CNG: Natural Gas in the US Transportation Fuel Market

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CNG Commercialization Manager
Constellation
Natural Gas Leadership

Figure 10. U.S. energy production by fuel, 1980-2040

Natural Gas has become the leading energy source produced in the US – quickly moving ahead of coal and 50% greater than domestic liquid fuel supplies.
U.S. Energy Production

Natural Gas – US Energy Market “Game Changer”

<table>
<thead>
<tr>
<th>Bcf/Year</th>
<th>1990</th>
<th>2000</th>
<th>2012</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Use</td>
<td>17,305</td>
<td>21,527</td>
<td>23,157</td>
<td>24,485</td>
</tr>
<tr>
<td>Pipeline Use</td>
<td>633</td>
<td>625</td>
<td>711</td>
<td>712</td>
</tr>
<tr>
<td>Lease &amp; Plant</td>
<td>1,236</td>
<td>1,016</td>
<td>1,436</td>
<td>1,570</td>
</tr>
<tr>
<td><strong>Total Demand</strong></td>
<td><strong>19,174</strong></td>
<td><strong>23,168</strong></td>
<td><strong>25,304</strong></td>
<td><strong>26,767</strong></td>
</tr>
<tr>
<td>U.S. Production</td>
<td>17,809</td>
<td>19,269</td>
<td>24,042</td>
<td>27,190</td>
</tr>
<tr>
<td>Net Imports</td>
<td>1,446</td>
<td>3,538</td>
<td>1,516</td>
<td>(90)</td>
</tr>
<tr>
<td><strong>Total Supply</strong></td>
<td><strong>19,255</strong></td>
<td><strong>22,807</strong></td>
<td><strong>25,558</strong></td>
<td><strong>27,100</strong></td>
</tr>
<tr>
<td>Import %</td>
<td>8%</td>
<td>16%</td>
<td>6%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- **Growth drivers:**
  - Power generation and CHP
  - Rebounding Industrial Sector
  - Transportation (high growth rates)

- Offsetting reliance on coal and oil
U.S. Energy Consumption

Natural Gas as a Transportation Fuel

Transportation market, by far, is the most concentrated energy sector in US

- Very high reliance and history with liquid fuels
- Of nearly 170 billion gallons of gasoline/diesel annual use in on-road transportation, less than 1% is natural gas (CNG/LNG)

Market factors point toward CNG growth opportunity

- Requires major capital investments and time for energy transition
  - CNG vehicles
  - CNG fueling infrastructure

![Projected Gallons (In Thousands)](image)
CNG as THE Transportation Fuel Alternative

Domestic Fuel Supply
• US nat gas production has reached levels equal to/greater than annual demand

Reliable
• Well-established transmission and distribution network across US

Cost Advantage and Stability
• Lower cost per mile
• Disconnected from the traditional volatility of world energy markets

Reduced Vehicle Emissions
• NGVs produce fewer GHG emissions than traditional fuels

Integrated Energy Management
Facility and Transportation energy management can benefit from an integrated, proactive approach

Capitalize on the benefits and availability

Focus on strategy rather than the procurement process to drive the desired results
CNG Industry Development Challenges

Core Costs Remain High:
- OEM vehicle offerings limited with cost-premiums consistently above 40% of base vehicle cost
- Aftermarket conversion costs have risen due to EPA certification requirements
- Fueling station costs are significant, and industry standardization needs to be more coordinated
- Station operating costs can be high for new stations where capacity utilization has not yet reached planned levels

Emissions
- Lessening of CNG advantages due to improvements in conventional fuels and exhaust after-treatment and hybrids

Incentives
- Uncertainty of the availability of vehicle and station incentives
- State-by-state differences in incentives and focus on particular alternative transportation fuels

