Outline

- Natural Gas - Review
- Vermont Gas
- The Addison Natural Gas Project
Outline

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What is “Natural Gas”
Methane – the lowest carbon fossil fuel

Natural Gas: $\text{CH}_4$

Propane: $\text{C}_3\text{H}_8$

Gasoline: $\text{C}_8\text{H}_{18}$

Fuel Oil: $\text{C}_{14}\text{H}_{30}$ to $\text{C}_{20}\text{H}_{42}$
Natural Gas is a Cleaner Fuel

**CO2**

Pounds of emissions produced per billion Btu

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Emissions (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>117,600</td>
</tr>
<tr>
<td>Oil</td>
<td>159,200</td>
</tr>
<tr>
<td>Propane</td>
<td>136,600</td>
</tr>
<tr>
<td>Wood (Dry)</td>
<td>195,000</td>
</tr>
</tbody>
</table>

**Particulate Matter**

Pounds of emission produced per billion Btu

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Emissions (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>7</td>
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<tr>
<td>Oil</td>
<td>12</td>
</tr>
<tr>
<td>Propane</td>
<td>8</td>
</tr>
<tr>
<td>Wood (Dry)</td>
<td>844</td>
</tr>
</tbody>
</table>

**Sulfur Dioxide**

Pound of emission produced per billion Btu

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Emissions (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>0.6</td>
</tr>
<tr>
<td>Oil</td>
<td>507</td>
</tr>
<tr>
<td>Propane</td>
<td>1.1</td>
</tr>
<tr>
<td>Wood (dry)</td>
<td>23.1</td>
</tr>
</tbody>
</table>

**Nitrogen Oxides**

Pounds of emission produced per billion Btu

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Emissions (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>92</td>
</tr>
<tr>
<td>Oil</td>
<td>129</td>
</tr>
<tr>
<td>Propane</td>
<td>142</td>
</tr>
<tr>
<td>Wood</td>
<td>116</td>
</tr>
</tbody>
</table>

Based on residential heating equipment commonly in use in Vermont

Source: U.S. Energy Information Administration, U.S. EPA, and Vermont Agency of Natural Resources
Production: From Well-head to Consumer

How Natural Gas Gets To Consumers
Northeast Infrastructure
Natural gas prices are projected to remain relatively low and very competitive into the foreseeable future.

**U.S. Natural Gas Wellhead Price vs WTI Oil Prices**

Data Source - U.S. Energy Information Administration
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Who is Vermont Gas?

- Vermont’s only natural gas utility, serving 45,000 customers in Franklin and Chittenden Counties and holding the franchise for all of Vermont
- Established in 1965 after a state initiative to evaluate bringing an alternative energy source to Vermont to support economic development
- Regulated by the Vermont Public Service Board
- Over 40 years experience building and operating and maintaining natural gas pipelines that deliver clean, economical and efficient energy to Vermont
- Committed to bringing the economic and environmental benefits of natural gas to more Vermonters
Vermont Gas’ Facilities
Invest Over $2 Million/Year in Energy Efficiency
$22 Million invested since 1992

- Energy Efficiency Services Include:
  - Home and Business Energy Audits
  - Equipment Rebates
  - Technical and Financial Assistance

- Results:
  - Served Over 22,000 Homes and Businesses
  - Saved Customers Over $11 Million Per Year
  - Eliminated 428,000 tons of Carbon Dioxide
  - Eliminated 336 tons of Nitrogen Oxides

- Nationally Recognized by ACEEE and DOE for Exceptional Energy Efficiency Programs

- 2012 EPA “Energy Star” Partner of the Year Award Winner
Competitively Priced
Natural gas costs 43% less than heating oil, 55% less than propane

Data Source: Vermont Department of Public Service March 2012
Based on average residential customer
Vermont Gas’ Vision – “Where we are going”

- Natural gas’ strong supply combined with attributes as a clean & affordable domestic supply position it well to meet the nation’s future energy needs.

