

Natural Gas Supply and Demand Outlook

Can Gas Supply Support a Growing Market?

Winter Fuels Outlook Conference
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**Energy and
Environmental
Analysis, Inc.**

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Note: All presented information is from EEA's Monthly Gas Update, EEA's Gas Supply Review, and EEA's Gas Market Compass.

What Determines Gas Prices?

- ◆ Fundamentals - Gas prices are determined by the balance of supply and demand in a regional marketplace.
- ◆ Technical factors - Trading momentum, speculator activities, etc.
- ◆ Market imperfections and manipulation - Has had some impact, but less than most think.

Determinants of Gas Demand

- ◆ Gas demand is driven by:
 - » Weather
 - » Electricity demand
 - » Economic growth

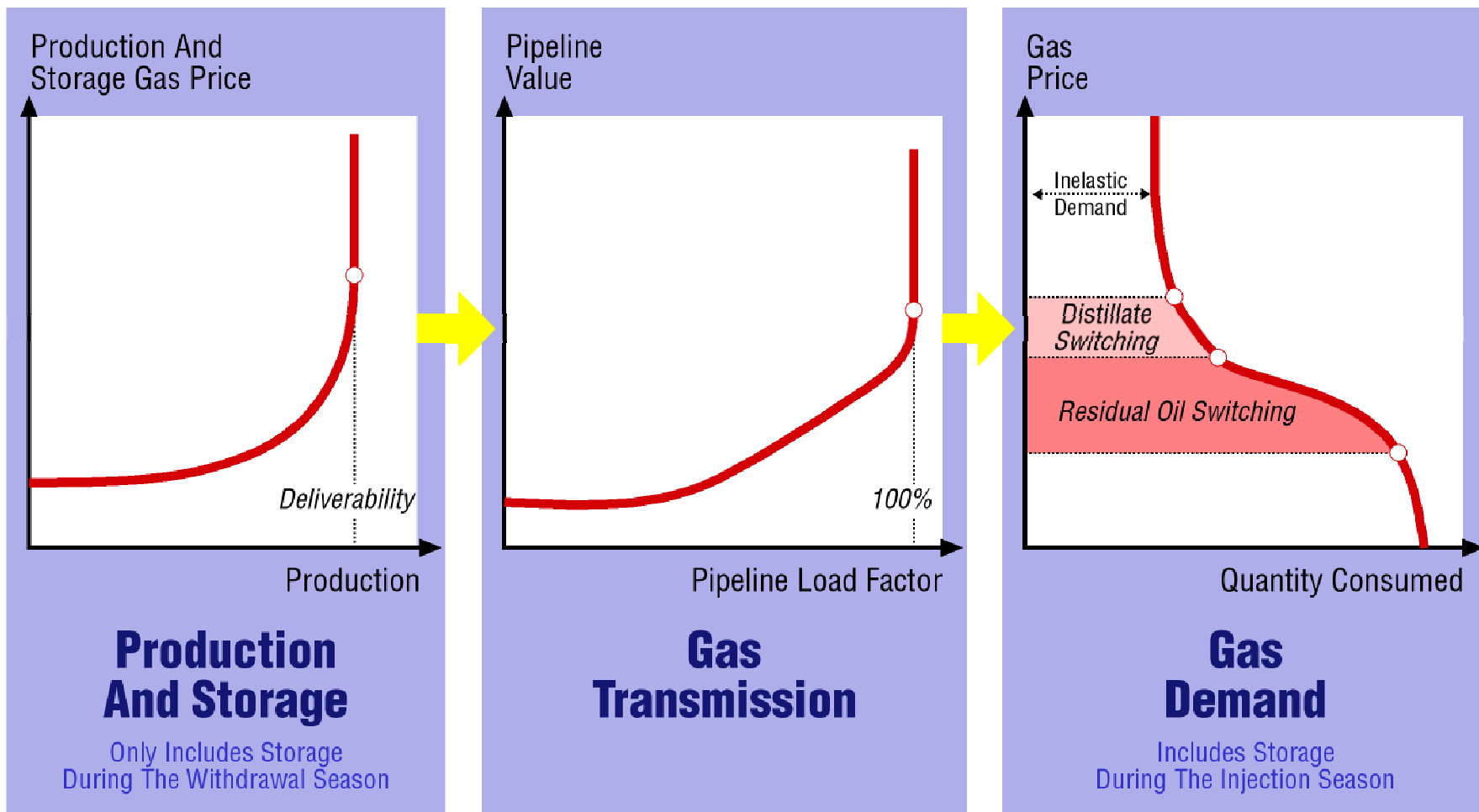
- ◆ Economics of the marginal customer's next best alternative:
 - » Ability to switch to alternate fuel, generally oil in the short-term.
 - » Power plant dispatch options.
 - » Industrial “shut-down” decisions when variable costs exceed product prices.

Determinants of Gas Supply

- ◆ In the near-term, gas supply is determined by:
 - Deliverability (or the total productive capacity).
 - Storage (deliverability and working gas).
 - Opportunity to sell gas into or out of a market ***including the cost and availability of transportation capacity.***

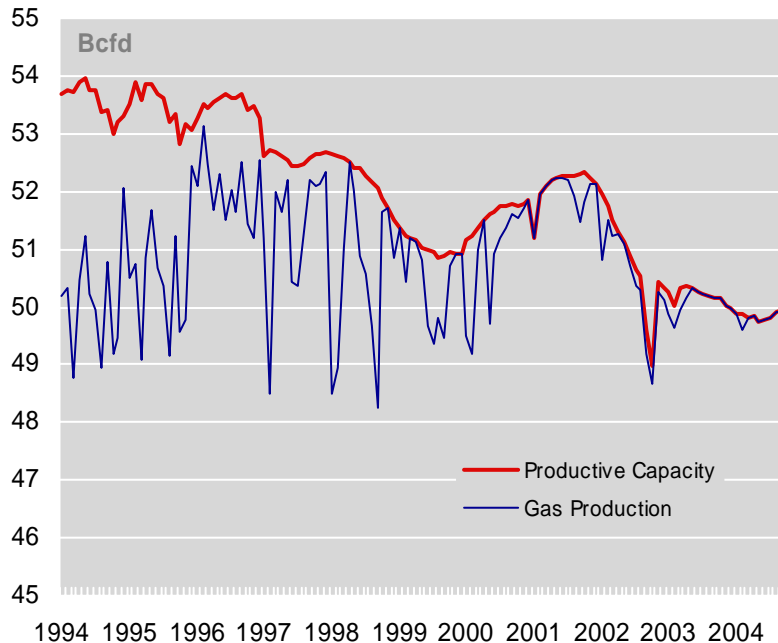
- ◆ In the longer term, gas supply is determined by:
 - Well activity.
 - Resource base and cost.