Lane Logistics
- Range of vehicles (greater range = greater cost) makes the coordination of logistics and refueling critical
- Commitment of lanes and vehicles need to be coordinated with commitments of new and existing CNG fueling stations
- Multi-point lanes require coordination of shippers, haulers and CNG refuelers
Constellation – A National Energy Services Leader

Constellation’s planned 100 CNG stations by 2018 would represent 5% of refueling infrastructure

Constellation’s CNG Station Network Location:
Strategic public sites within the Great Lakes – Ohio River Valley regions’ interstate highway travel corridor
- One of the largest volume regions for interstate trucking and freight traffic
- Located near the highest concentration of Constellation’s retail natural gas and power supply customers
- Promotes private CNG station development (example: Detroit, MI to Kokomo, IN fleet route)

Large Market for Local Interstate Anchor Fleets & Traffic:
> 554 million GGE/yr of fuel demand within 25 miles of the sites
- Potential fuel contracts of 3MM GGE/yr

Additional Stations Under Development:
- Columbia SC
- Scranton PA
- Ft. Wayne IN
- Cumberland County NJ
- Cincinnati OH

Constellation’s CNG Locations:
- Indianapolis, IN
- Lafayette, IN
- Greensburg, IN
- Dayton, OH
- Findlay, OH
- Seymour, IN

Active CNG Network

Public Constellation CNG station network
Public sites in construction
Potential sites in development

Constellation Active CNG Markets (in Blue)
Fleet Owner Benefits of CNG

1. **Reliability**
   - Energy Security - US produced natural gas reserves 100+ years
   - Dual Compressors at CNG stations mean 99.9% availability
     - Potential for Nat Gas emergency generation on-site to ensure fuel availability during power outages

2. **Capital**
   - No cap-ex needed
   - Internal dollars available for vehicle purchases/incremental CNG capital

3. **Resources**
   - Turnkey install & on-going management does not fall on existing staff
   - Best-in-class providers as extension of your energy team

4. **Operations**
   - Refueling solutions designed for zero operational impact
   - OEM CNG Vehicle technology advances minimize traditional loss, performance, range and maintenance concerns

5. **Energy Costs**
   - Receive long-term budget certainty for transportation fuel
   - Fuel/Energy savings of $1-$2 per gallon result in quick ROI and then bottom-line operating cost savings
   - Limit energy market risk impacting traditional liquid transportation fuels

6. **Competitiveness**
   - Advantage of lower $/mile operating costs
   - Lower cost routes and transportation costs
## Fleet CNG Decision Factors

### Benefits

- $1-$1.50/gal fuel savings
- Lower portion of fuel price related to commodity volatility (30% for CNG vs 70% for diesel & gasoline)
- Domestic energy source
- Boost the U.S. economy
- Cleaner burning fuel with less emissions

### Tradeoffs

- Incremental vehicle conversion cost
- Decreased payload from CNG equipment
- Horsepower can decrease 5-10% with heavy duty applications
- Different maintenance schedules vs petrol
- Garage/facility retrofits

### Conversion Costs

- $10,000 to $15,000 for light duty
- $20,000 to $70,000 for heavy duty

### Vehicle Incentives

- State-specific programs offer grants up to offset up to 50% of incremental vehicle cost

### Local Maintenance Light-Duty:

- Annual Gallons (per vehicle): 2k
- Fleet Investment (per vehicle): $10k
- Payback Period: 48 months

### Regional Distributer Semi Truck:

- Annual Gallons (per vehicle): 20k
- Fleet Investment (per vehicle): $60k
- Payback Period: 24-36 months

### Refuse & Waste Hauler Truck:

- Annual Gallons (per vehicle): 10k
- Fleet Investment (per vehicle): $20k
- Payback Period: 24 months
Sample ROI – The CNG Price Advantage for Fleets

