

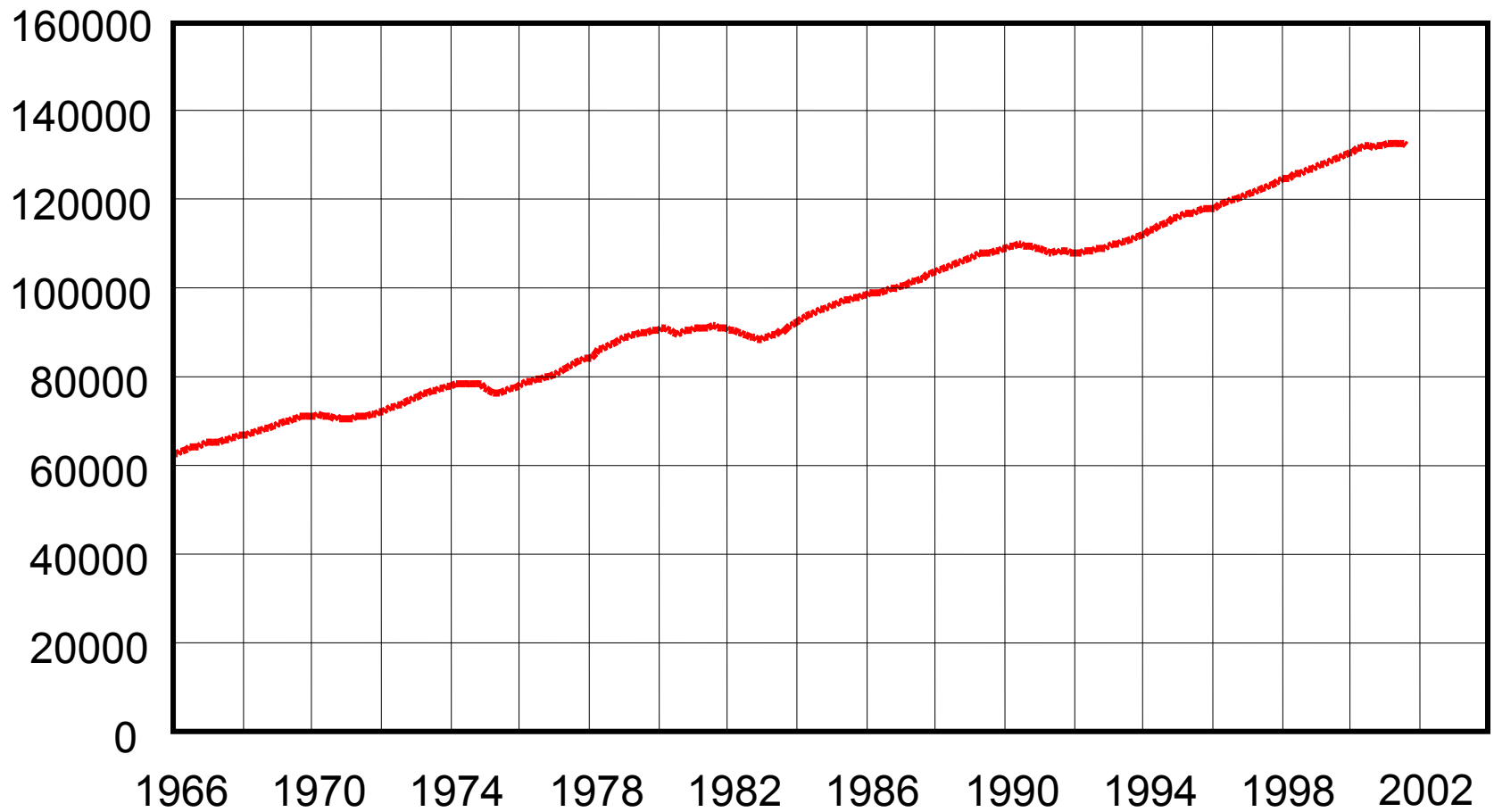


Arctic Gas Symposium
Ronald E. Oligney