Gas Market Fundamentals: Gas Quantity And Price Equilibrium

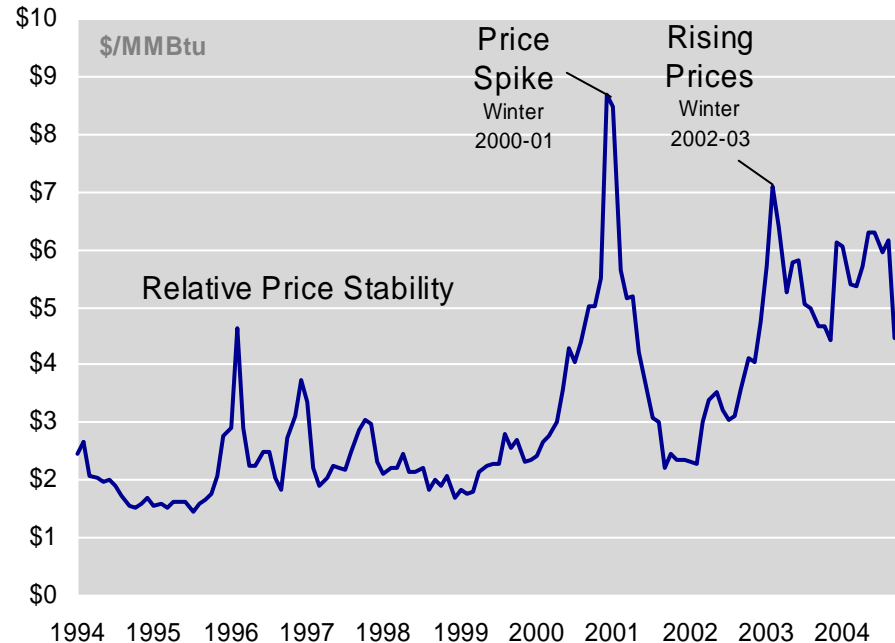


The Changing Gas Balance

Lower-48 Dry Gas Production vs. Dry Gas Productive Capacity



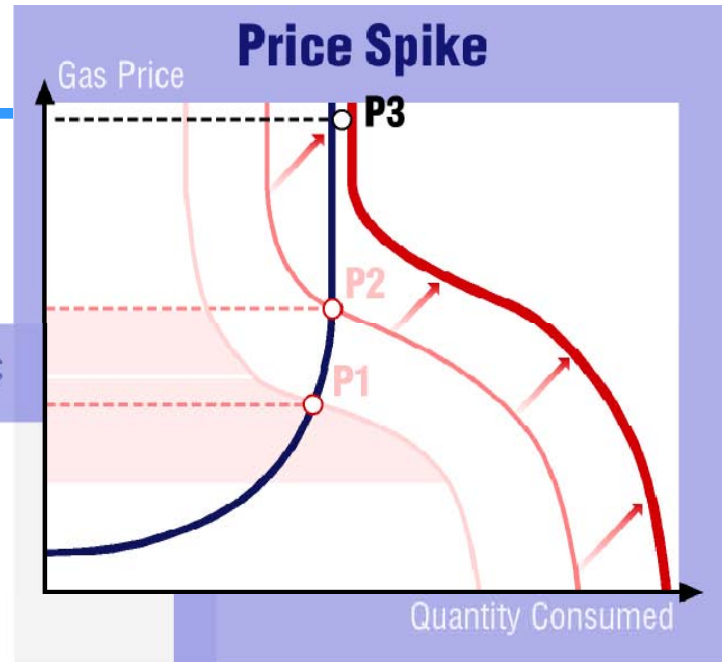
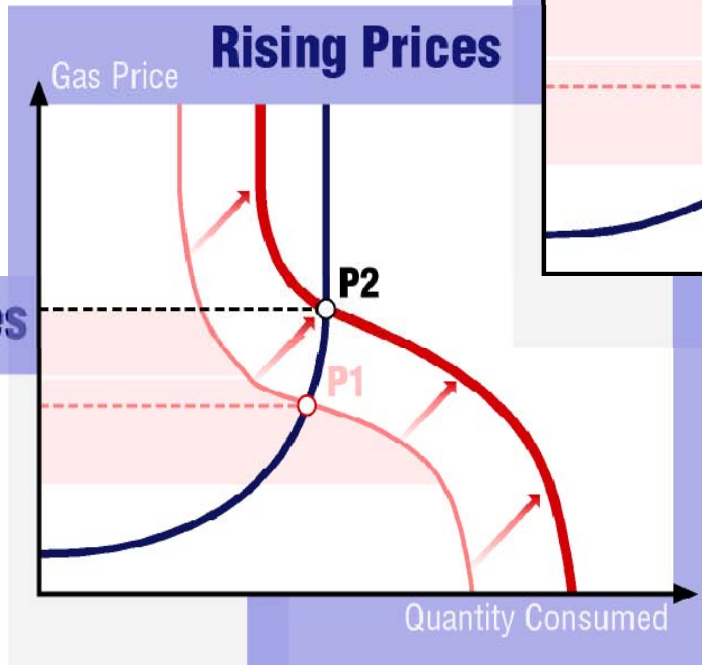
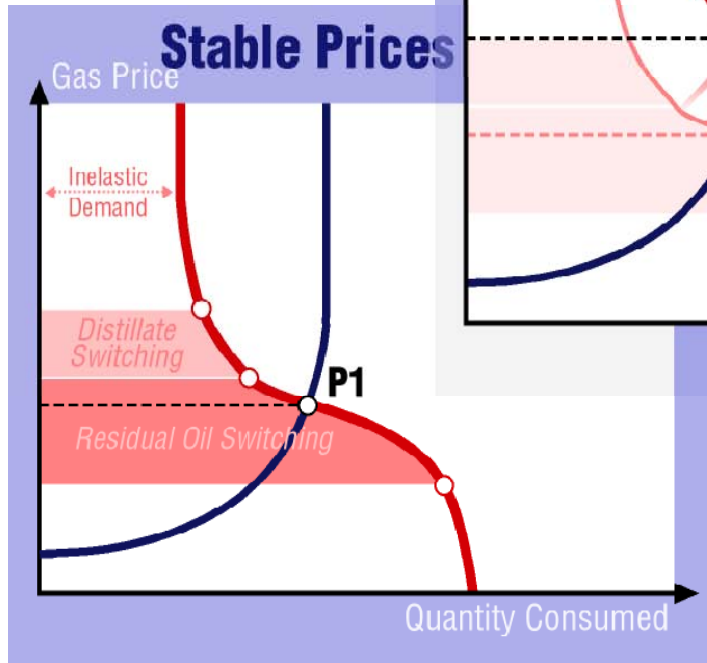
Historical Gas Prices At Henry Hub



Divergent trends in gas supply and demand have led to the tight balance between supply and demand, higher gas prices, and increased price volatility.

TIGHT BALANCE EXPECTED TO CONTINUE

Gas Price Response to Demand Shifts



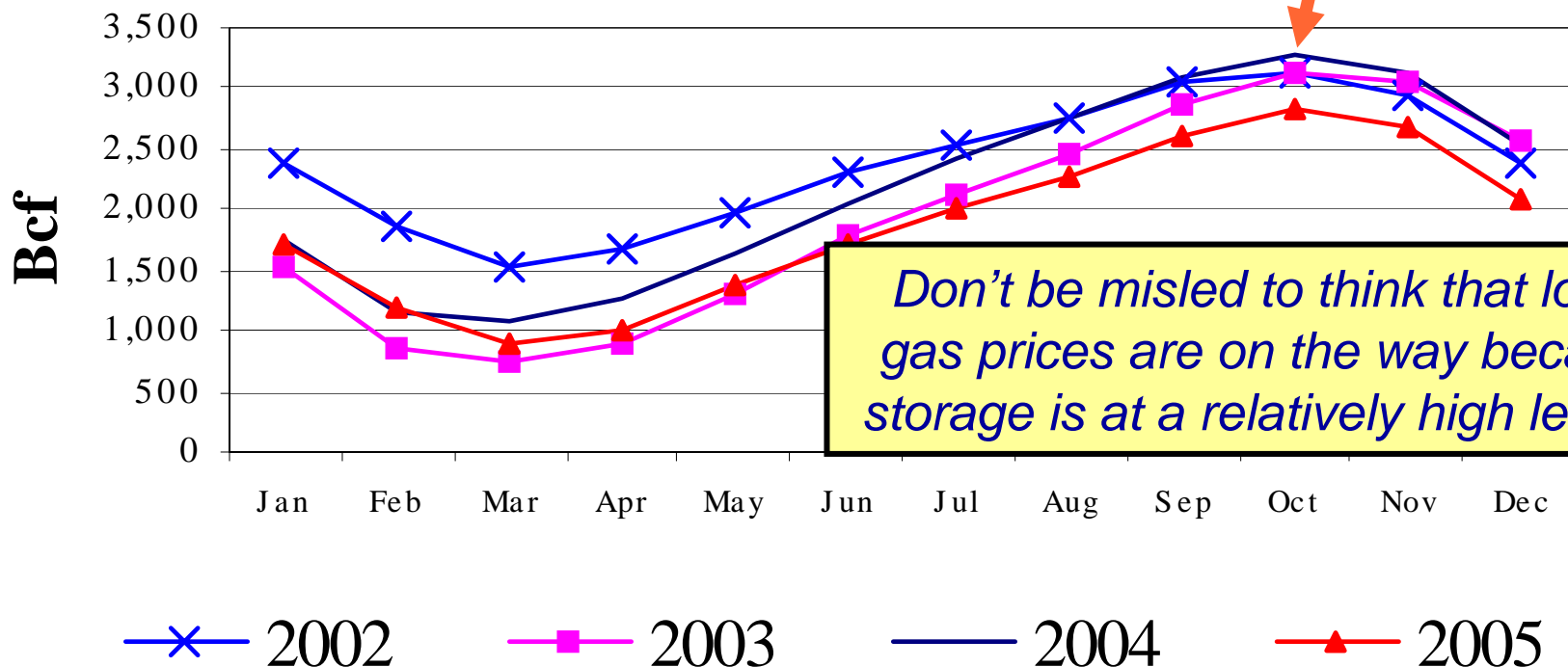
2004-05 Winter Outlook

U.S. Gas Storage Levels

Cooler than normal summer weather has helped storage refill ...