INPUT

- Fleet Type: Class 8 Truck
- Fleet Fuel: Diesel

Select Alternative Fuel: Compressed Natural Gas, Liquified Natural Gas, Biofuel

- Fleet Size: 5 Trucks
- Total Fuel Tank Capacity Per Truck: 300 gallons
- Average Miles Per Year Per Truck: 59223 miles
- Average Diesel Fuel Economy: 5.86 MPG
- Diesel Price: $3.15 per gallon

OUTPUT

- Diesel:
  - Gallons Used Per Year: 50532
  - Miles on a Full Tank: 1758
  - Total Annual Fuel Cost: $169174.45

- Compressed Natural Gas:
  - Gallons Equivalent Used Per Year: 56949
  - Miles on a Full Tank: 1560
  - Total Annual Fuel Cost: $91688.02

Results

- Payback on Incremental Truck Cost: 1.33 Years
- Annual Fuel Savings: $67436.43

http://www.ep-act.org/alternative-fuel-calculator
Exelon Corporation: A National Energy Leader

Operations & Business Activities in 48 states, Washington D.C. & Canada

Revenues: $27.4 billion  |  Assets: $86.8 billion

Employees: 29,000

Competitive Load Served:
• 180 TWH (electric)
• 650 BCF (natural gas)

Energy Generation: Exelon Generation
• Generating Capacity: 32,500 MW

Competitive Energy Sales: Constellation
• 175,000 business & public sector customers
• More than 2 million residential customers
• Wholesale sales, dispatch, and delivery from Exelon’s 33 GW power generation portfolio

Transmission & Distribution: BGE, ComEd, PECO
• 6.6 million electric customers
• 1.2 million natural gas customers

NYSE Ticker Symbol: EXC
Headquarters: Chicago, IL

*2014 data

One of the nation’s leading competitive power generators, with approximately $27.4 billion in annual revenues. The Exelon family of companies participates in every stage of the energy business, from generation to competitive energy sales to transmission to delivery.
## Constellation’s CNG Value Proposition – How It Works

<table>
<thead>
<tr>
<th>Constellation Designs &amp; Manages Construction Project</th>
<th>Constellation Pays All Up-front and On-going CNG Station Costs</th>
<th>Customer Pays for Monthly CNG Consumption</th>
<th>Fuel Fleets with CNG Effectively for Your Business</th>
</tr>
</thead>
</table>
| **Constellation provides the station:** a **private Station** on your property for your fleet or a **public access** serving the needs of multiple fleets | **Using approved fleet cards, customer vehicles refuel at Constellation CNG stations.** Constellation owns, operates, and maintains the stations. | **Customers are billed for the overall consumption at a price per Gallon Gas Equivalent (GGE):** Gas Supply + Compression Cost = Price per GGE | **CNG vs. Petroleum Fuels**
• Long-term price advantage
• Significantly lower GHG emissions
• Clean burning, abundant, U.S. produced fuel supply |

**Financial & Operational Value**
• Long-term budget certainty for fleet fuels
• Quick return on investment for CNG vehicle conversions
• Constellation solution minimizes expense: no upfront capital expense, no Operations & Maintenance (O&M) cost
• Land leasing or property tax can be leveraged based on location, agreements, and availability.
Lower CNG price advantage dictates the target fleets

Focus on private fleets, fleet mileage, fuel consumption and operational areas providing specific targets for CNG pipeline, at varying values of CNG to Diesel price spread.
What Is Impacting Current Energy Price Trends?

Weather – Neutral
• 6-10 day: Warm outlook expected for the Plains, Midwest, and Texas whereas heat for California. Normal temperature outlook for the East.
• 11-15 day: Forecast trends warmer for the Midwest, Interior West, and South-west. Variability in the East but less persistent warmth than the Midwest.

Economy – Neutral
• Good news: Jobless claims are steady at rock bottom lows (264k for wk 09/12), continued optimism in housing (housing market index at 10 year highs), and solid growth in retail sales.
• Bad news: Reversal in auto production pulled down Industrial Production (falling 0.4% vs. anticipated 0.2%) and weak CPI for August due to soft consumer prices.

