

# Natural Gas: Leading the Way to a Low Carbon Century

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Herb Vogel  
President,  
BP Energy Company



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# Natural gas and low-carbon context



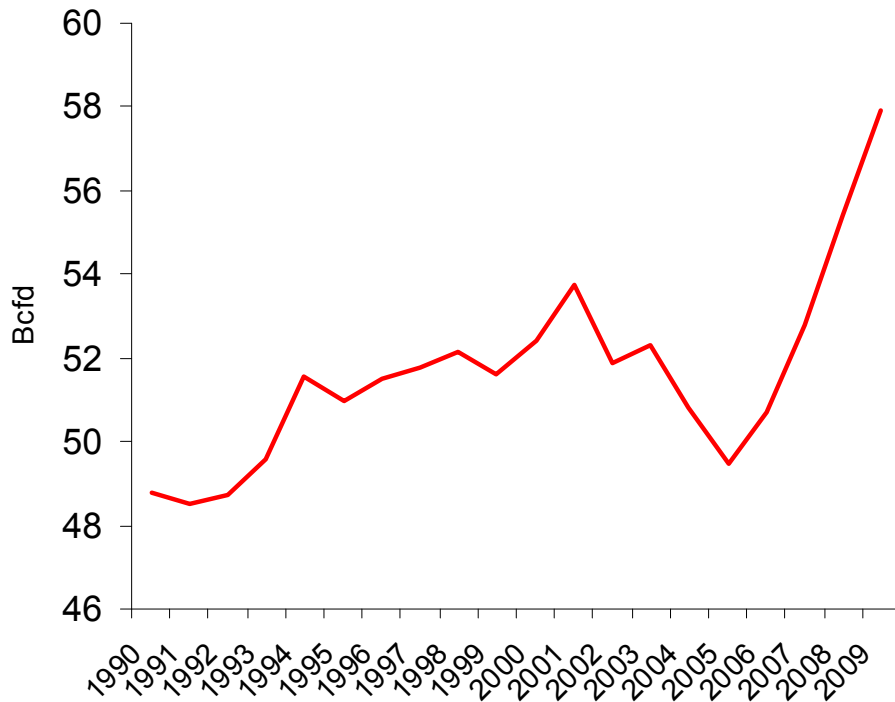
- Gas supply: profound and revolutionary changes underway
- Gas demand: on the cusp of recognizing the new environment
- Regulatory aspects: renewed attention on the role of gas
- A transition to the “Low-Carbon Century”
  - Wind
  - Solar
  - Hydro
  - Carbon Capture & Storage (CCS) of coal and gas power generation
  - Nuclear
  - All underpinned by gas-fired power generation in support of renewables