... hence, U.S. working gas will rise to a little over 3.2 Tcf by November 1st, near its five-year high.

U.S. Working Gas



Don't be misled to think that lower gas prices are on the way because storage is at a relatively high level ...

U.S. Gas Supply/Demand Balance

(Billion Cubic Feet per day)

Story Line

- 1) Last winter was on average 4% warmer than normal in the U.S.
- 2) Increased U.S. drilling activity keeping U.S. production flat.
- 3) LNG imports up by about 0.6 Bcfd this coming winter, and net Canadian imports up by 0.7 Bcfd.
- 4) Increased reliance on gas storage.

	Injection Season 2003	Injection Season 2004	Winter 2003-04	Winter 2004-05 /1
Gas Demand	60.7	60.0	73.7	77.4
<i>R/C/I Gas Use</i>	30.9	30.7	57.0	59.3
<i>Power Gas Use</i>	13.1	13.8	11.0	12.4
<i>Other Gas Use</i>	5.4	5.4	5.7	5.7
<i>Net Injections</i>	11.3	10.1	NA	NA
Gas Supply	61.4	60.7	74.7	78.3
<i>U.S. Production /2</i>	51.5	50.7	51.3	51.2
<i>Net Imports</i>	9.9	10.0	9.8	11.2
<i>Net Withdrawals</i>	NA	NA	13.6	15.9
Balancing Item	0.7	0.7	1.0	0.9

1. Normal winter weather assumed for 2004-05 winter.
2. Includes impact of Hurricane Ivan.

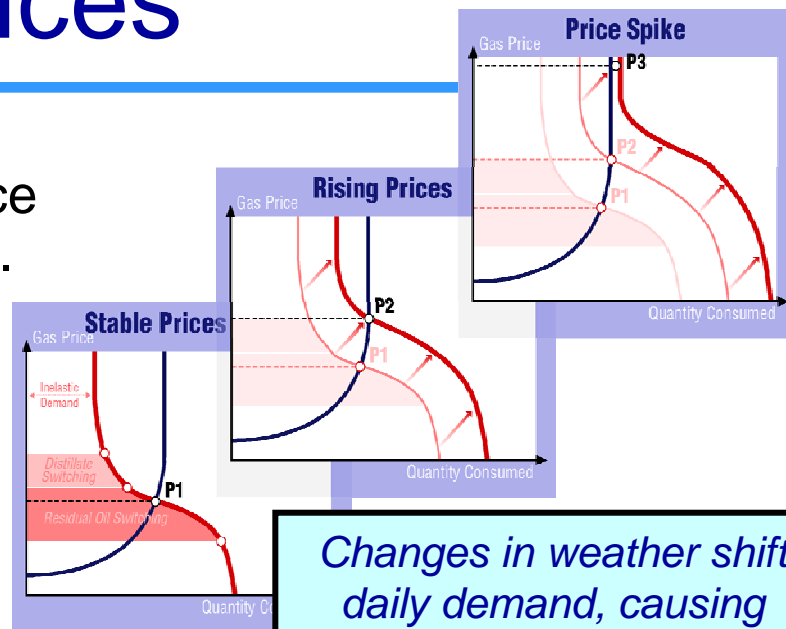
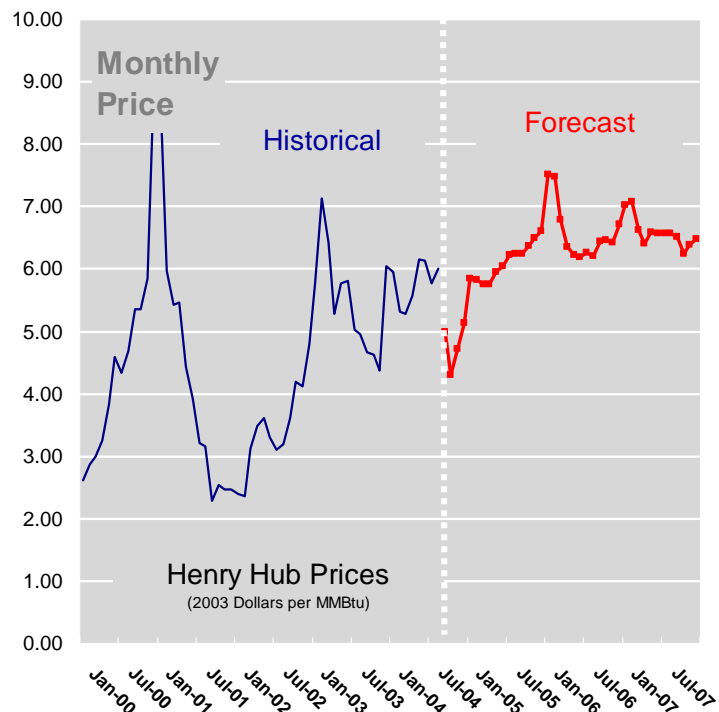
Unfortunately for gas consumers, increased imports and storage withdrawals during the upcoming winter will be offset by increased gas use.

Henry Hub Gas Prices

◆ Henry Hub prices will remain relatively high due to the persistence of the tight supply/demand balance.

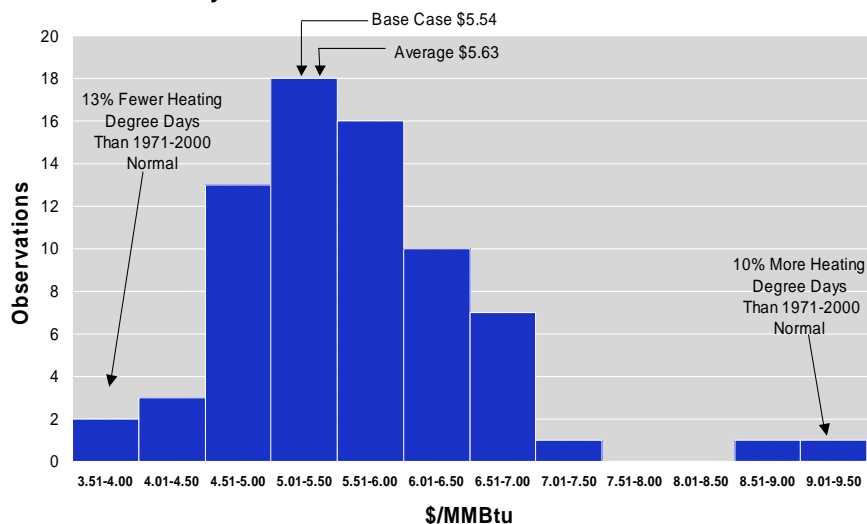
– An October price dip is possible as storage inventories fill, but upward price pressure will return with cold winter weather.

◆ Expect significant price volatility.



Changes in weather shift daily demand, causing wide swings in gas prices.