November 18, 2002

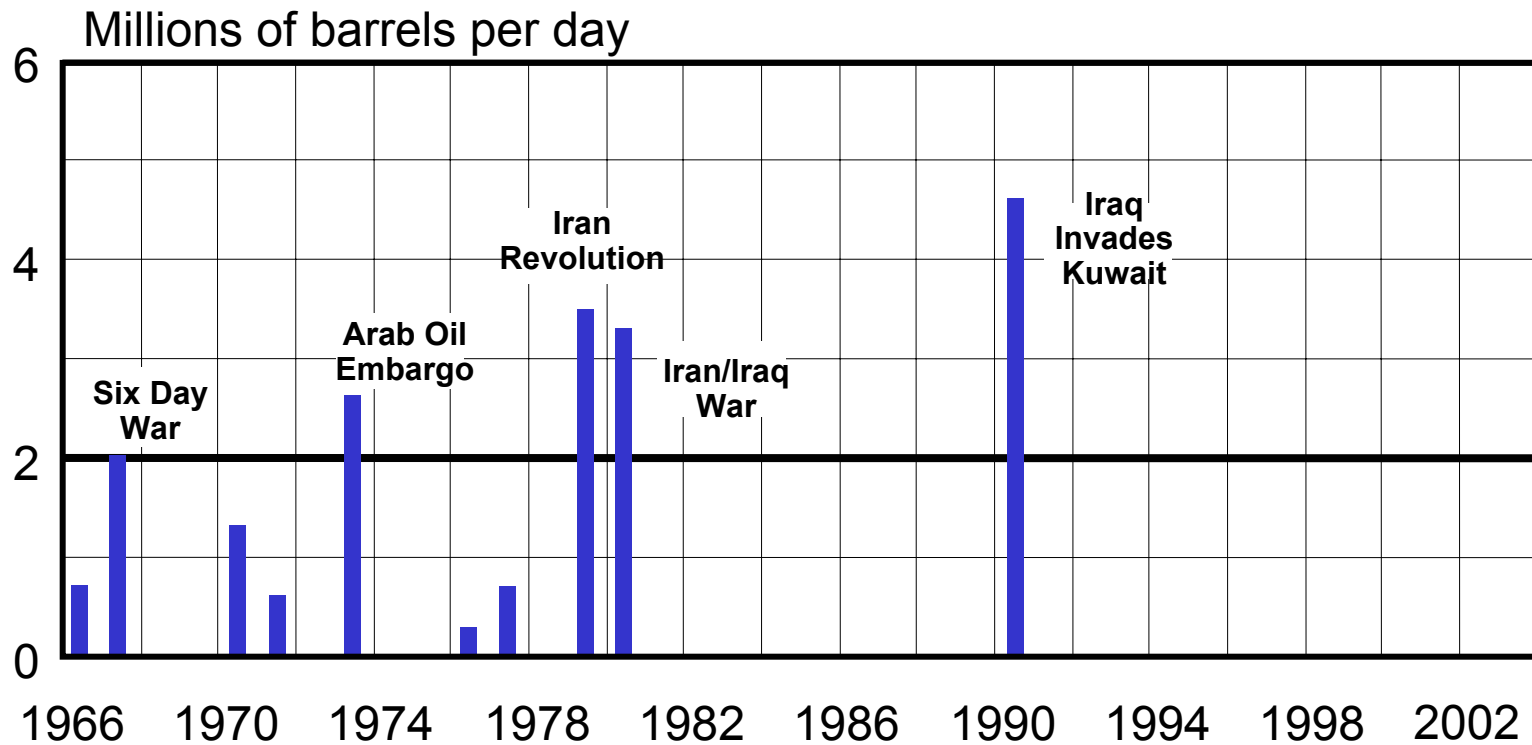




U.S. Employment (1000s)