***Natural Gas*** now leading the way...

# Profound changes in gas outlook

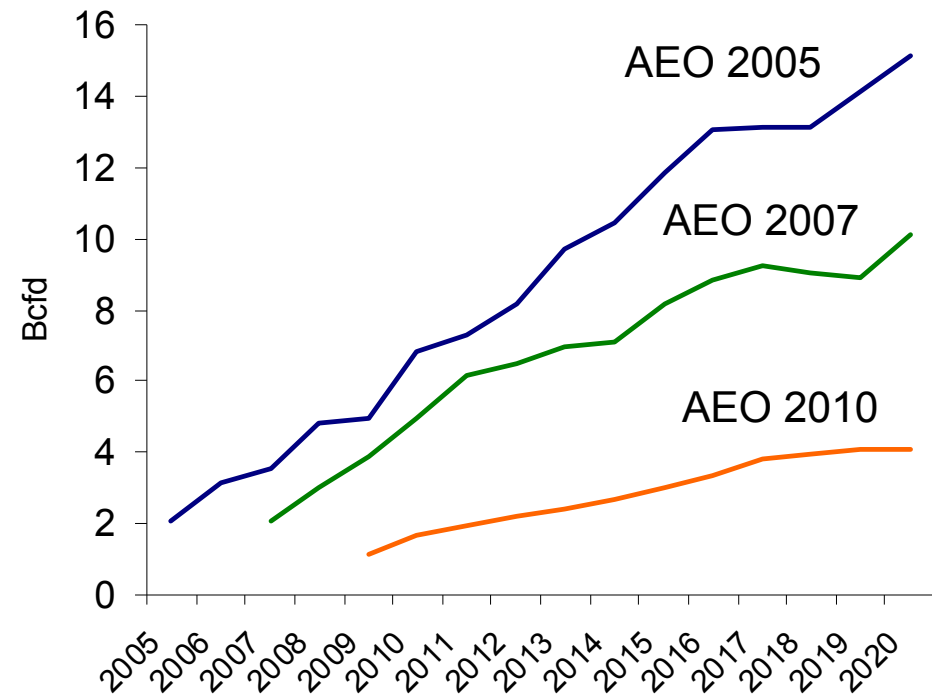


## US Dry Gas Production



Source: US EIA

## US LNG Import Forecast



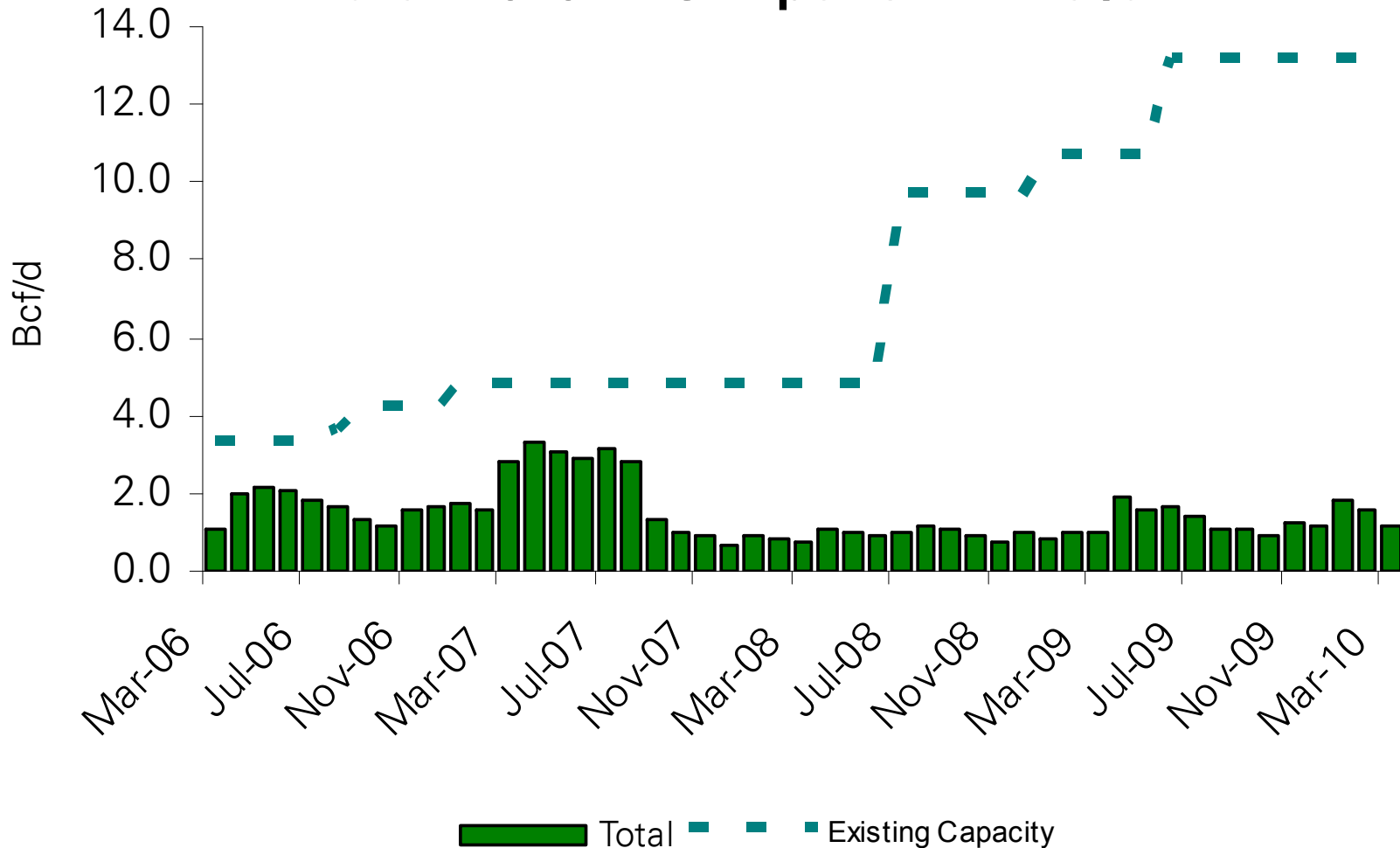
Source: US EIA AEO

# U.S. LNG Imports by Terminal



**March 2010 LNG Imports: 1.2 Bcf/d**

Source: DOE, EIA

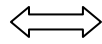


**Currently, U.S. LNG regasification capacity is ~10% utilized**

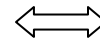
# Natural Gas Supply: A quiet revolution



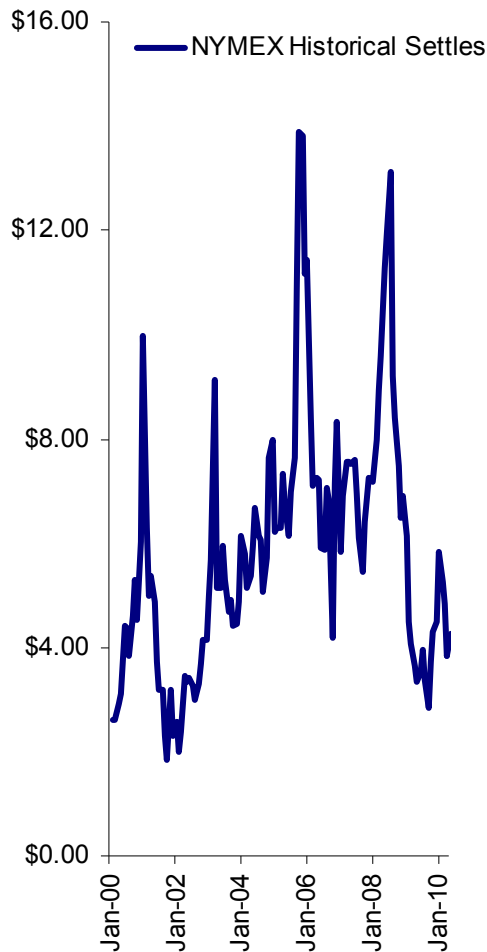
Strong price signal prompted increased E&P investment



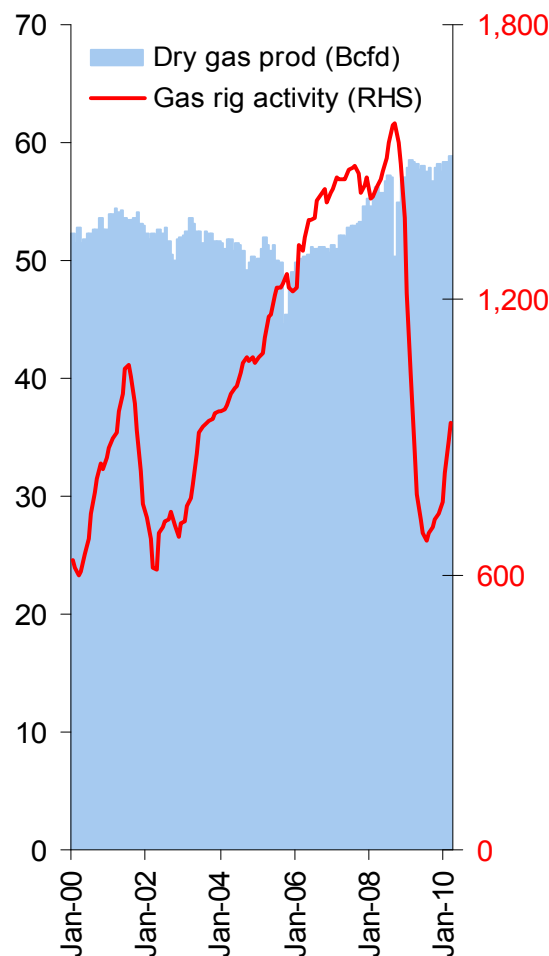
Higher activity and application of new technology led to increased production



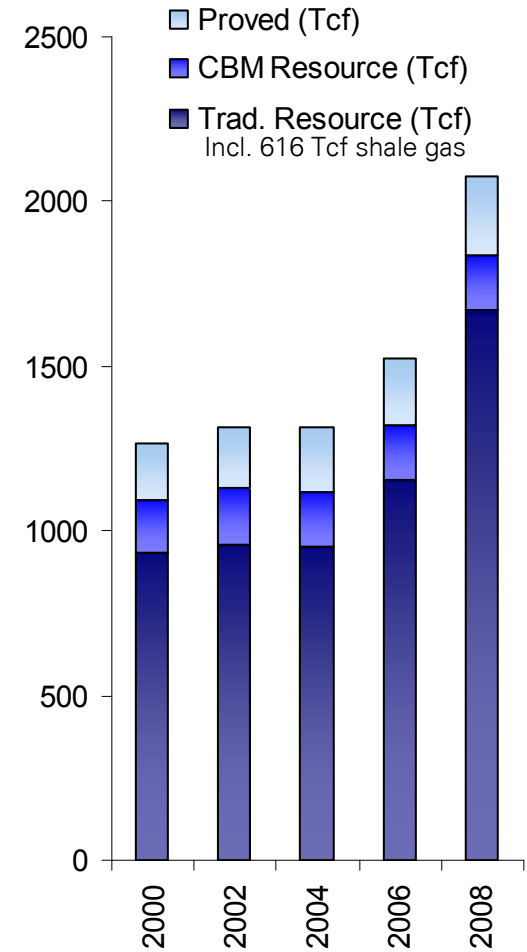
35% increase in estimated resource driven primarily by reevaluation of shale gas