Henry Hub Price Distribution For Nov 2004 - Mar 2005

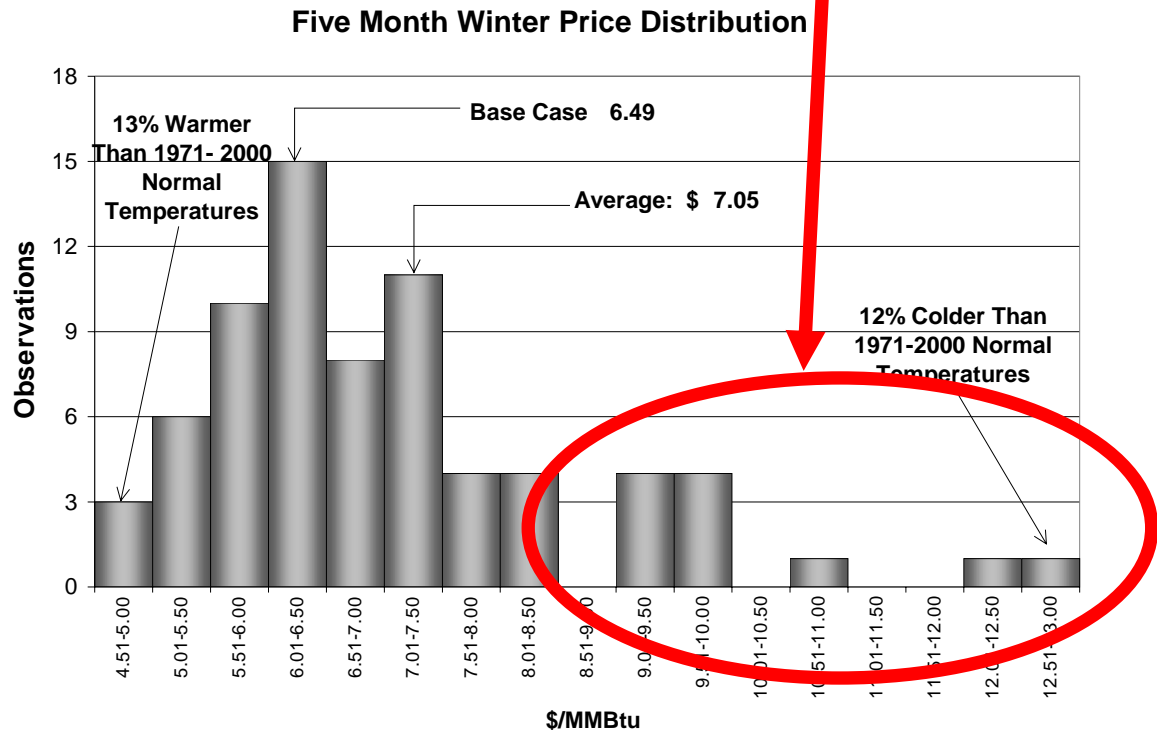


Regional Gas Prices

- ◆ Generally, regional prices will follow Henry Hub prices up and down.
- ◆ Some pipeline and storage constrained regions with limited ability to switch to alternative fuels may experience price shocks.
 - Recall the \$70 prices in New England and New York City during this past February.

New York City and New England are subject to continued price spikes with cold winter weather.

New York Weather Distribution (Nov. 2004 - Mar 2005)



Is Gas Supply Adequate to Meet Demand During the Upcoming Winter?

Yes, but ...

- ◆ There is little ability for supply to change in the near term.
 - Gas supply is almost totally price inelastic in the short run.
- ◆ In the short run, supply balances with demand mostly because of demand-side changes.
 - Fuel switching
 - Power plant dispatch options
 - Conservation
 - Shut down of facilities
- ◆ A much colder than normal winter would cause significant problems.

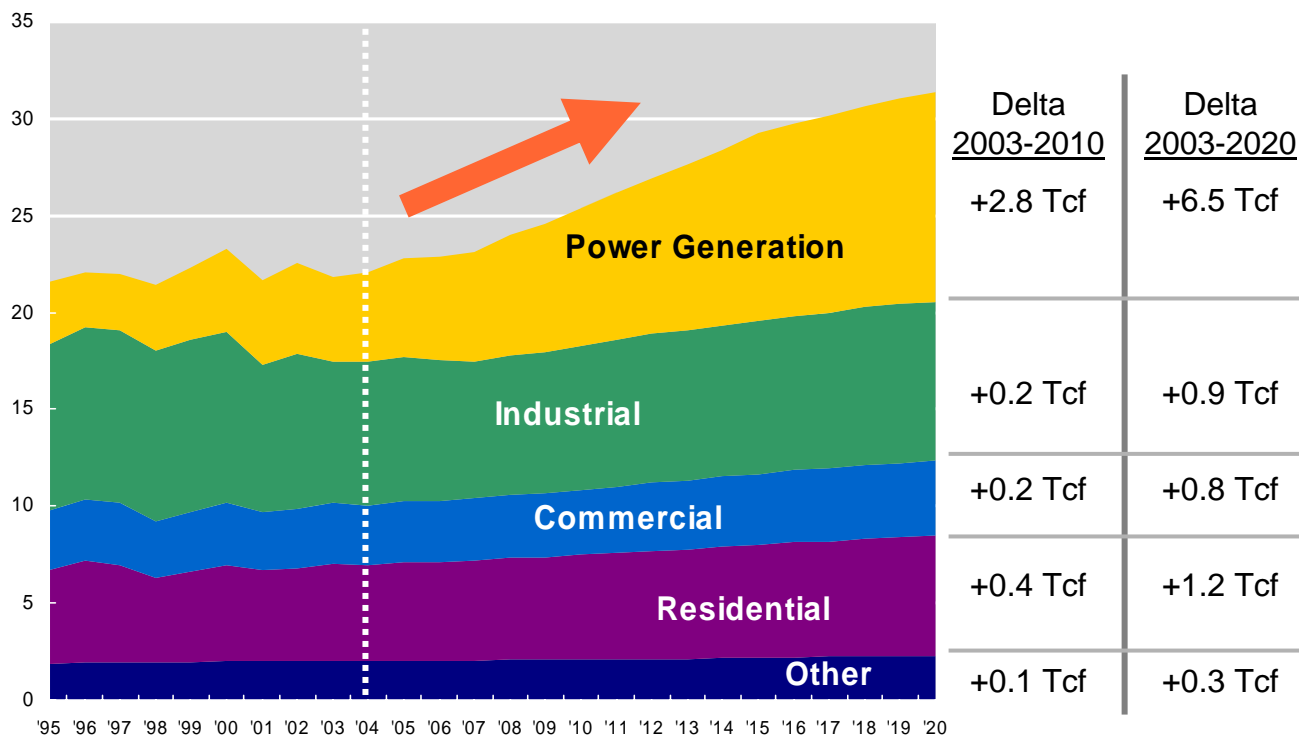
Longer Term Outlook

Gas Demand Outlook

- ◆ Gas consumption in the power sector will grow substantially.
 - Over 200 GW's of new gas-based generating capacity in the U.S. will be used to satisfy increasing electric load.
- ◆ Modest growth in R/C gas consumption.
- ◆ Industrial gas consumption will fluctuate around current levels.
 - Well below pre-2000 levels.
- ◆ When necessary, price-induced demand reductions will balance the market.

U.S. Gas Consumption

(Trillion Cubic Feet, Tcf)