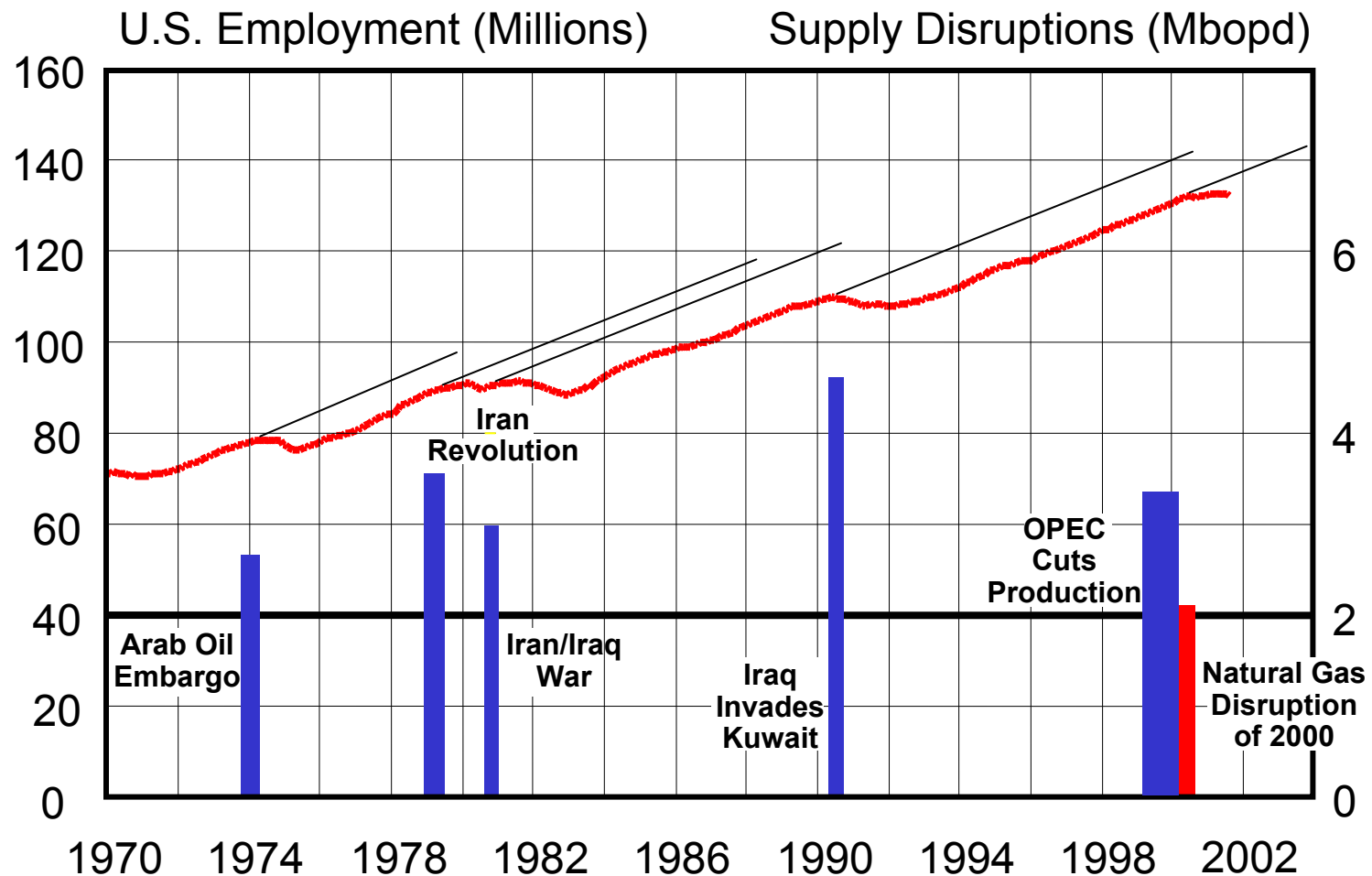


Major Energy Supply Disruptions

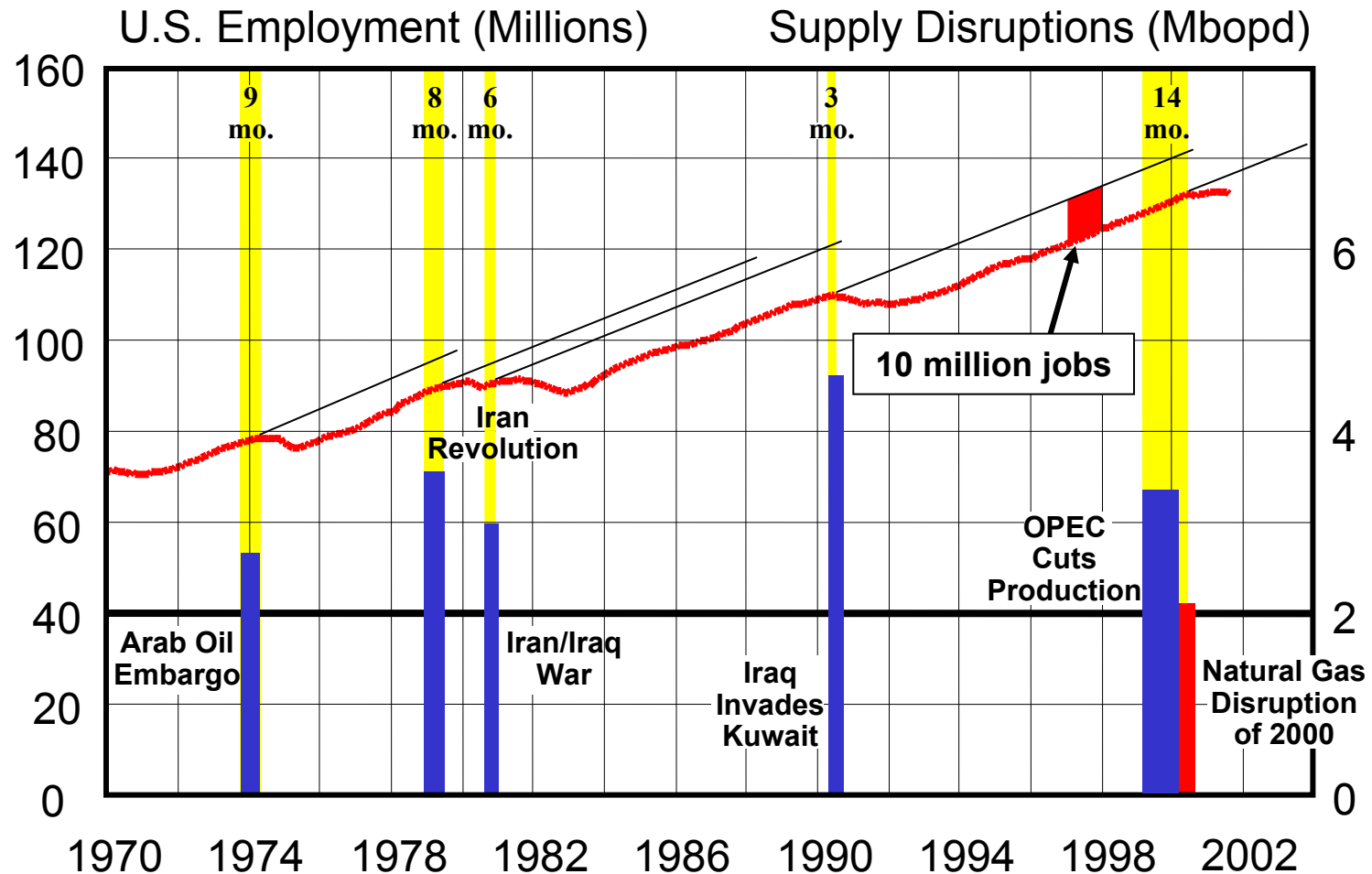


Source: EIA

U.S. Employment and Major Energy Supply Disruptions in OPEC Era



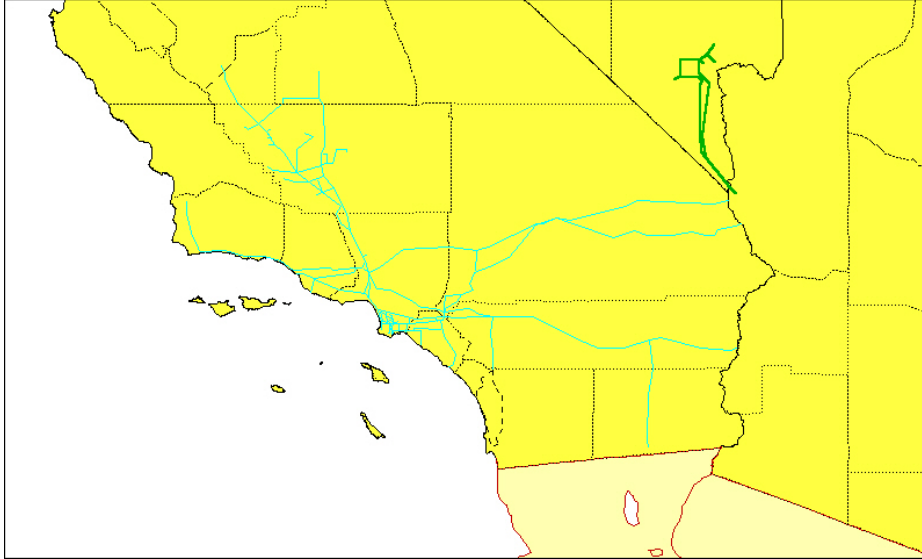
U.S. Employment and Major Energy Supply Disruptions in OPEC Era



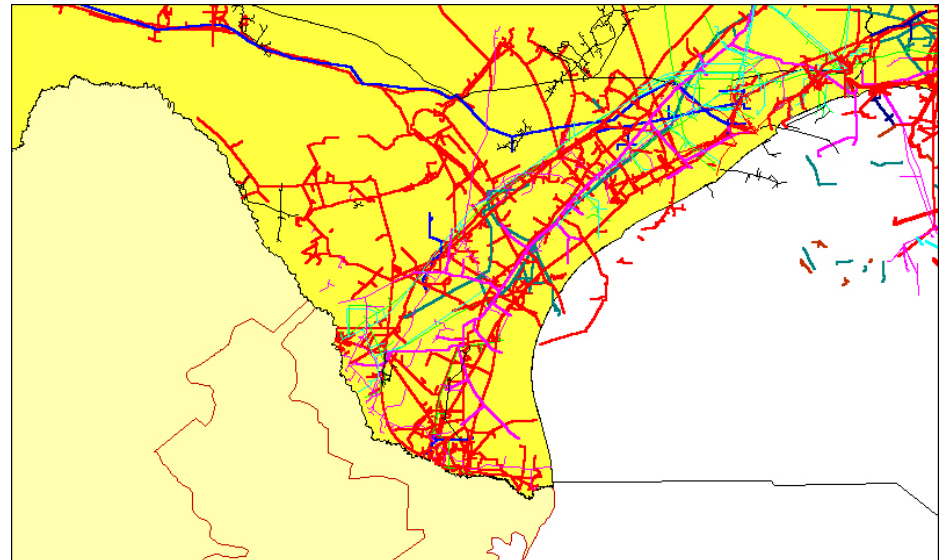
	<u>Country</u>	<u>Reserves</u> <u>(Tcf)</u>	<u>% of World</u> <u>Total</u>
1	Russia	1700	32%
2	Iran	812	15%
3	Qatar	394	7%
4	Saudi Arabia	213	4%
5	UAE	212	4%
6	United States	167	3%
7	Algeria	160	3%
8	Venezuela	147	3%
9	Nigeria	124	2%
10	Iraq	110	2%
11	Turkmenistan	101	2%
12	Malaysia	82	2%
13	Indonesia	77	1%
14	Kazakhstan	68	1%
15	Canada	64	1%
16	Netherlands	61	1%
17	Kuwait	55	1%
18	Libya	46	<1%
38	Peru	9	0%
47	Bolivia	5	0%
	Rest of World	668	13%
	Total	5274	100%