Commodity Fundamentals – Neutral
• NYMEX prompt month gas ($2.60) was lower w-w, although volatile during the week with expectations of warmer temperatures.
• For the week ending Sep 11, EIA reported storage injection of 73 Bcf, in line with expectations.
• WestHub calendar strips w-w were slightly lower but the front of curve remains stronger than the back.
Constellation’s Core Business – Energy Supply

This page contains informal talking points about the market intelligence Constellation provides its customers. Our intent is to distill the vast amount of market data we receive into concise bullets which you can use to educate, entertain or bore anyone who’ll listen to tears. We welcome your feedback.

Weather

- Following a period of cooler than normal conditions seen in the mid-Continent since the Ides of August, forecasts now feature a pattern change that will bring some of the hottest conditions of the season to parts of the Midwest. The first week of Sept is looking to be hot as a pistol from the Midwest to the Northeast, with major pop centers likely to reach 90° or better, including Chicago where only seven days this year have reached 90°. The first third of this month is tracking towards record heat based on pop-weighted CDDs.
- Similar to the Donald’s steady trend of ticking higher at the polls, the strong El Niño in the Pacific continues to make gains as its own polls are now at the highest temp departures since 1997. As we know, this setup causes the weather types to favor above-normal temps across the US northern tier and way above-normal precip. Why? Because the El Niño shifts the subtropical jet stream that normally pours rain over the jungles of southern Mexico and Central America toward California and the southern US. One needs to take the good with the bad however; yes, this would alleviate the drought that has plagued California since the days Occupy Wall Street was all the rage, but when this occurred in 1997-98 storms brought LA nearly 25 inches of rain, more than twice normal... cue the flooding and mudslides.

Natural Gas & Oil

- Weekend and Monday deliveries at the Algonquin Citygate clocked in at $2.57. That price could seem like a blue-light special if planned capacity restrictions at one of the Algonquin compressor stations collides head on with forecasts for warmer temps and light pre-holiday weekend trading. Restrictions for maintenance on flows into New England are slated to be in place for another two weeks. With big expectations for heat and demand this week the restriction could place upward pressure on Algonquin basis.
- The prompt October contract fell 1.8 cents to $2.715 on an 8.4 cent range last week. Natural gas trading was a sea of tranquility compared to the wild gyrations emanating from Wall Street and other markets. Recall, the Dow opened the week with a 1,000 point plunge and ended with a loss of 588 points; the prompt Nymex gas contract moved 2.6 cents that day. The incredibly small price range continues to suggest the possibility of establishing both a new high and low in coming weeks. Made even more likely as the net managed money short position surged to over 78,000 contracts last week and is the largest since July 7, while open interest fell to 917,000 and is the lowest since November 4, 2014. The most renowned trade in gas is called the “widow maker”; a rush to the exits in a spurt of short-covering amid late summer illiquidity spells price spikes.
- Crude skyrocketed nearly $4/bbl Monday after a bullish supply report from the EIA and increasing chatter among the OPEC members that an emergency meeting is warranted to address low prices. In the past three trading days, crude has gained more than 25% to just over $49/bbl. That the EIA cut production volumes for June in its wrap-up report and a number of cartel members are willing to link arms and “face the oil industry’s challenges together” has clearly put a bid under prices, it may be short-lived. Unless Saudi Arabia, the only country capable of leading an effort to restrain production, participates, any emergency meeting is likely to be ineffective. Additionally, the $49/bbl level was a price magnet for traders looking to play around Mexico’s recent monster option purchase to hedge half of its 2016 exports.