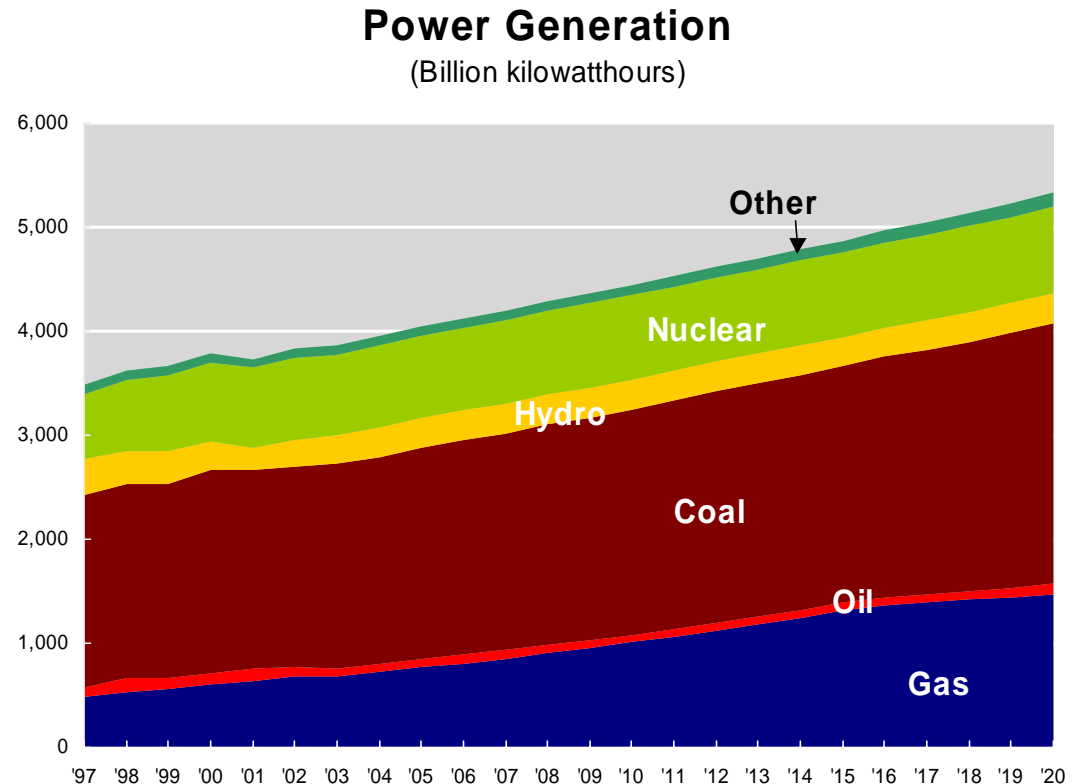


The North American gas market may be best characterized as a “demand leads supply market” for the foreseeable future.

1st Most Frequently Asked Question:

What Drives Growth in Power Generation Gas Use?

- ◆ More than 200 Gigawatts of gas generating capacity recently constructed.
 - Little switching capability.
- ◆ Electricity load has grown at about 2 percent per year during the past 15 years, a trend expected to continue.
- ◆ Coal generation expected to increase, but by only enough to satisfy 40 percent of growth in electric load.
 - Consistent with recent history.
 - Increases of output at existing coal plants limited by environmental regulations.
 - Significant additions of new coal capacity not expected during next 10 years.
- ◆ Nuclear and renewables output is expected to grow only slightly.



Gas-based capacity will satisfy a large part of the incremental growth in electricity load through the end of next decade.

2nd Most Frequently Asked Question: Will Industrial Gas Use Fold at High Gas Prices?

Recent Gas Use, Bcf

Source: U.S. Energy Information Administration

	Residential	Commercial	Industrial	Power Generation	Other	Total
1998	4,520	3,009	8,320	4,588	1,808	22,246
1999	4,726	3,056	8,079	4,820	1,724	22,405
2000	4,996	3,230	8,142	5,206	1,793	23,368
2001	4,776	3,052	7,363	5,343	1,713	22,247
2002	4,909	3,181	7,203	5,672	1,688	22,653
Annual Average	4,785	3,106	7,822	5,126	1,745	22,584
% of Total	21%	14%	35%	23%	8%	

Only 40 percent of the industrial sector's gas use will be subject to additional demand destruction.

Gas Use by Type of Industry, Bcf

Industry	Gas Use in 2003 (Bcf)	Percent of Total Industrial Gas Use (%)	Gas Share of Value Added (%)
Chemicals (all chemicals except ammonia production)	2,134	30	13
Ammonia Production	329	5	80
Refining	1,307	18	8
Pulp and Paper Products	596	8	6
Food Processing and Manufacturing	585	8	3
Iron, Steel, Aluminum, Other Metals	337	5	6
Stone, Clay, and Glass	339	5	2
All Other Manufacturing and Non Manufacturing	1,576	22	2

Significant demand destruction has occurred during the past few years.

Bottom Line: Not much future demand destruction is expected, unless supply significantly constrains the market.

Source: Energy and Environmental Analysis, Inc.

The Fundamental Question on Gas Supply: “Can Gas Supply Support a Growing Market?”

Yes!

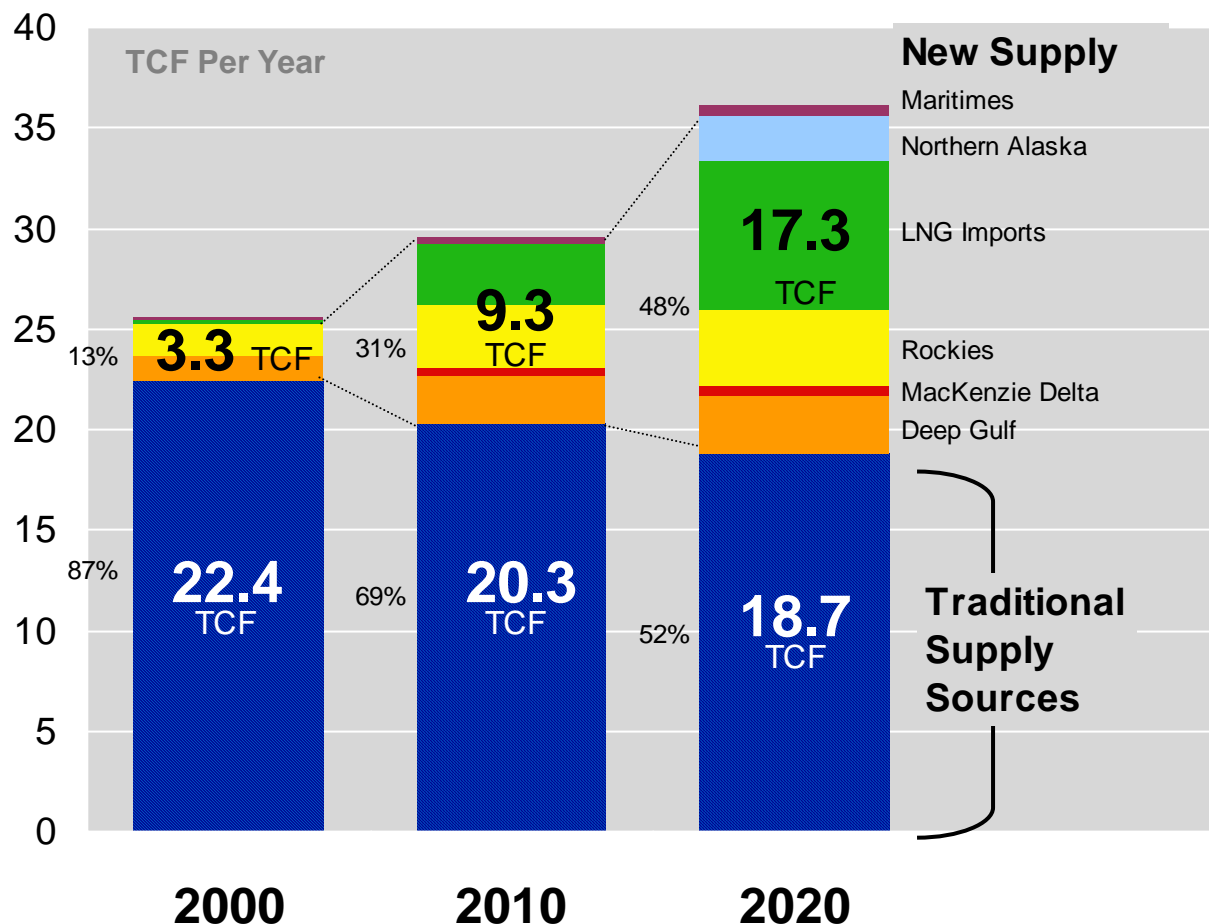
- ◆ Sufficient gas resource is available in North America and around the world.
- ◆ These resources can be developed and delivered to the North American market at prices that will allow gas demand to continue to grow.
- ◆ ***But not without the construction of new facilities to access and deliver new frontier gas supplies.***
 - ***Pipelines, storage, and LNG infrastructure.***
 - ***These projects have long lead-times and require large capital investments.***

