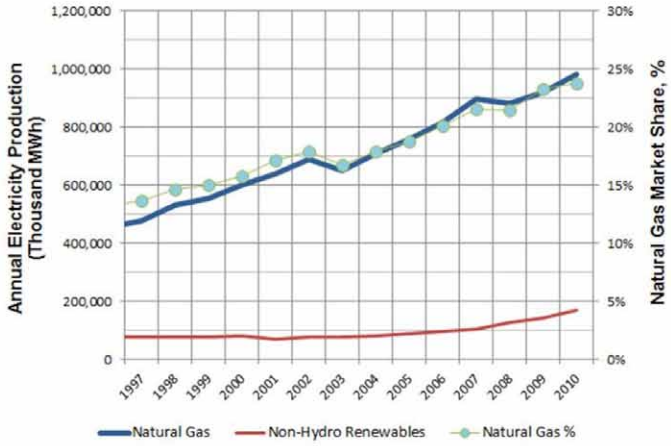
Power Generation

Moving To 9 Tcf Annual Demand





15

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Natural Gas Opportunities to Reduce Liquid Fuel Dependence

> Natural gas poised to gain market from liquid fuels
  - High fuel oil, diesel, gasoline prices
  - Residential/commercial heating oil: over 1 Tcf incremental gas market
  - Transportation: 1 Tcf with high displacement scenario

> Offset U.S. demand for imports

> Improve energy security and balance of trade (about $25-35 billion)

Res/Com Market Displacement Potential	Current Annual Fuel Oil Sales, million gallons	Natural Gas Equivalent Potential (Tcf)
Residential	4,600	0.63
Commercial	3,000	0.4
	7,600	**1.03**

Transportation Displacement Scenarios	Diesel Gallons, millions	Gasoline Gallons, millions	Natural Gas Equivalent Potential Tcf
Low	940	570	0.11
Medium	2,800	1,640	0.32
High	9,400	2,610	**1.06**

16

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Transportation Sector and Natural Gas

>Natural gas use for vehicles is multi-faceted
- Direct, indirect
- About 1.3 Tcf (mostly indirect "industrial sector" fuels production)

>Direct: NGVs
- CNG, LNG (about 40 bcf)

>Indirect
- Hydrogen for petroleum refining
- Ethanol, biofuel production

>New paths:
- H2 vehicles, GTL, PHEV power

17

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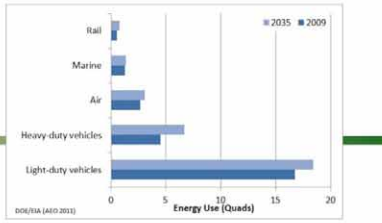
Natural Gas Vehicles

>Strong market interest, driven by fuel price differential
- Medium and heavy-duty fleet vehicles are core market
- Off-road opportunities (e.g., marine)
- Light duty (and home fueling) is long-term goal

>Main challenges: cost reduction for vehicles, infrastructure
- Growth & volume will move market towards improved pricing over next five years



18

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Summary

> U.S. natural gas industry in a special period due to confluence of E&P innovations & supply endowment

> Poised for demand growth: led by power generation, industrial (chemical/petrochemical), and transportation

- Reduce coal, liquid fuel use → **major** societal benefits: reduced emissions, increased energy security, improved balance of trade
- Many major capital projects announced (power & industrial)

> Natural gas pipeline & distribution companies investing $15-20 billion annually on new/replacement delivery systems and related assets

> Major step-change increase underway in NGV infrastructure investments and vehicle purchases

19

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