NYMEX



Baker Hughes, EIA

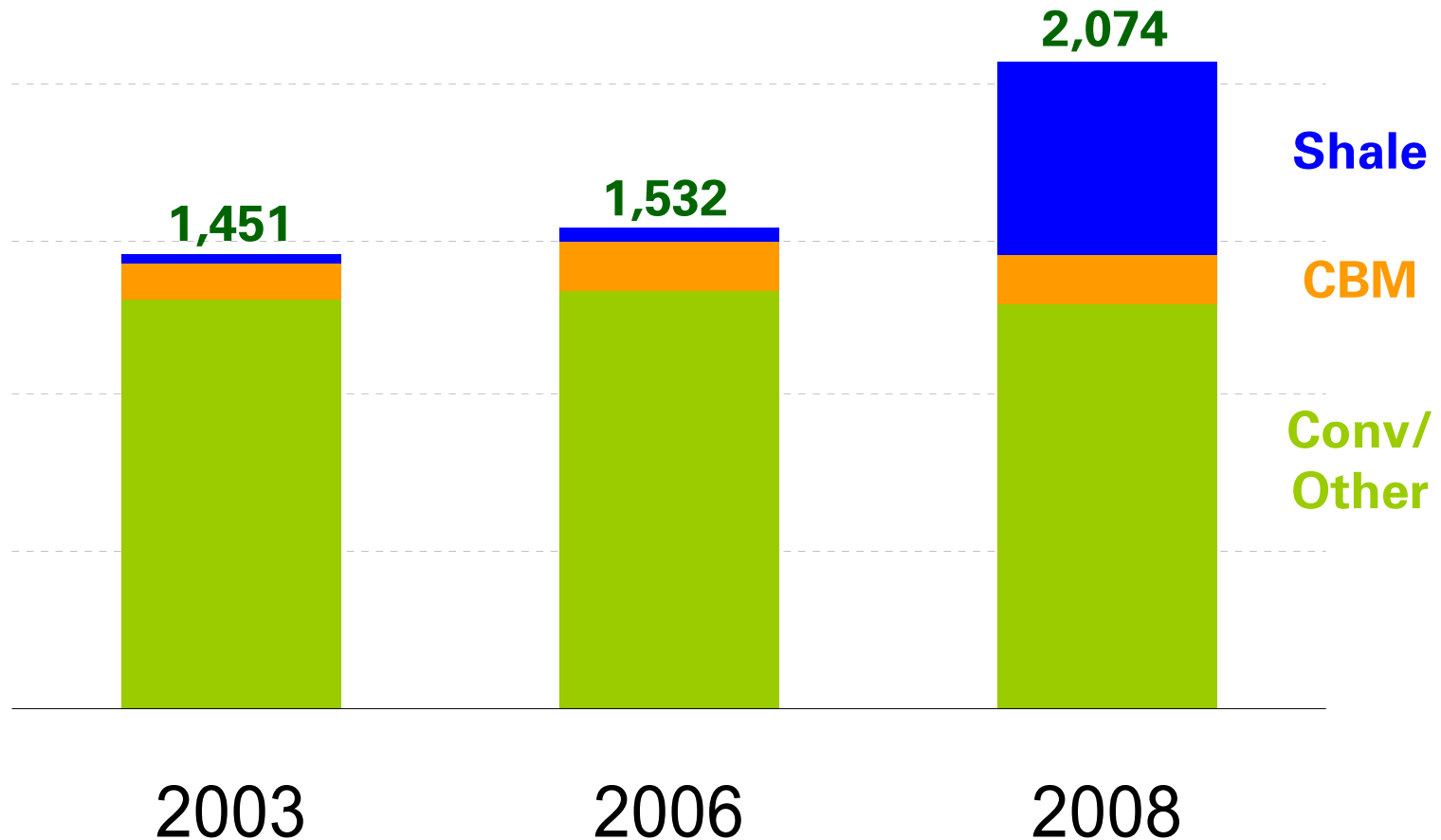


Potential Gas Committee

# Paradigm shift in gas resources...

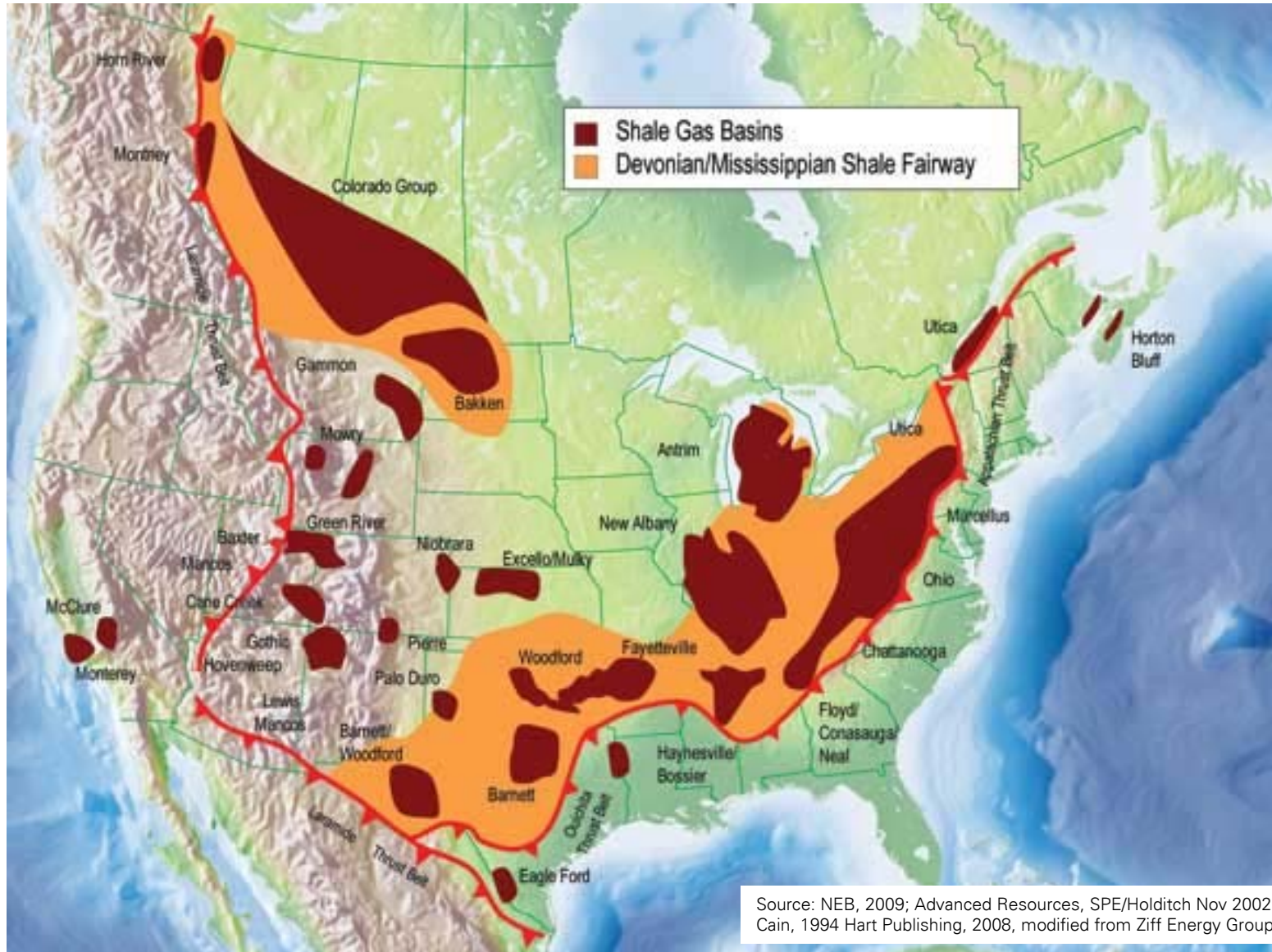


## US Gas Resource Estimates by Type (Tcf)



Note: Gas resource includes proved, probable and potential categories  
Sources: NPC 2003, PGC 2009, EIA AEO