- In Vermont, natural gas has the potential to reduce both its over-dependence on oil and the state’s greenhouse gas emissions.
Natural Gas can Reduce Vermont’s Dependence on Oil
71% of its homes are heated by oil or propane versus 51% in New England and 13.5% nationally.

**United States**
House Heating Fuels
US Census Bureau 2006 Estimates

- **Natural Gas**: 50.9%
- **Electric**: 33.1%
- **Fuel Oil**: 7.7%
- **Wood**: 1.8%
- **LPG**: 5.8%
- **Other**: 0.6%

**New England**
House Heating Fuels
US Census Bureau 2006 Estimates

- **Natural Gas**: 34.4%
- **Fuel Oil**: 46.6%
- **LPG**: 4.5%
- **Wood**: 2.5%
- **Electric**: 11.2%
- **Other**: 0.8%

**Vermont**
House Heating Fuels
US Census Bureau 2006 Estimates

- **Natural Gas**: 14.0%
- **Fuel Oil**: 56.0%
- **LPG**: 15.0%
- **Wood**: 11.0%
- **Electric**: 4.0%
Natural Gas can reduce Vermont’s greenhouse gas emissions

Climate change concerns have made the reduction of the greenhouse gas emissions a priority for Vermont.

80% of Vermont’s greenhouse gas emissions come from two sectors – the transportation sector (46%) and the residential – commercial and industrial fuel use sector (34%)

Source: Vermont Governors Commission on Climate Change
Natural Gas Vehicles –
A Clean Air Solution for Vermont’s Transportation Market

- Vermont’s transportation sector is responsible for 46% of the greenhouse gas emissions
- Natural gas vehicles reduce greenhouse gas emissions by 23% to 29%
- Proven technology
  - Vermont Gas has 8 Honda Civic GX’s
  - UVM has 5 buses
  - City of SB has 1 vehicle
  - Burlington has 4 vehicles
  - Casella Waste has 4 vehicles
- Fueling stations
  - Vermont Gas
  - Burlington DPW
  - Casella Waste
Recent Experience with Expanding Natural Gas

Three new communities in three years…and a fourth scheduled for this year.
Jericho - A Recent Example of the Economic and Environmental Benefits of Natural Gas Service to Vermont Communities

- **Within one year of Vermont Gas’ extension of natural gas service to Jericho:**
  - 450 residents converted to natural gas
    - 45% from oil
    - 55% from propane

- **The residents of Jericho received significant economic benefits**
  - Customers converting from oil saved $315 to $1,450 per year
  - Customers converting from propane saved $1,300 to $1,600 per year
  - In total, Jericho residents are saving $390,000 to $650,000 per year
  - And the town of Jericho will gain $25,000 in annual tax revenue

- **Vermont gained significant environmental benefits**
  - 900 tons of CO₂ emissions are being eliminated *annually*
  - 12 tons of other greenhouse gas emissions are being eliminated annually
  - Emissions from trucks transporting liquid fuels have been eliminated
  - There is less traffic and wear and tear on Vermont’s roadways
Long Term Approach

Long Term Expansion Concept:
- Extend natural gas service to new communities in Vermont and Interconnect to U.S. system

Challenges:
- The rural nature of the state limits infrastructure development
- Small markets and large investments make major expansions economically challenging

Solution:
- Expansion requires a long term commitment, creative thinking and broad public and private support
Benefits of Addison County Expansion

- **Economic benefits** –
  - Reduces overall energy cost by $44 million over 20 years
  - Will help to create and retain jobs

- **Environmental benefits** –
  - Reduces 6.3 million gallons of oil use per year in Vermont
  - Eliminates over 16,000 tons of greenhouse gas emissions per year

- **Supports key stakeholders and employers who are calling for natural gas expansion**

- **Can provide long term reliability benefits**
  - Rutland Service
  - Potential interconnection to US natural gas system
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Addison Expansion Project