Gas Supply Outlook

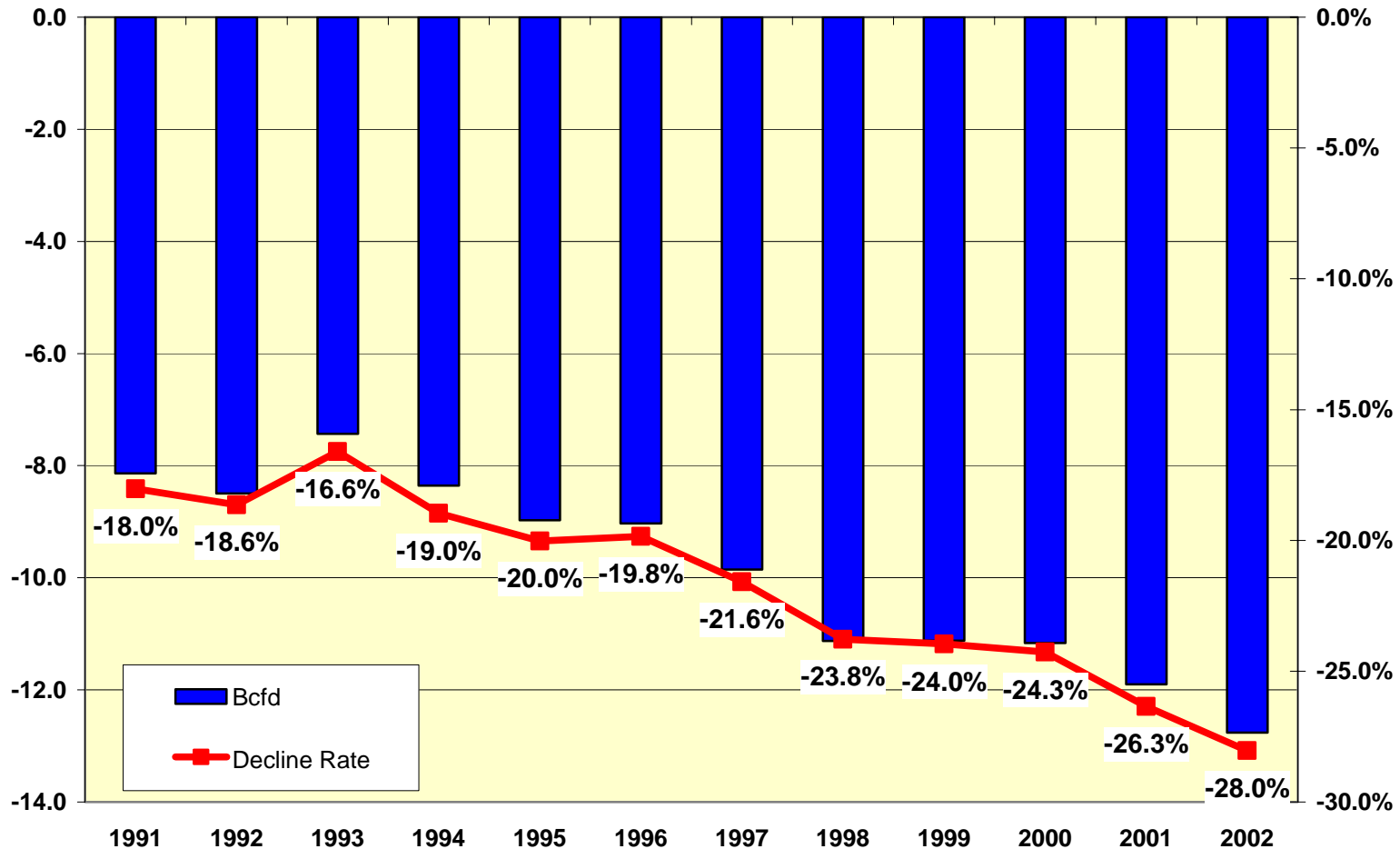
Relying On "New Frontiers"

- ◆ Production from mature producing areas will decline by 0.7 percent per year, necessitating development of new frontier gas supplies.
- ◆ New frontier supplies will account for 31 percent and 48 percent of total U.S. and Canada gas supply in 2010 and 2020, respectively.

U.S. And Canada Gas Supply



L-48 (IHS States) Gas Well Gas Base Decline



source: EEA GSR. Includes data supplied by PI/Dwights.

New Frontier Gas Supplies

“Abundant... and developable at reasonable cost, but not at \$2 per MMBtu”

◆ New frontier supplies may be delivered to market at unit costs under \$4 per MMBtu, *but*

◆ Market prices will be higher than minimum delivered to market costs due to development delays and risk premiums.

Cost Of New Frontier Gas Supplies			
New Frontier Source	Total Amount Delivered To U.S. And Canadian Markets In 2020 (TCF)	Estimate Delivery Cost Per Unit Of Gas ¹ (\$/MMBtu)	Capital Expended Through 2020 To Develop Supply ² (Billion\$ U.S.)
Deepwater Gulf Of Mexico³	2.9	2.50	260
Rocky Mountain Gas⁴	3.9	2.80	133
LNG Imports	7.3	3.50	107
Northern Alaska⁵	2.3	3.80	50
Eastern Canada Offshore	0.4	3.50	16
MacKenzie Delta⁶	0.5	3.60	14
Total Of New Frontiers...	17.3		580

1) Cost of deliveries into closest major market area in constant 2003 dollars. 2) Total cost of development, including all E&P expenditures and all development expenditures to bring the gas supply to market. 3) Almost two-thirds of the capital expenditure applies to oil well development. 4) Does not include San Juan Basin (SJB) gas. 5) 4 Bcfd project followed by 2 Bcfd expansion. 6) Includes development of satellite fields.

Regional Gas Supply

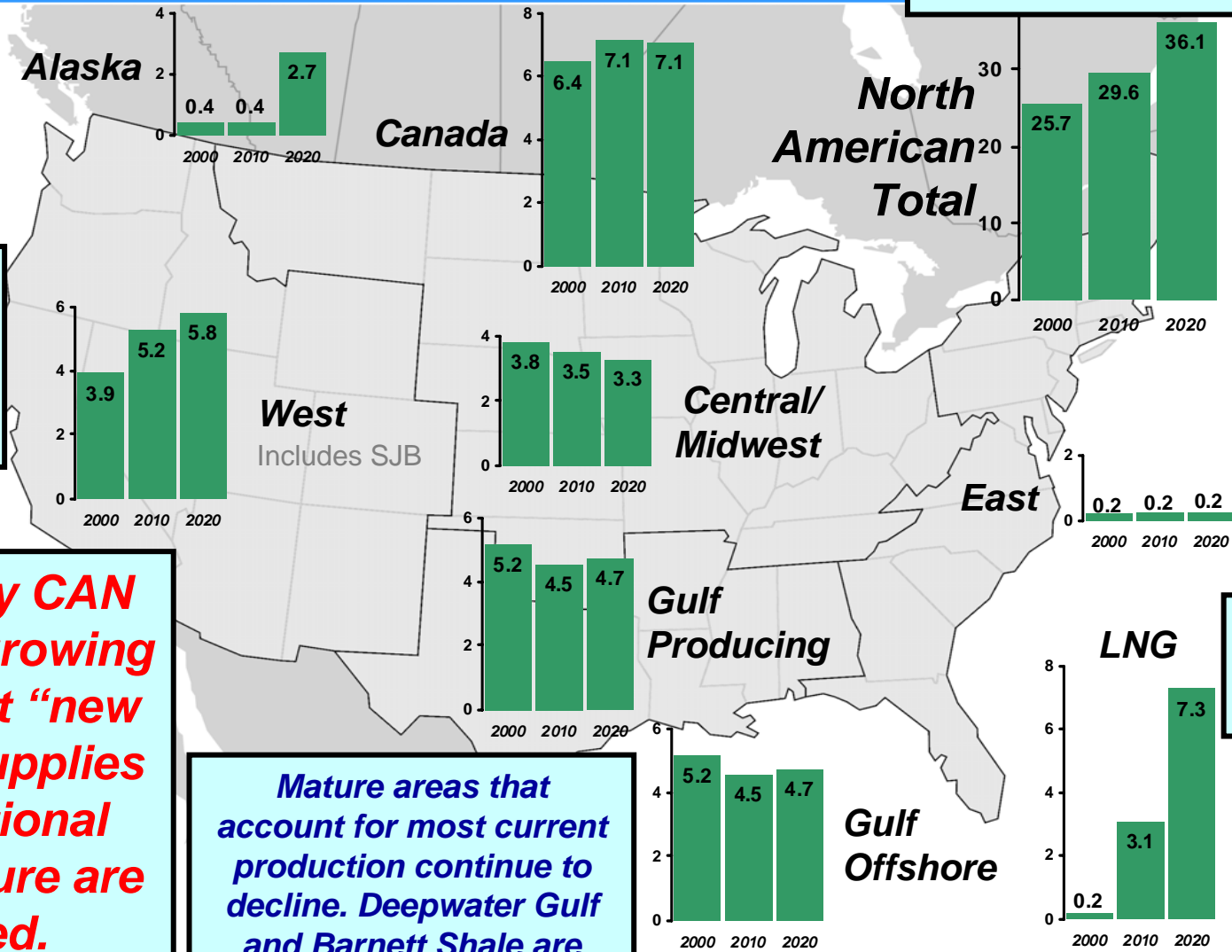
Canada would significantly decline without MacKenzie Delta and coalbed methane.

