Underground Gas Storage and Gas Strategies in North America

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- Introduction
- Natural Gas Transportation
- Underground Gas Storage
- Natural Gas Exploration & Production Activity
- Dramatic Changes in the Dynamics of the Gas Industry
  - When will LNG Imports Increase as Predicted?
  - When will the Arctic Natural Gas flow South?
North American Gas Pipelines

- **Canada**: 40,000 Miles of Transmission Pipeline (15,000 Miles, TransCanada Pipelines)
- **UNITED STATES**:
  - 1.9 Million Miles of Distribution
  - 0.3 Million Miles of Transmission
  - 2.2 Million Miles of Pipeline

North American Gas Pipelines

- **Kinder Morgan**
- Second largest Transporter of Natural Gas in U.S.
- Approximately 22,000 miles of interstate/intrastate pipeline
North American Gas Storage

Kinder Morgan Energy Partners
Second largest Operator of Underground Gas Storage in North America
5 Depleted Reservoirs
9 Aquifers
9 Salt Dome Caverns
400 Bcf of Working Capacity

United States Storage Industry

- 75 Storage Operators
- 400 Storage Facilities – 30 States
  - 326 facilities in depleted oil and gas reservoirs
  - 43 facilities in aquifer reservoirs
  - 31 facilities in salt caverns
- 4,300 BCF of Working Gas Capacity (122 BCM)
- 85-90 BCF per day of peak deliverability (2.5 BCM/D)
- Operate over 17,500 Storage Facility Wells
North American Gas Storage

- 9 Storage Operators
- 50 Storage Facilities - 5 Provinces
  - 42 facilities in depleted oil and gas reservoirs
  - 0 facilities in aquifer reservoirs
  - 8 facilities in salt caverns
- 650 BCF of Working Gas Capacity (18 BCM)
- 5-10 BCF per day of peak deliverability (150-300 MMCM/D)
- Operate over 650 Storage Facility Wells

Canadian Storage Industry
North American Storage Types

Volume in MMCF

- Depleted Reservoir
- Aquifer
- Dome Salt Caverns
- Bedded Salt Caverns

Working Capacity

3,995,585
359,021
158,669
33,118
Abandoned Storage Fields

Cumulative North American Storage Development History

<table>
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<th>Decade</th>
<th>Canada</th>
<th>US</th>
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<td>1990s</td>
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- Volume in MMCF

Legend:
- Abandoned Aquifer
- Abandoned Depleted Gas Reservoir
- Abandoned Coal Mine
Top North American Operators

Working Capacity by US State and Canadian Province
Total Wells by Operator

Through September 25, 2009

United States Storage Inventory

3.589 Tcf  491 Bcf > 2008;  481 Bcf > 5 Yr. Ave.

262 Bcf > than ever on this date
United States–Potential Gas Resources

Long Term Supply Outlook
Shale Production Changes Everything

Supply Push – The Midstream Story

U.S. & Canadian Production Increase
(2009 - 2026)

Total Increase: 5.5 Bcf
Lower 48 Increase: 7.0 Bcf

Source: Kinder Morgan – NACO Directories
US Electric Generation - 2007

- Coal: 48.5%
- Natural Gas: 21.6%
- Petroleum: 1.8%
- Other: 0.3%
- Other Renewables: 2.5%

Total = 4,157 Billion kWh
Electric Utility Plants = 66.2%
Independent Power Producers & Combined Heat and Power Plants = 30.0%

Source: US EIA

Supply Surge driven by Shale Gas

The current economy and low price will reverse growth in the near term

US Production Forecast

Source: World Mackenzie
Arctic Gas Pipeline Alternatives

LNG Deliveries into North America Expected to Climb Rapidly?

North American LNG imports

- Canada
- Mexico
- US

Source: Cambridge Energy Research Associates
Underground Gas Storage and Gas Strategies in North America

- Conclusions
- Natural Gas Transportation - Shifts from south to north to west to east
- Underground Gas Storage – Growth 80-100 Bcf/year working gas
- Natural Gas Exploration & Production Activity - Significant growth in shale gas production underway.
- Dramatic Changes in the Dynamics of the Gas Industry - will continue
- 100’s of years remain in the North American natural gas era!

Transportation Drivers (2005 vs Current)

Map showing average prices from 2005 to 2009 across various locations in North America.
1999–2000: Six interstate header pipelines with in excess of 3.4 Bcf/d of capacity, primarily to transport coalbed methane gas to interstate pipeline interconnections.

2000: Alliance Pipeline (2.0 Bcf/d)

2001: TransCanada Pipeline System (0.4 Bcf/d)

2002: Questar Southern Trails Pipeline (0.1 Bcf/d)

2002: North Baja Pipeline (0.5 Bcf/d)

2003–2004: Five interstate pipelines from the Barnett Shale formation area to interconnections with interstate pipelines (more than 3 Bcf/d)

2005–2006: Five interstate pipelines from the Barnett Shale formation area to interconnections with interstate pipelines (more than 3 Bcf/d)

2006: Centerpoint E DPipeline (0.1 Bcf/d)

2006: Millennium Pipeline (0.5 Bcf/d)

2007: Express Pipeline System (0.4 Bcf/d)

2008: Millennium Pipeline (0.5 Bcf/d)

2008: Express Pipeline System (0.4 Bcf/d)

2009: Maritimes & Northeast

2009: Portland Natural Gas pipeline systems.
The Consuming East (including Eastern Canada) region relies extensively on storage gas to meet peak demand during the winter months. Its share of US and E. Canada totals:

- 54% of total working gas capacity
- 54% of the storage deliverability (44 Bcf/d out of 80)
- Approximately 65% of gas consumption

Due to storage and transport limitations into the U.S. Northeast, it is difficult to secure adequate storage services and hence price spikes occur almost every winter.

Much of the storage in the Producing Region are linked to market centers and play a vital role in the efficient export and transmission of natural gas to other areas.
EIA Gas Storage Regions

Working Gas Capacity by Region

- Consuming East: 2.3 Tcf
- Producing: 1.3 Tcf
- Consuming West: 0.7 Tcf
- Total: 4.3 Tcf
Major Portions of the Gas Resource Base are Not Accessible

Approximately 29 trillion cubic feet (TCF) of the Rockies gas resources are closed to development and 108 TCF are available with restrictions.

Source: AGA

North American Supply Forecast

Source: KINDER MORGAN
Basin Development Costs per Mcf for a 10% IRR

NYMEX ($/Dth)

Source: Morgan Stanley

Electric Power Generation

2009 Nuclear, Oil, Hydro Wind, Solar Coal Gas Share

Source: Morgan Stanley