# Shale gas plays: geographically diverse

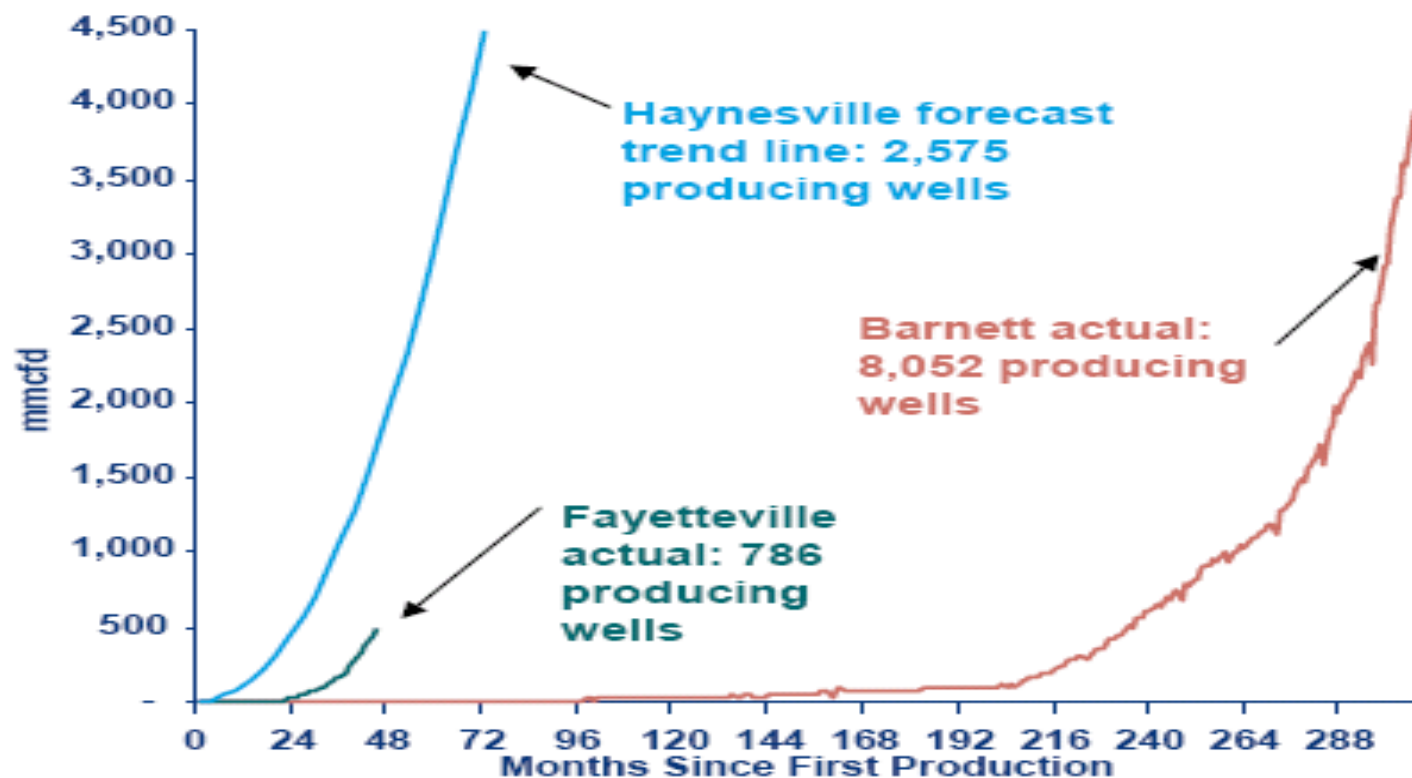


Source: NEB, 2009; Advanced Resources, SPE/Holditch Nov 2002 Hill 1991, Cain, 1994 Hart Publishing, 2008, modified from Ziff Energy Group, 2008