Alaska always 10 years out - but needed.

The Rocky Mountain Basins continue to shine.

Gas supply CAN support a growing market, but "new frontier" supplies and additional infrastructure are required.

Mature areas that account for most current production continue to decline. Deepwater Gulf and Barnett Shale are among few bright spots.



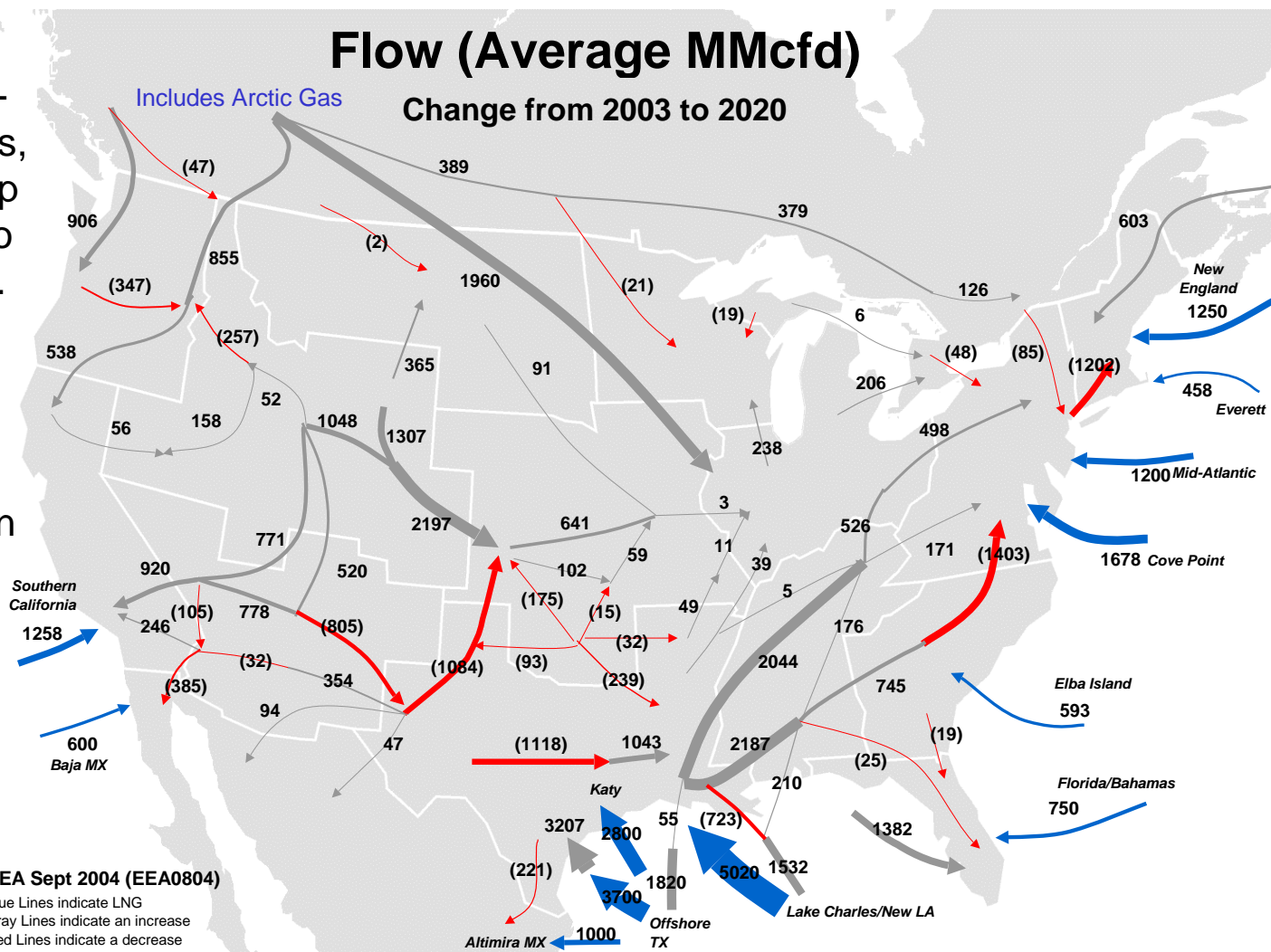
LNG to the rescue!

Units: Trillion Cubic Feet per year.

New Gas Supplies Affect Regional Flow Patterns

2003-2020

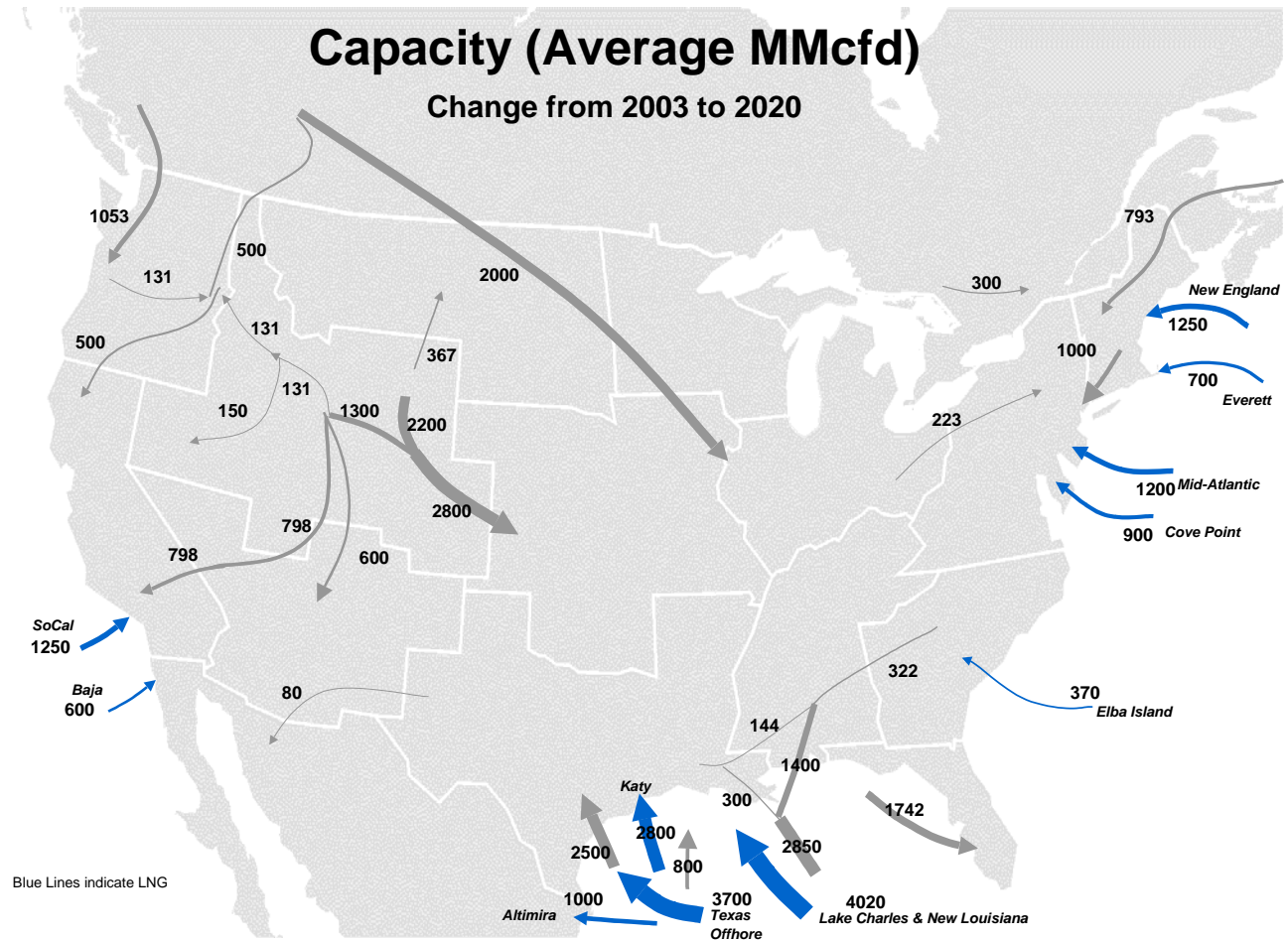
- ◆ New frontier supplies from Alaska, Mackenzie Delta, LNG imports, Rockies, and the Deep Gulf of Mexico grow to about 17 Tcf per year.
- ◆ Other “traditional” North American production declines.
- ◆ Alaskan and Canadian Arctic development increases imports from the north.
- ◆ U.S. LNG imports increase to about 20 Bcfd or 7.3 Tcf per year.