Pipeline Infrastructure in California

Southern California



South Texas



U.S. Employment

- Last major energy disruption (1990) resulted in permanent loss of 10 million U.S. jobs.
- Latest energy supply disruption may ultimately result in 20 to 40 million jobs lost.
- Delaying action on energy situation may nominally cost 1 million U.S. jobs per month.

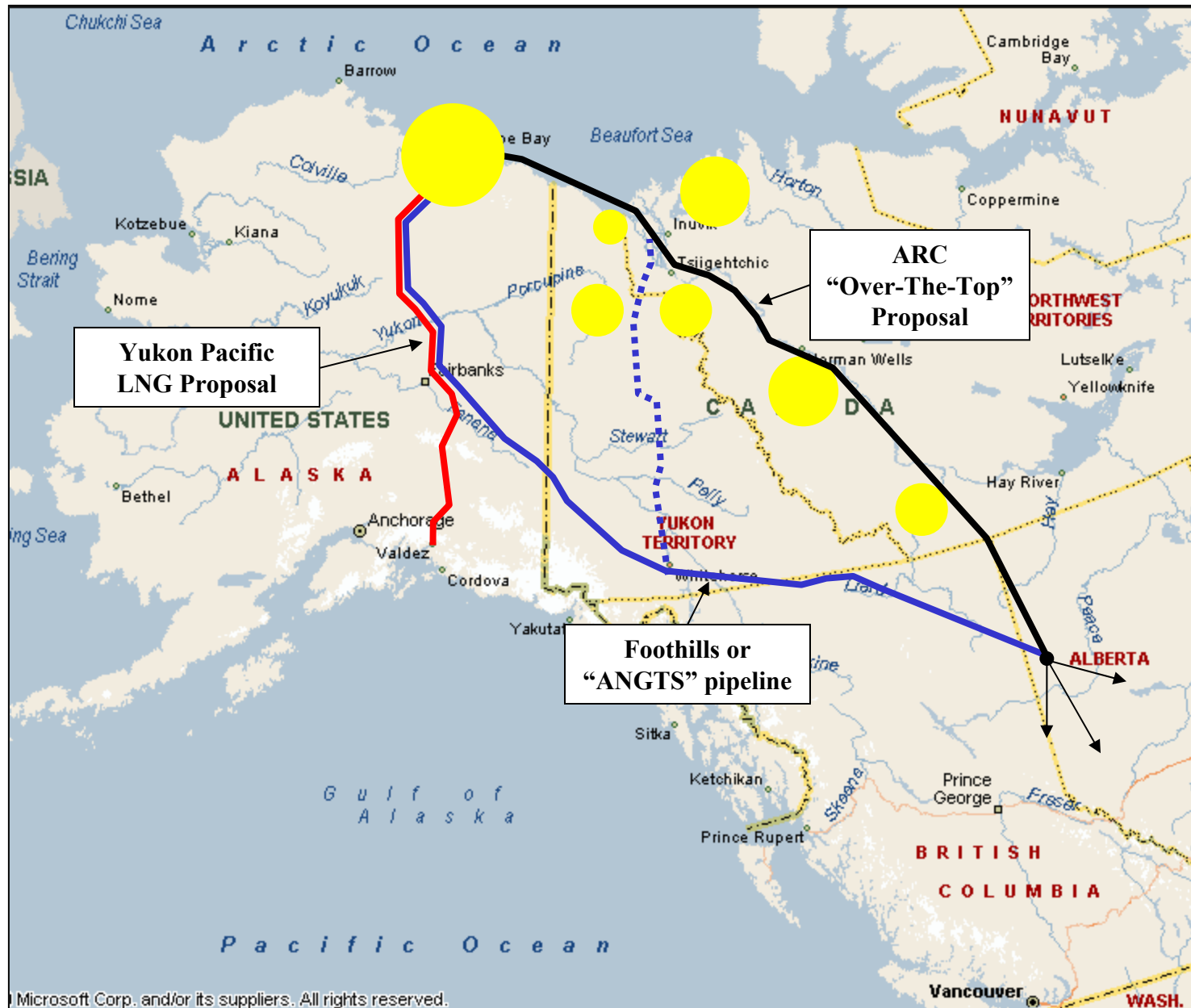
Alaska Employment Impact

<u>Scenario</u>	<u>Impact</u>
• Mandate uneconomic pipeline, natural gas demand materializes	– 10 million jobs
• Mandate uneconomic pipeline, demand does not materialize	0 jobs
• Clarify requirements, allow market solution(s)	+225,000 jobs

Arctic Pipeline Direct Employment

- Production 5 Bcf per day
- Natural gas price \$2.50 per Mscf
- Direct contribution to GDP \$12 million per day
\$4.5 billion per year
- GDP per employee (U.S.) \$69,230
- Direct employment 66,000 jobs

