BAMA: STOP THIS PIPELINE OR THE PEOPLE WILL
An Industry in Transition:
Where There is Oil & Gas There Will Be Pipelines

By Jeff Share

Pipeline & Gas Journal
connecting you to the pipeline industry worldwide
Pipeline Mileage Totals

Under Construction: 44,951
Planned: 49,848

TOTAL: 94,799

- 33% North America
- 5% South & Central America and Caribbean
- 7% Africa
- 5% Middle East
- 3% Western Europe & EU Countries
- 32% Asia Pacific Region
- 12% FSU-Eastern Europe
P&GJ’s 2016 survey figures indicate 94,799 miles of pipelines are planned and under construction worldwide. Of these, 49,848 miles represent projects in the engineering and design phase; 44,951 miles are in various stages of construction.

<table>
<thead>
<tr>
<th>Region</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>34,122</td>
</tr>
<tr>
<td>South/Central America and Caribbean</td>
<td>5,085</td>
</tr>
<tr>
<td>Africa</td>
<td>6,528</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>29,759</td>
</tr>
<tr>
<td>Former Soviet Union and Eastern Europe</td>
<td>11,191</td>
</tr>
<tr>
<td>Middle East</td>
<td>4,929</td>
</tr>
<tr>
<td>Western Europe and European Union</td>
<td>3,116</td>
</tr>
</tbody>
</table>

**TOTALS:**
- Pipeline Miles Under Construction: 44,951
- Pipeline Miles Planned: 49,848
- Total Miles: 94,799
Crude Oil Cost Curve

Mid-Cycle Breakeven Costs in Fall 2014 (including 9% After-tax Return)*
Selected Producing Regions
WTI Oil Price Required, US$ per barrel

**Weighted Average = US$60-61

1.0  2.0  3.0  4.0  5.0  6.0  7.0  8.0
Cumulative Production (mb/d)

- Montney Oil AB & BC
- SK Bakken
- Eagle Ford, USA Shale*
- Lloyd & Seal Conv. Heavy, AB
- Conv. Light, AB & SK
- SAGD Bitumen, AB $40-80
- Niobrara, USA Shale
- North Dakota Bakken, Shale $54-79
- Permian Basin, TX Shale $59-82
- $53 Legacy Projects

* Excludes 'up-front' costs (initial land acquisition, seismic and infrastructure costs): treats 'up-front' costs as 'sunk'. Rough estimate of 'up-front' costs = US$5-10 per barrel, though wide regional differences exist. Includes royalties, which are more advantageous in Alberta/Saskatchewan.
+ Liquids-rich Eagle Ford plays, assuming natural gas prices of US$3.80 per mmbtu.
++ Weighted avg. = US$60-61 including existing Integrated Oil Sands at C$53 per barrel.
Data source: Scotiabank Equity Research and Scotiabank Economics.
U.S. Oil Output to suffer Record drop

U.S. Oil Output About to Suffer Record Drop
A collapse in the drilling rig count means 570,000 barrels a day less oil next year

Source: Energy Information Administration
Bloomberg
Coastal Gas Link Map

- Coastal GasLink Pipeline Project
  - Morice River North Alternate Route (Reva)
  - Coastal GasLink Pipeline Project Study Corridor
  - Proposed Coastal GasLink Metering facility
  - Proposed Coastal GasLink Compression & Metering Facility
  - Potential Future Coastal GasLink Compression Facilities (TBD)

Other
- Proposed LNG Canada Facility (3rd party)
- TransCanada’s NOVA Gas Transmission Ltd. (NGTL) Existing System
- Highways
- Cities and Towns

*Morice River North Alternate route is 35 kms from Houston
Lake Island Delivery
Meter Station Map
NEXUSs Map
Share of natural gas in primary energy mix, by region, 1990-2040
Global Oil Demand in the Long Term

- OECD
- Developing countries
- Eurasia
- World

mb/d

2014–2020
2020–2025
2025–2030
2030–2035
2035–2040
Natural gas production in selected regions (Jan 2012 - June 2015) cumulative change since January 2012, billion cubic feet per day (Bcf/d)

Since the beginning 2012, the Marcellus and Utica regions have accounted for 85% of increases in production from these selected shale gas regions.

Annual Changes in non-OPEC Supply, 2013-1016
Fatigue Life of ERW Pipe

- Improved Methods for Estimating Remaining Fatigue Life of ERW Pipelines
  - Sources of conservatism identified
  - Recommendations that improve accuracy and precision
  - Could increase estimated fatigue lives by 10X
Route Selection

Guidance Document: Onshore Pipeline Route Selection & Assoc. Data Gathering

- Eliminate or reduce costs to owners and contractors
- Anticipate conditions that impact construction
- More confident route definition – reduce contingency cost estimates.
Welding

Assessment of Weld High/Low Misalignment

Phase I results:

- Defect free GMAW & SMAW girth weld coupons
- FEA and experimental - effects on load capacity
- FEA modeling of full pipes
- Results suggest that less restrictive criteria may be appropriate

Work underway to extend the testing and verification

Will lead to code-ready recommendations
Leak Detection

- **Methane Hand Held Leak Detection**
  - A hand-held methane sniffer to accurately methane leak location
  - Sensor is an open-path, multi-pass tunable laser spectrometer and plots all data atop a 2D map in real-time on a tablet.

- **Airborne Threat Detection Support Package Prototype**
  - Hardware available and being flown
  - For long range data collection by operator

- **A New Look at the Pipeline Variable Uncertainties and Their Effects on Leak Detection Sensitivity – API 1149 Updated Publication**
  - *Reduction in LD Uncertainty*
  - *Includes transient conditions, additional products and utilizes statistical means for identifying more realistic uncertainty conditions*