Capacity Additions Needed to Meet Growing Gas Demand

Notable Changes

- ◆ New long haul capacity to move Canadian and Alaskan gas to Canadian and U.S. markets.
- ◆ New long haul capacity to move Rocky Mountain gas to the West Coast and Midcontinent.
- ◆ New short haul capacity to link deepwater GOM gas to the onshore infrastructure.
- ◆ New short haul capacity to connect LNG imports to markets.



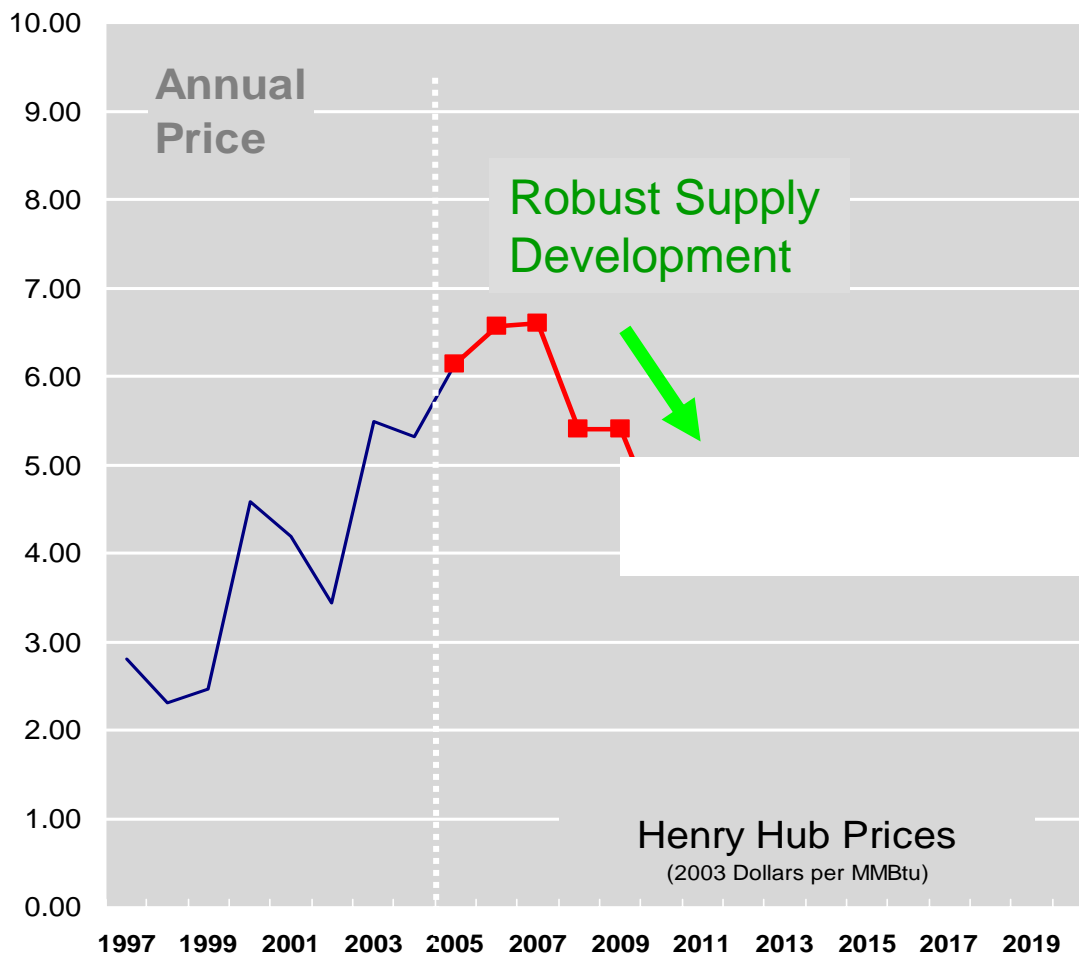
Obstacles For Supply Growth

- ◆ Large Capital Requirements
- ◆ Issues With Contracting Gas Supply Into the Market
- ◆ Investor Recognition of Opportunities
- ◆ Price Volatility Creates Uncertainty
- ◆ Uncertainty About Future Gas Demand
- ◆ Access Restrictions
- ◆ Cumbersome Approvals Process
- ◆ Environmental and Siting Issues
- ◆ Pipeline and Storage Infrastructure Inadequate for New Supplies

There is much uncertainty about future gas supply development.

Gas Price Outlook

- ◆ Gas prices will average between \$4 and \$5 per MMBtu in the longer term.
 - Growing gas demand will maintain upward pressure on North American natural gas prices, encouraging development of new frontier gas supplies.
- ◆ Price volatility will remain high because of continued tightness in the supply/demand balance and the uncertainty of supply development.
 - Expect prices well above \$5 and below \$4, but upward price risk is much greater.



Projection assumes that oil price (i.e., WTI crude) moderates back to about \$25 per barrel in real terms by the end of this decade.

Summary and Conclusions

Conclusions

- ◆ Gas supply/demand balance will remain tight.
 - ***Storage fill to near-record levels is not a cure-all.***
 - ◆ Henry Hub gas prices likely to average between \$4 and \$5 per MMBtu for the foreseeable future and ***MUCH HIGHER THAN THAT*** for the next two years.
 - ◆ High levels of gas price volatility likely to continue.
 - ***Weather alone can swing average gas prices by a few dollars.***
-
- ◆ Gas use likely to rise as a result of increased reliance on gas-fired power generation.
 - ◆ Gas supply ***CAN*** support a growing market, but “new frontier” supplies and additional infrastructure are required.
 - ***Rockies***
 - ***Deep Gulf of Mexico***
 - ***LNG Imports***
 - ***Alaskan gas***

The Fundamental Question on Gas Supply: “Can Gas Supply Support a Growing Market?”

Yes!

- ◆ Sufficient gas resource is available in North America and around the world.
- ◆ These resources can be developed and delivered to North American market at prices that will allow the gas demand to continue to grow.
- ◆ ***But not without the construction of new facilities to access and deliver new frontier gas supplies.***
 - ***Pipelines, storage, and LNG infrastructure.***
 - ***These projects have long lead-times and require large capital investments.***

*Without development of new frontier supplies, gas prices will rise to levels well beyond levels presented herein.
The risks are real!*

EEA thanks the U.S. Department of Energy (DOE) Office of Energy Assurance (OEA), the National Energy Technology Laboratory (NETL), the Energy Information Administration (EIA), and the National Association of State Energy Offices (NASEO) for the opportunity to have presented its views on the North American gas market.

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