MISSION

“To expand natural gas service to Addison County in a manner that maximizes economic, environmental and reliability benefits to stakeholders – while maintaining a strong competitive advantage, excellent customer satisfaction, superior safety and positions Vermont Gas for future expansion.”
### Addison County Expansion Project

<table>
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<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
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<td>1Q</td>
<td>2Q</td>
<td>3Q</td>
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<td>1Q</td>
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<td>248 Looping</td>
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<td>248 Proceeding</td>
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<tr>
<td>Construction</td>
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<td>Looping</td>
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<tr>
<td>Customer Turn-ons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Addison</td>
</tr>
</tbody>
</table>

**Vermont Gas Clean Energy Clean Air**
Issues to be addressed in the Stakeholder Engagement Process

- Transmission Terminus
  - How far south should we extend the transmission system?

- Corridor
  - What is the best corridor to follow for the expansion
    - Route 7, VELCO Other?
  - What are the tradeoffs of the different routes
    - Environmental, economic, operational

- System design
  - What are the tradeoffs on the different design options
Advisory Group - Representation

- State Agencies
  - DPS
  - ANR
  - Commerce Dept
  - VTrans

- Federal Agencies
  - Army Corp
  - EPA
  - PHMSA

- Environmental Groups

- Elected Official

- Businesses

- Citizens

- Town Managers

- Town Planners

- Regional Planners

- Regional Economic Development

- Non-Profits

- VELCO
Segments in Northern Section focus on traversing the densely populated Burlington area with transmission pipeline.

**Northern Section**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Seg 1</th>
<th>Seg 2</th>
<th>Seg 3</th>
<th>Seg 4</th>
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<td>⚫</td>
<td>⚫</td>
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<td>Safety</td>
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<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
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<tr>
<td>Capacity</td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
<td>⚫</td>
</tr>
<tr>
<td>Constructability</td>
<td>⚫</td>
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<td>⚫</td>
</tr>
<tr>
<td>Market</td>
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<td>⚫</td>
<td>⚫</td>
</tr>
<tr>
<td>Cost</td>
<td>⚫</td>
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</tr>
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<td>Environmental</td>
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<td>NE</td>
<td>NE</td>
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<td>⚫</td>
<td>⚫</td>
</tr>
</tbody>
</table>

NE = Not Evaluated
Segments in Southern section expand service by extending pipeline to Addison County either with additional transmission or distribution pipeline.

### Southern Section

<table>
<thead>
<tr>
<th>Measure</th>
<th>Seg 5</th>
<th>Seg 6</th>
<th>Seg 7</th>
<th>Seg 8</th>
<th>Seg 9</th>
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<tbody>
<tr>
<td>Reliability</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Safety</td>
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<td></td>
</tr>
<tr>
<td>Capacity</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Constructability</td>
<td></td>
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<tr>
<td>Market</td>
<td></td>
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</tr>
<tr>
<td>Cost</td>
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<td>Environmental</td>
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<tr>
<td>Archeological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- Green: Evaluated
- Orange: Evaluated
- Red: Not Evaluated