# Successful Technology Led to Shale Growth



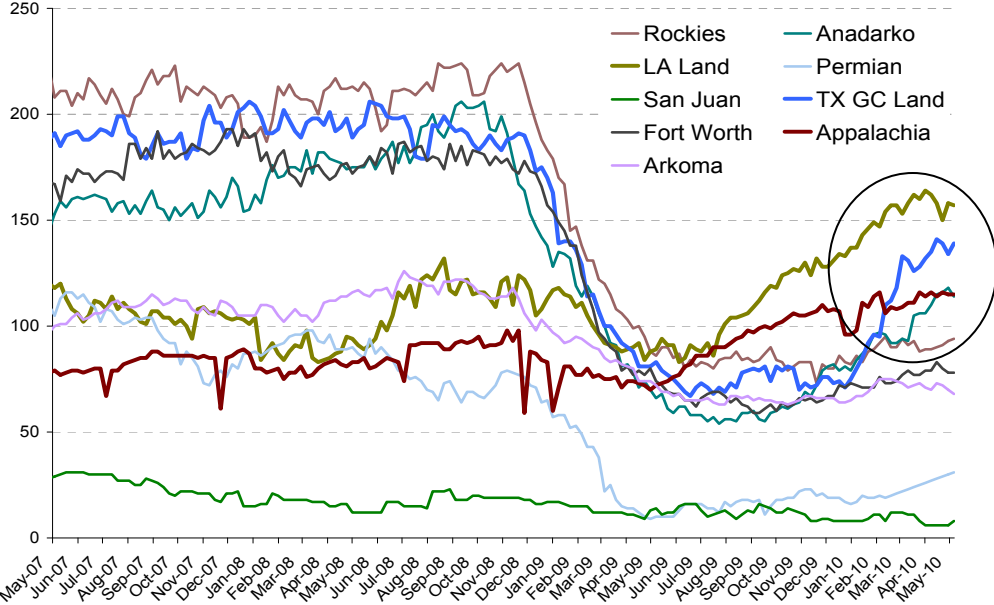
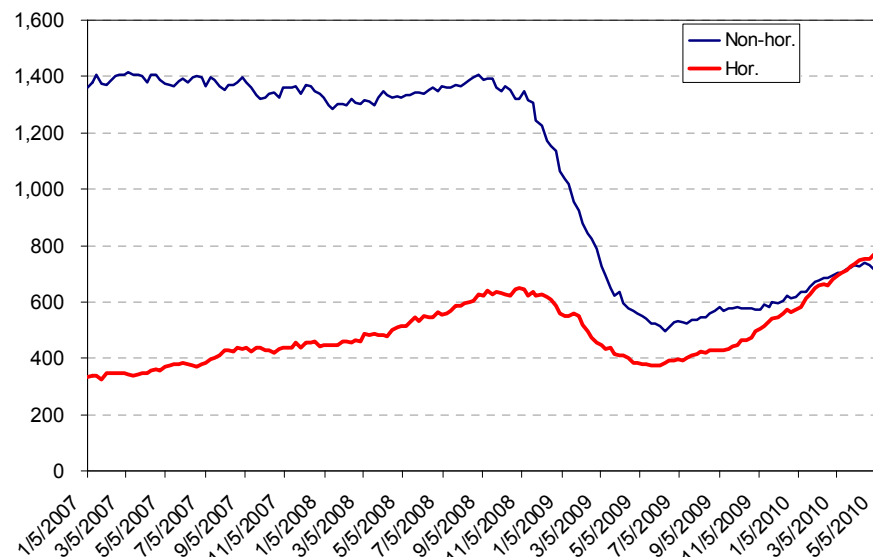
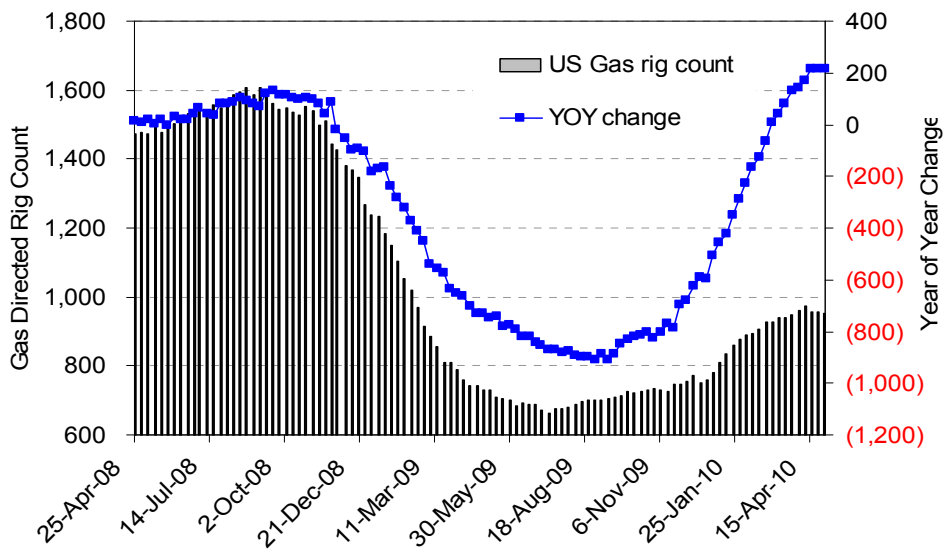
## Production Ramp-up



Note: Haynesville Time Zero is 1Q 2008; Fayetteville Time Zero is 2004; Barnett Time Zero is 1982

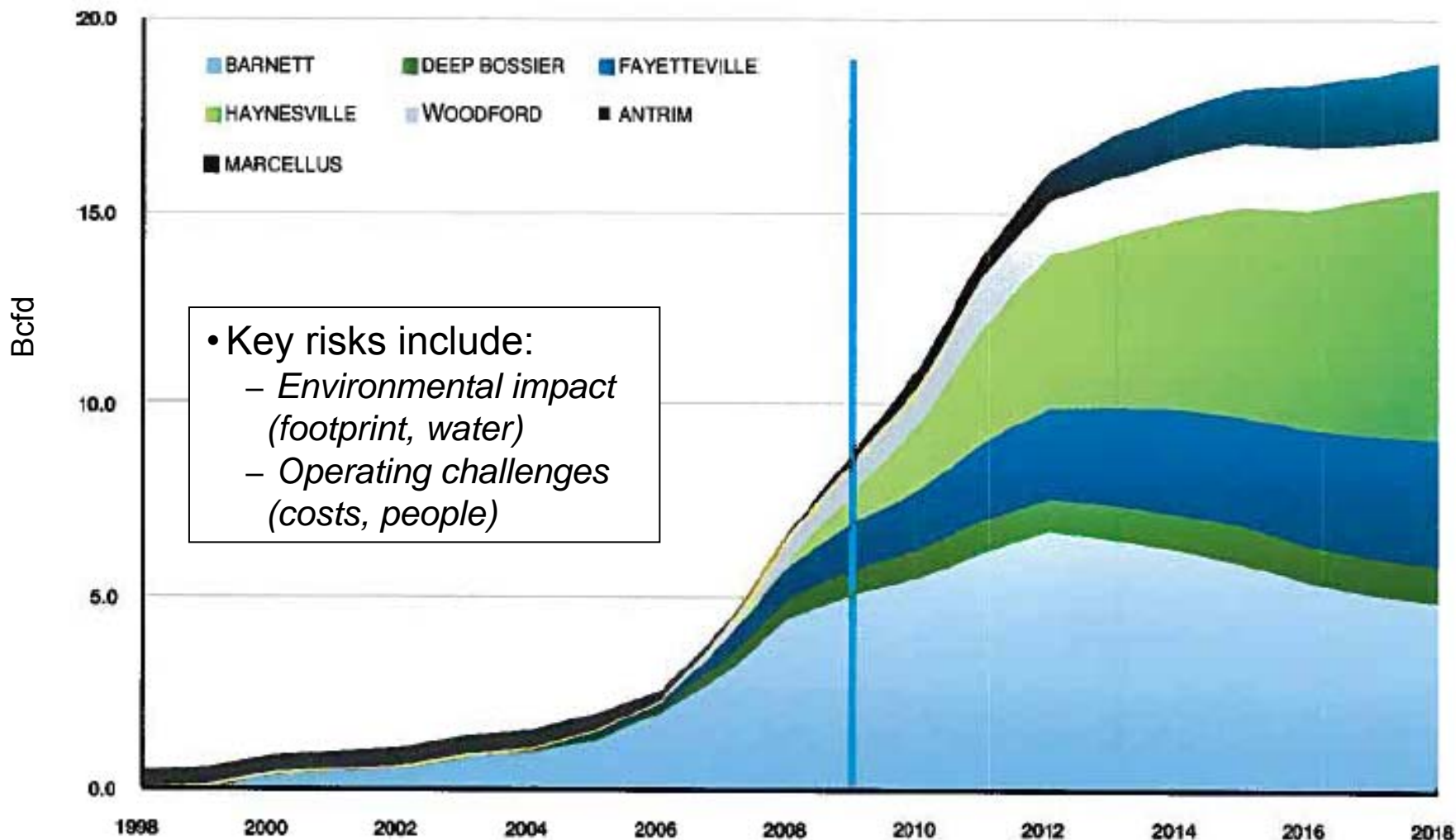
Source: Wood Mackenzie, State Production Data

# US rig activity: turnaround driven by unconventional plays



- Overall US gas rig count has recovered to surpass year-ago levels
- Higher horizontal rig activity; some recovery in non-horizontal activity (driven by oil drilling)
- Steady increase in unconventional plays, including Haynesville, Marcellus and Eagleford
  - driven by acreage capture, higher liquids value