Alaska-Canada natural gas pipeline routes.



Debate in Alaska

- Natural gas supply for Fairbanks/Anchorage
 - Alaska construction jobs
 - Environmental issues
-
- Concerns are poorly quantified, but opinions are strongly held.
 - Alaska politicians are ready to take action, and have been for 20 years.

Excerpt from H.R. 4 (Passed August 1, 2001)

TITLE VII—PIPELINES

SEC. 801. PROHIBITION ON CERTAIN PIPELINE ROUTE.

No license, permit, lease, right-of-way, authorization or other approval required under Federal law for the construction of any pipeline to transport natural gas from lands within the Prudhoe Bay oil and gas lease area may be granted for any pipeline that follows a route that traverses—

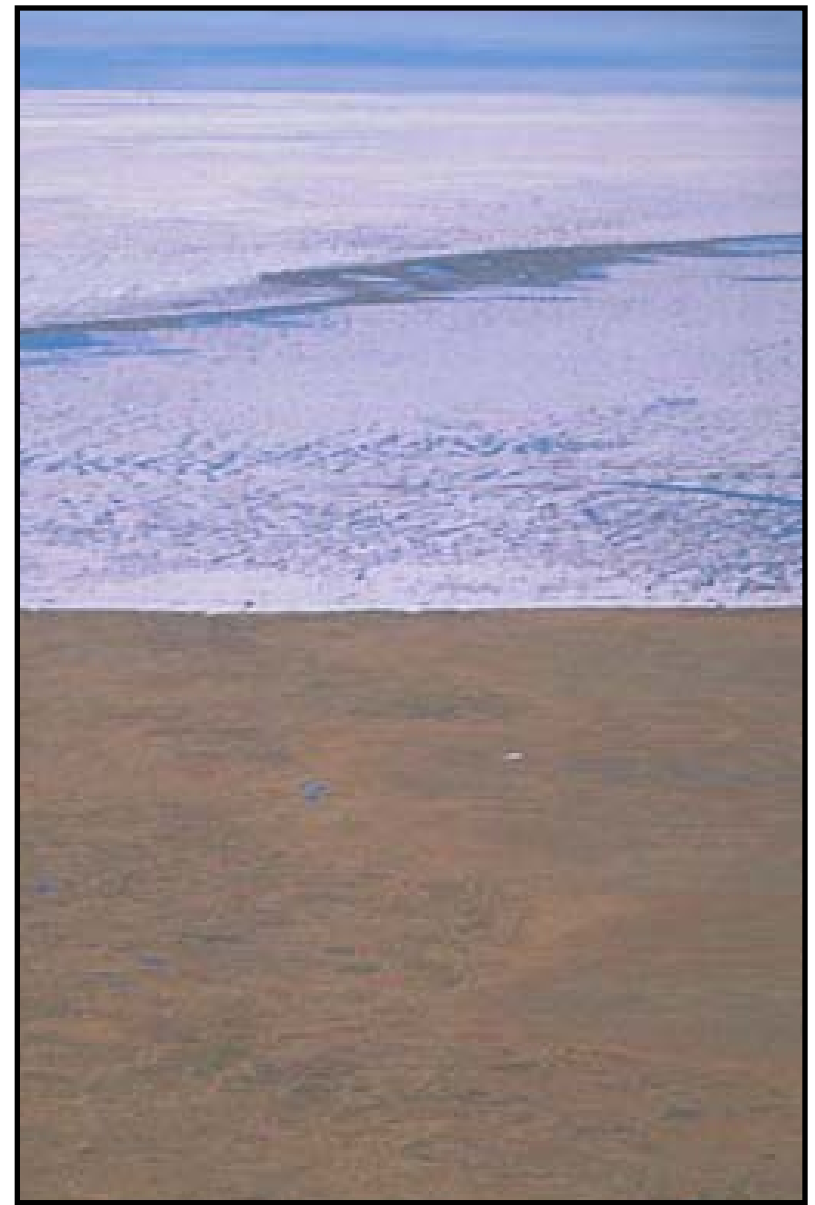
(1) the submerged lands (as defined by the Submerged Lands Act) beneath, or the adjacent shoreline of, the Beaufort Sea; and