**Note:** NE = Not Evaluated
The Route Alternatives

Alternative 1

Alternative 2

Alternative 3

Alternative 4

Alt 1a/b

Alt 2a

Alt 2b

Alt 3a

Alt 4a
The Route Alternatives

Alternative 1
Alt 1a/b

Alternative 2
Alt 2a
Alt 2b

Alternative 3
Alt 3a

Alternative 4
Alt 4a
<table>
<thead>
<tr>
<th>Route / Criteria</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 2(a)</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Transmission (10&quot;) along area considered for circumferential highway; Distribution (12&quot; HDPE) from Williston to Vergennes &amp; Middlebury via secondary roads and Route 7</td>
<td>Transmission (10&quot;) within area considered for circumferential highway and south along VELCO east corridor; Distribution feeders to Vergennes (6&quot;) and Middlebury (10&quot;) and via Rte. 7</td>
<td>Transmission (10&quot;) within area considered for circumferential highway and south along VELCO east corridor; Distribution Feeders across to Vergennes (6&quot;) through New Haven to Middlebury (10&quot;) (off Route 7)</td>
<td>Transmission (10&quot;) within area considered for circumferential highway and south of I-89 to Monkton along VELCO east corridor</td>
<td>One Large Distribution Feeder to Vergennes and Middlebury</td>
</tr>
<tr>
<td><strong>Pipeline Distance</strong></td>
<td>46.4 miles total; 13.8 miles transmission, 32.6 miles distribution</td>
<td>50.7 miles total; 24.5 miles transmission, 26.2 miles distribution</td>
<td>50.1 miles total; 24.5 miles transmission, 25.6 miles distribution</td>
<td>45.3 miles total; 24.5 miles transmission, 20.8 miles distribution</td>
<td>38.2 miles total; 26.1 miles transmission, 12.1 miles distribution</td>
</tr>
<tr>
<td><strong>Budget / Rank</strong></td>
<td>$61.9M – Most expensive</td>
<td>$57.6M – 2nd most expensive</td>
<td>$57.2M – 3rd most expensive (tie)</td>
<td>$57.2M - 3rd most expensive (tie)</td>
<td>$56.0M – least expensive</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td>Manageable; Least number of stream crossings</td>
<td>Manageable; less wetland mitigation than alternative 4; less resources and potential impacts than alternative 4</td>
<td>Manageable; less wetland mitigation than alternative 4; less resources and potential impacts than alternative 4</td>
<td>Manageable; less wetland mitigation than alternative 4; less resources and potential impacts than alternative 4</td>
<td>Manageable; Most storm water and water supply concerns; Most RTE occurrences</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>Would have higher than desired interruptions in Addison</td>
<td>Sufficient</td>
<td>Sufficient</td>
<td>Sufficient</td>
<td>Sufficient</td>
</tr>
<tr>
<td><strong>Rutland</strong></td>
<td>Not well positioned for service beyond Vergennes and Middlebury</td>
<td>Capacity for future expansion to Rutland</td>
<td>Capacity for future expansion to Rutland</td>
<td>Capacity for future expansion to Rutland</td>
<td>Capacity for future expansion to Rutland</td>
</tr>
<tr>
<td><strong>Markets - Misc.</strong></td>
<td>Serve customers along Rte. 7</td>
<td>Service on Rte. 7 south from Vergennes</td>
<td>No service along Rte. 7; service in New Haven center</td>
<td>Service on Rte. 7 south from Vergennes</td>
<td>Service on Rte. 7 south from Vergennes</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>Provides reliability to existing customers</td>
<td>Provides reliability to existing customers</td>
<td>Provides reliability to existing customers</td>
<td>Provides reliability to existing customers</td>
<td>Does not provide additional reliability</td>
</tr>
<tr>
<td><strong>Constructability</strong></td>
<td>Manageable</td>
<td>Manageable</td>
<td>Manageable</td>
<td>Manageable</td>
<td>Manageable; transmission construction through densely populated area</td>
</tr>
</tbody>
</table>
The Route Alternatives

Alternative 2

Alt 2a
Alternatives 2 and 2a

- Increases reliability for existing customers.
- Future expansion to Bristol and downtown New Haven possible.
- **Transmission line is extended further south than** the other alternatives, thereby preparing for future expansion to Rutland.
- Allows greater flexibility in New Haven
- Wider VELCO corridor
- Some believe that Alternative 2 involves lesser environmental impacts than Alternative 4.
Next Steps

- Continued Community Outreach
  - Williston
  - St. George
  - Hinesburg
  - Monkton
  - New Haven
  - Ferrisburg

- RFP for Engineering Design Firm

- Environmental / Field Work
Next Steps

- **E-mailing / Newsletter** – Vermont Gas will be providing regular updates via e-mail & newsletter on the status of the project

- **Public meetings** – We will attend public meetings or venues to discuss this project and answer questions
Questions?

- Contact Steve Wark at:

  Office: (802) 863-4511

  E-mail: swark@vermontgas.com
Thank you!