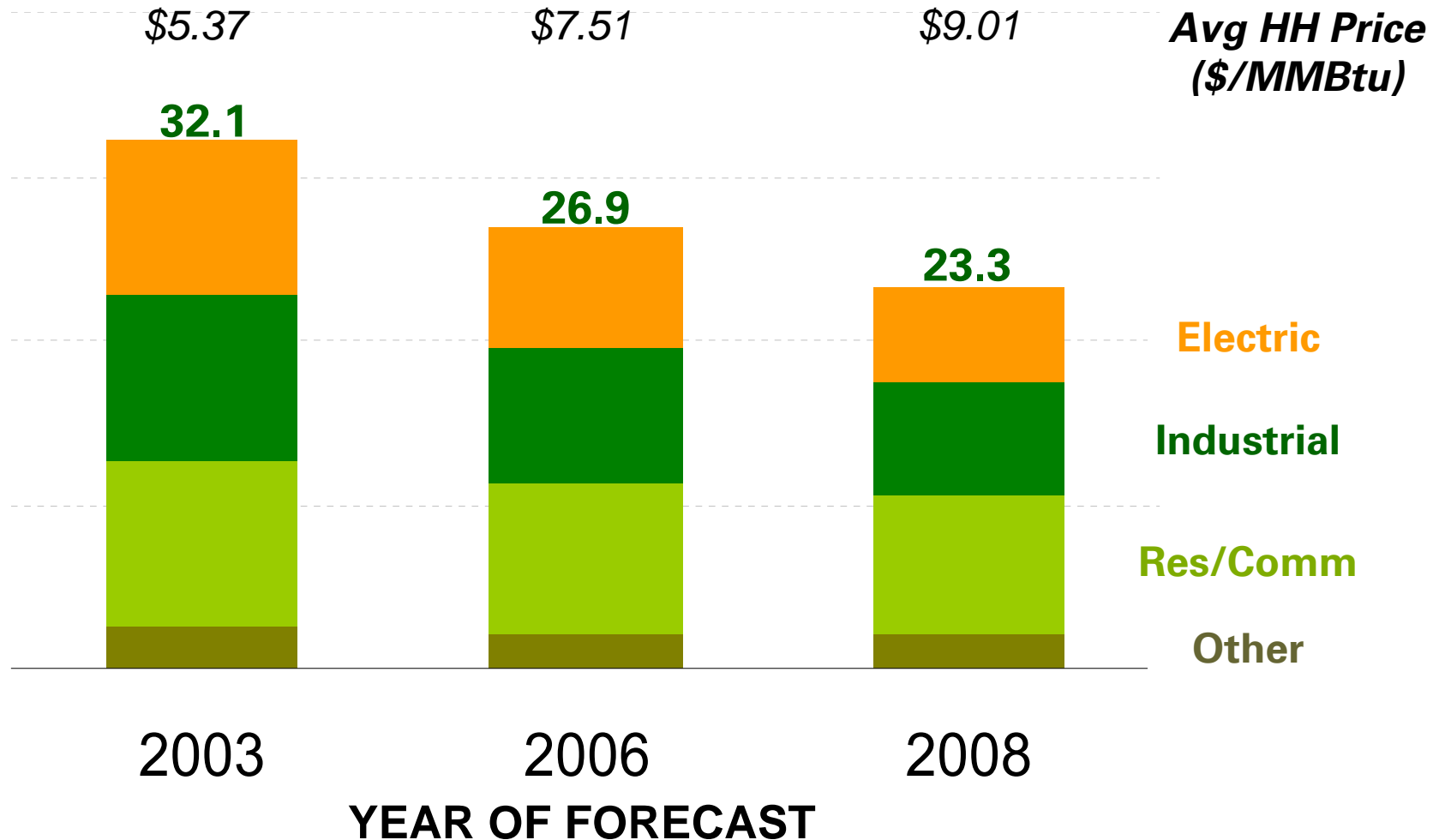
# Shale Production Forecast: Significant Growth Potential



# Outlook for natural gas demand has been declining



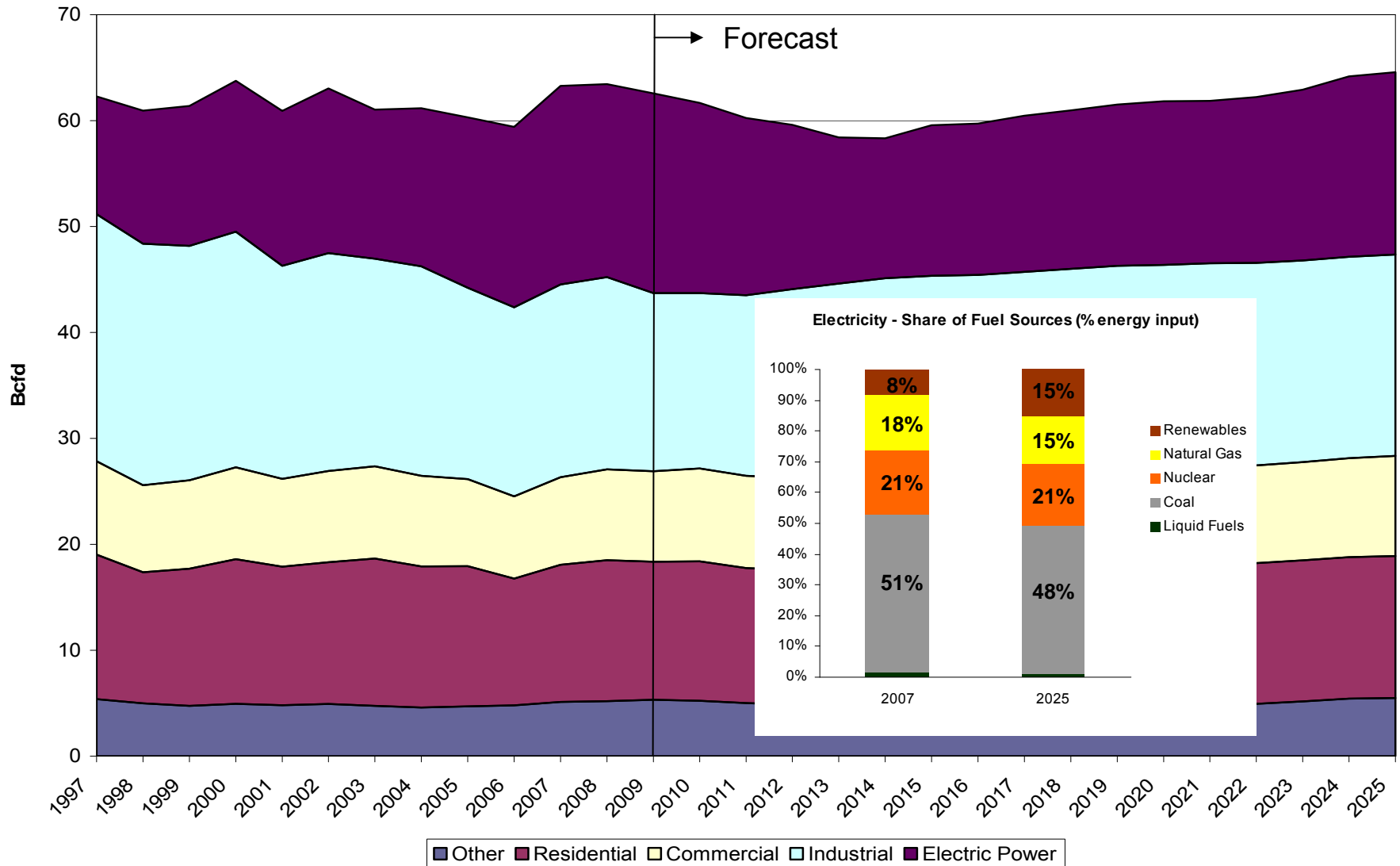
## Projected **2020** US Gas Demand by Sector (Tcf)