Power

- Flouting the same near-boundless energy the Aerobic fad brought to workouts everywhere, ERCOT broke its own peak demand record multiple times last month. On Aug 5th, ERCOT broke its standing four-year peak hourly demand. On Aug 6th, it broke the newly-set peak another two times. Power demand in the cowboy state then crushed all previous records on Aug 10th when demand hit 69,000 for the first time topping out at 69,783 MW. Prices were wildly different across the days as the ORDC price adder was in effect during the several peak periods. On Aug 5th, the price adder drove most prices system-wide to over $600/MWh but was much less present on later days as prices were often in the $80 range. The Operating Reserve Demand Curve began in 2014 to more accurately price reserve shortage and scarcity pricing scenarios.

Risk Management

- Bullish? Read this: Near term forecasts favoring heat will be downsizing storage injections beyond this week’s EIA release. A sizable upswing into the 85+ Bcf zone has likely been priced in for this week, and any extension of hot temps toward mid-Sept or storm activity into the GOM could easily force nearby futures up into the $2.80s. Yawn.
- Bearish? Read this: How much more downside are you looking for? The short side of the trade is already overcrowded. Not enough specs want to bet these low prices can reach even lower. When the market flushed down below $2.75, a lot of traders came in to short the market, but when we hit $2.65 interest dried up.
The NYMEX 12 mo Strips is trading $2.85-$2.90/MMBtu the last week as heat in the beginning of September supports prices to the downside and flat production is holding prices from running up.

Winter weather forecasts will begin to firm up in October so look for opportunities between now and September to layer in forward purchases.

Customer Takeaway: The NYMEX 12 mo strip is range bound by lack of fundamental demand to drive above $3.25/MMBtu while end of October storage less than 4 Tcf will support prices from moving too much lower in the short run.
El Nino Status – Stronger

- The latest water temperature anomaly for the key El Nino region ticked up to +2.3 degrees C.
- This places the current El Nino well into the strong category and slightly ahead of the super strong El Nino of 1997-98.
- The strength of El Nino will be key for the winter.
  - There will be warmer winter risks if the El Nino slowly declines during the late autumn.
  - There will be colder winter risks if the El Nino starts to rapidly collapse through the autumn.
  - The Euro monthly forecasts show mostly mild winter temperatures, however storminess could lead to more heating demand across the southern tier.
CNG Has Price Stability and Remains Cheaper

Benefits:

Fuel Savings - CNG is cheaper than petroleum fuels

More stable fuel price - A GGE of CNG has a lower portion related to commodity volatility (~25% for CNG vs ~70% for diesel & gasoline), so the price at the dispenser is less volatile.

In Other Words:

CNG is both cheaper and, for a given change in the commodity price, the price at the dispenser for CNG fluctuates less:

<table>
<thead>
<tr>
<th>Δ in CNG commodity cost per Dth:</th>
<th>+$0.50</th>
<th>+$1.00</th>
<th>+$1.50</th>
<th>+$2.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>+8 to get GGE</td>
<td>+$0.063</td>
<td>+$0.125</td>
<td>+$0.188</td>
<td>+$0.250</td>
</tr>
<tr>
<td>Δ in CNG cost at the pump:</td>
<td>+$0.016</td>
<td>+$0.031</td>
<td>+$0.047</td>
<td>+$0.063</td>
</tr>
</tbody>
</table>

Sample Breakdown of CNG cost at the Pump*

*Prices & taxes vary by state
Constellation Retail by the Numbers

What We Serve

Natural Gas: More than 650 Bcf load in C&I markets

Retail Power: More than 110 TWh C&I load under contract

Energy Efficiency: 34,000 MWh conserved by customers

Distributed Energy: 300 MW customer sited, completed or under construction

Who We Serve

More than 2.5 million customers

Serving 2/3 of the Fortune 100

More than 185,000 business & public sector customers

More than two million residential customers

Where We Serve

RETAIL ELECTRICITY & NATURAL GAS SERVICE

Constellation is headquartered in Baltimore, MD and is a unit of Exelon Corporation

*2014 data, ^annualized load
Constellation’s CNG Program

Constellation
America’s Energy Choice

Steve Shearson, CEM
CNG Commercialization

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