# U.S. Natural Gas Demand by Sector: What do you believe?



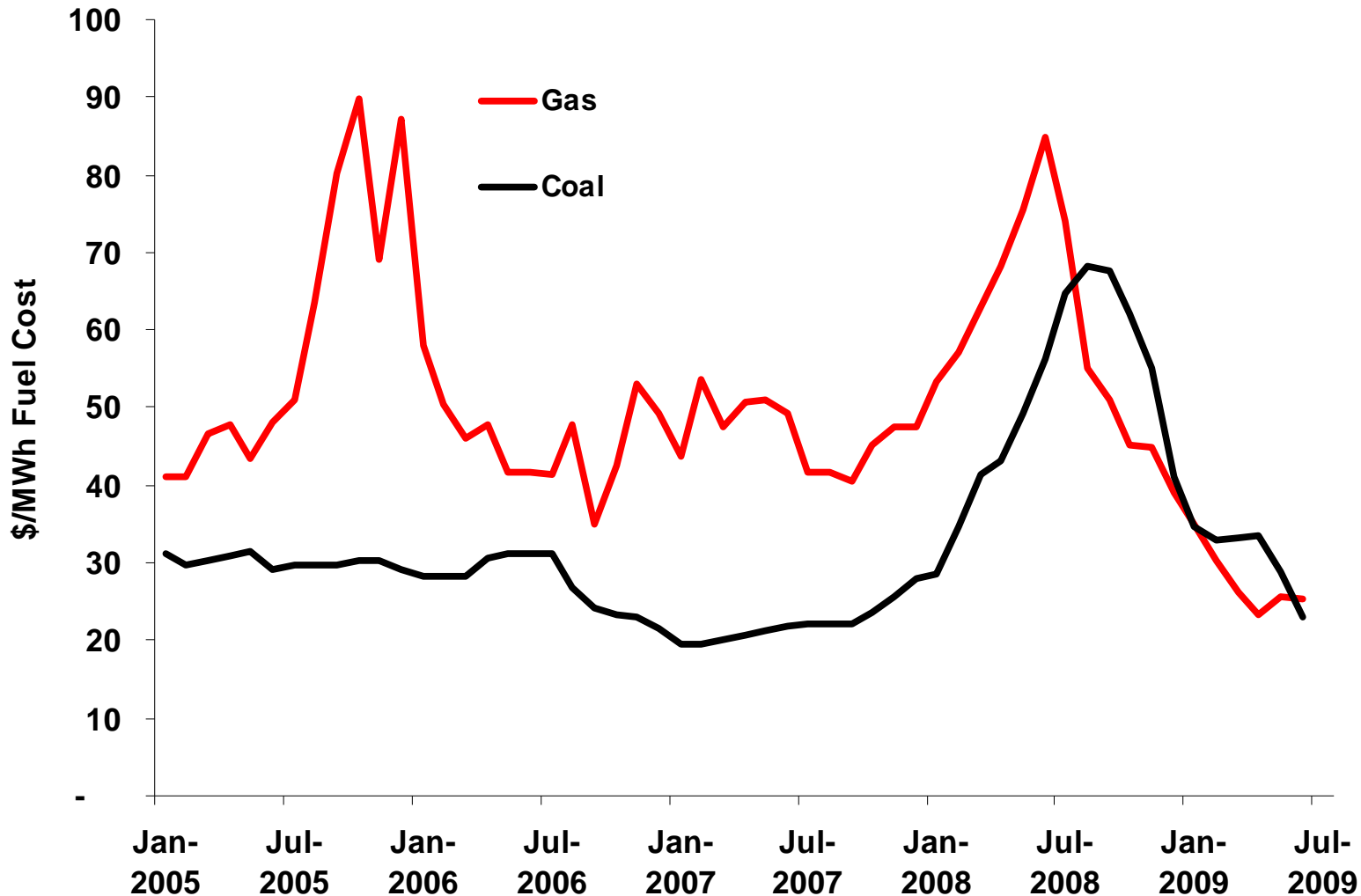
Source: EIA AEO 2010



# New coal vs. gas market paradigm?



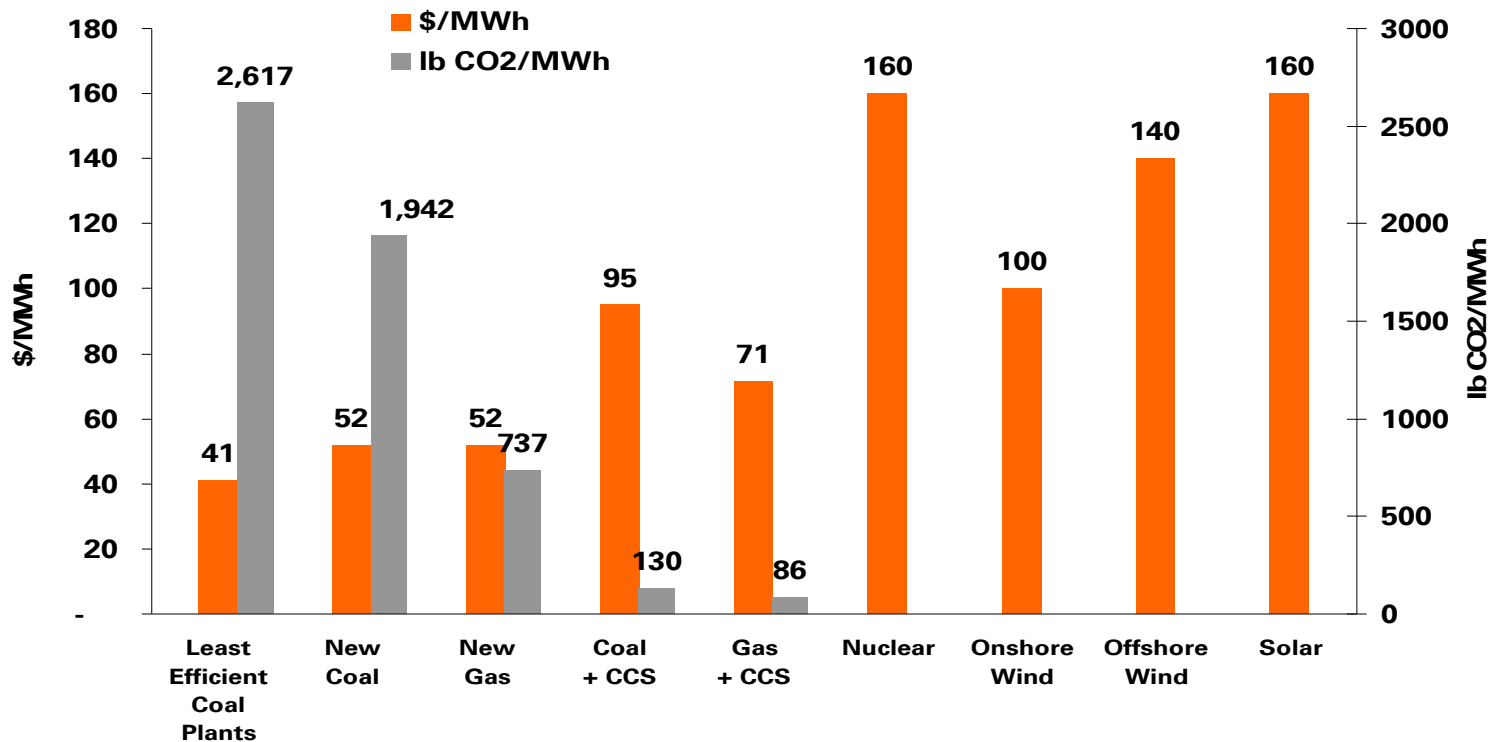
## Natural Gas vs. Coal



# New gas plants offer an inexpensive way to reduce carbon - today



Source: Developed From DOE NETL, EPA EGRID, and Harvard Data

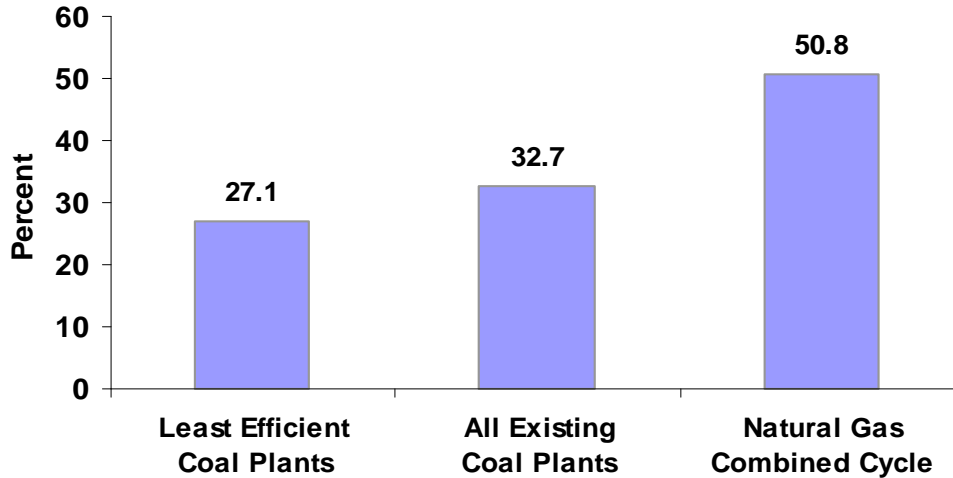


- Coal paired with CCS can produce lower emissions than a new gas plant, but with a substantial increase in cost
- Gas paired with CCS can produce even lower emissions and at lower costs, both in terms of \$/MWh and \$/ton of CO2 avoided
- Switching to gas is a lower cost alternative, both in terms of \$/MWh and \$/ton of CO2 avoided, than renewables identified above

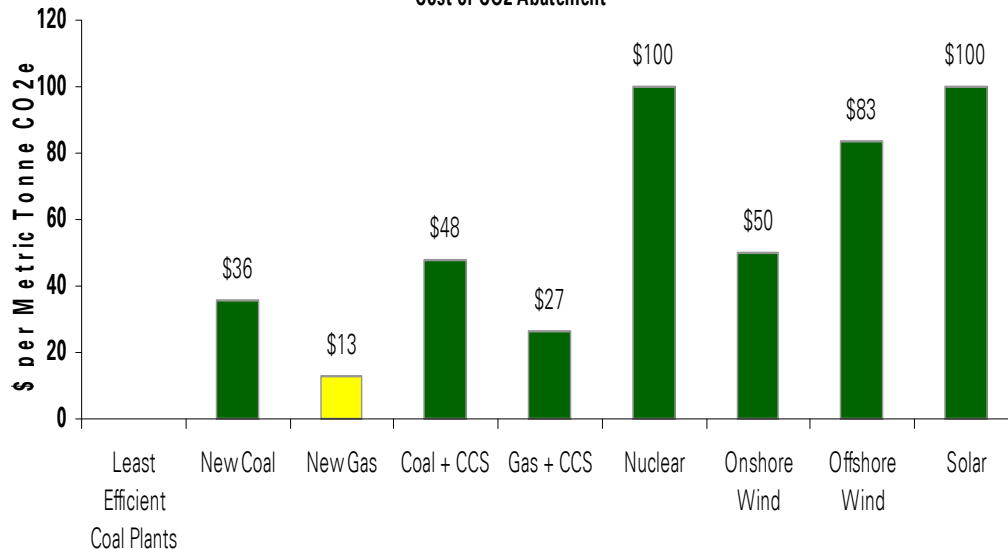
# Incentives to retire coal plants



Average Thermal Efficiency - %



Cost of CO2 Abatement



- *Approximately 1 TCF/yr (3 Bcfd) of additional gas fired electricity generation could replace ~ 80 of the least efficient, smaller, older coal-fired plants (7.5% of existing capacity)*
- *CO2 performance would be improved by up to 70%, with minimal consumer impact and an implied carbon abatement cost of ~\$13/metric ton CO2 (even less for switching on existing gas fired capacity)*
- *An additional 1 TCF/yr of gas fired electricity generation could replace another 40 plants w/ similar environmental benefits*

Source: Developed From DOE NETL and EPA EGRID Data  
 Note: "Least Efficient Coal Plants includes NOx, SOx, and Hg control capital costs developed from the Congressional Research Service report "Power Plants: Costs and Characteristics"



- Ample and secure long term gas supply
  - √ Growing indigenous supply
  - √ Significant LNG re-gasification capacity in place
- Transportation and storage infrastructure in place... and expanding
- Low cost and short timetable for investing in new and highly efficient gas fired CCGT
- Lower carbon emissions
- Complementary to renewables

# A BP Gas Policy View...



- The best approach to *prudent climate-change action* is an economy-wide carbon price, with transportation, industry, the power sector – including natural gas, renewables and coal -- all competing on a level playing field.
- As a first step along that pathway, BP supports *voluntary incentives* for the decommissioning of the oldest, least efficient and most polluting power plants.
- BP is a longstanding proponent of comprehensive energy policies that promote *energy security at affordable cost* through development of both traditional and non-traditional sources.
- If the necessary technology is applied, within a stable fiscal and regulatory framework, natural gas can fundamentally *transform the energy outlook* and emissions profile in the decades -- and now even *the low-carbon century* -- ahead.

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