(2) enters Canada at any point north of 68 degrees North latitude.



Art Wolfe / PNI

ANWR MSNBC



The Real ANWR in Summer

The Imperatives of Arctic Natural Gas Development

By

Ronald Oligney, University of Houston

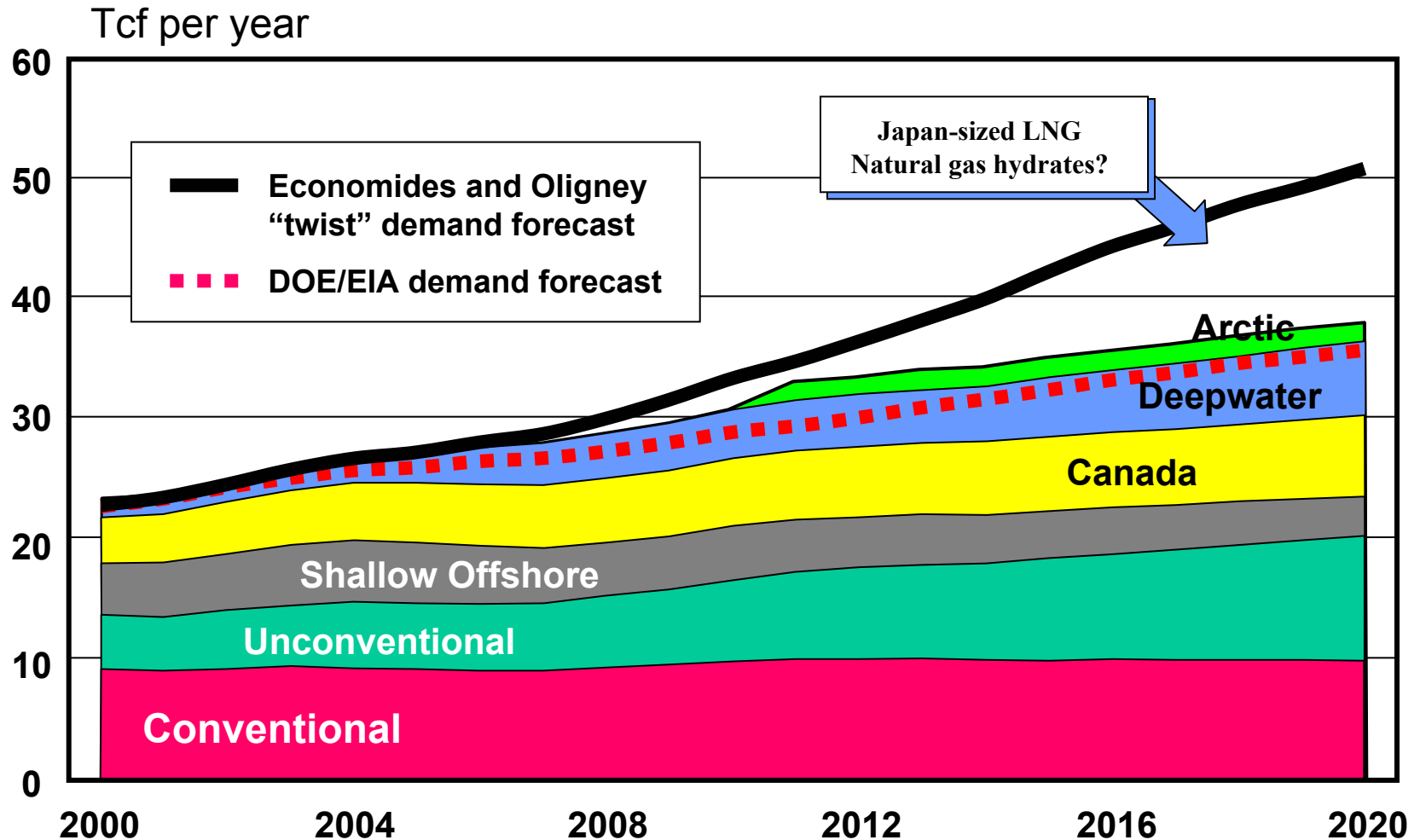
James Longbottom, University of Houston

November 2001

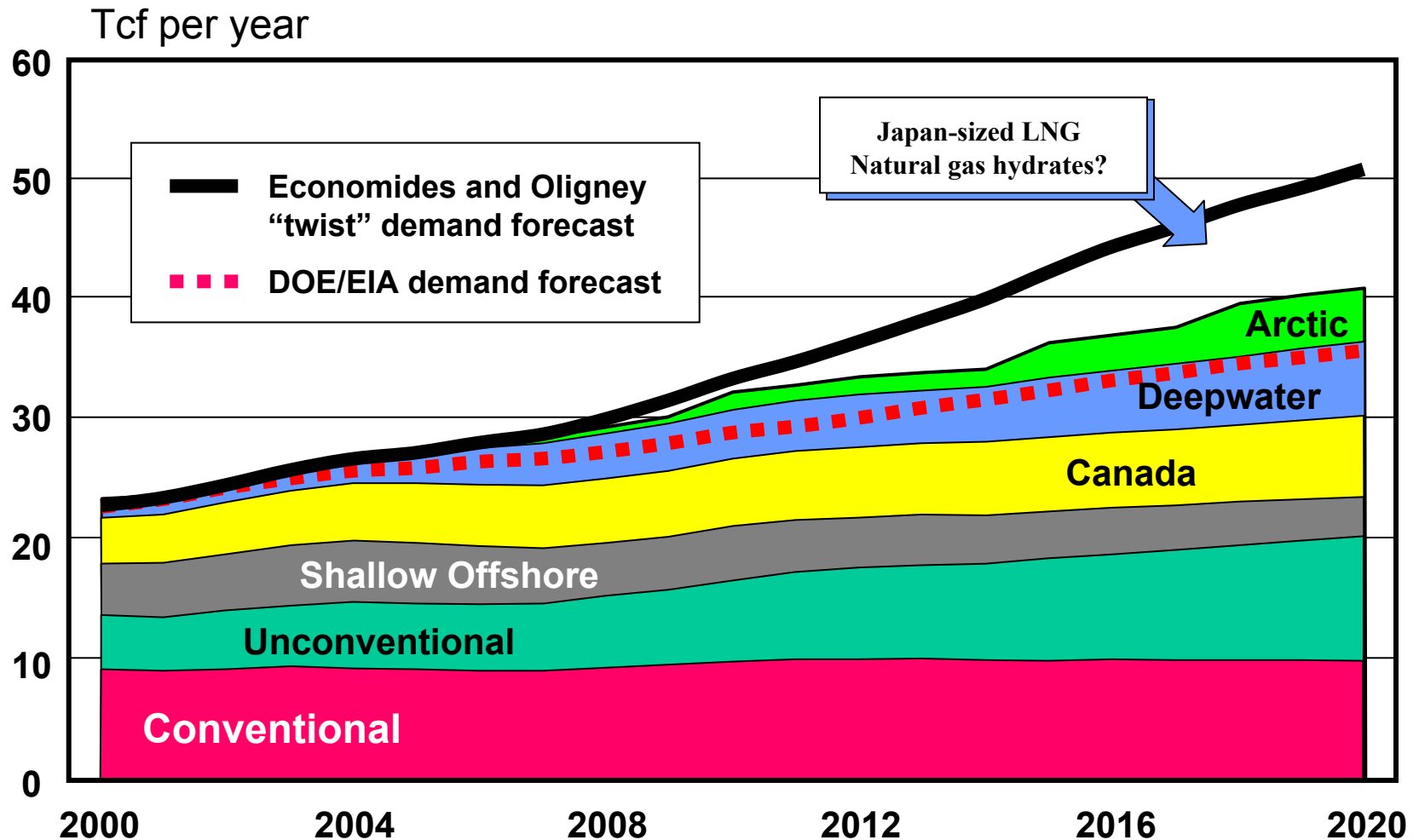
Primary Messages

1. The United States must pursue 12 Bcfd of natural gas production from the Arctic, not 4 or 6 Bcfd—America needs the gas!
2. Oil or natural gas supply disruptions—whether geopolitical or infrastructure related—quickly destroy 10 million U.S. jobs.
3. The \$3.00 per Mscf price floor for natural gas necessary to support Arctic pipeline development will emerge in the next 24 months.
4. Risk and uncertainty are the greatest roadblocks to Arctic pipeline construction, not the much-debated standard financial variables.
5. Staged pipeline construction is the obvious mechanism to materially reduce costs, risk and uncertainty.
6. Under almost any political, financial or price scenario, a natural gas pipeline down the Mackenzie corridor will be developed first.

U.S. Natural Gas Demand and Supply Sources



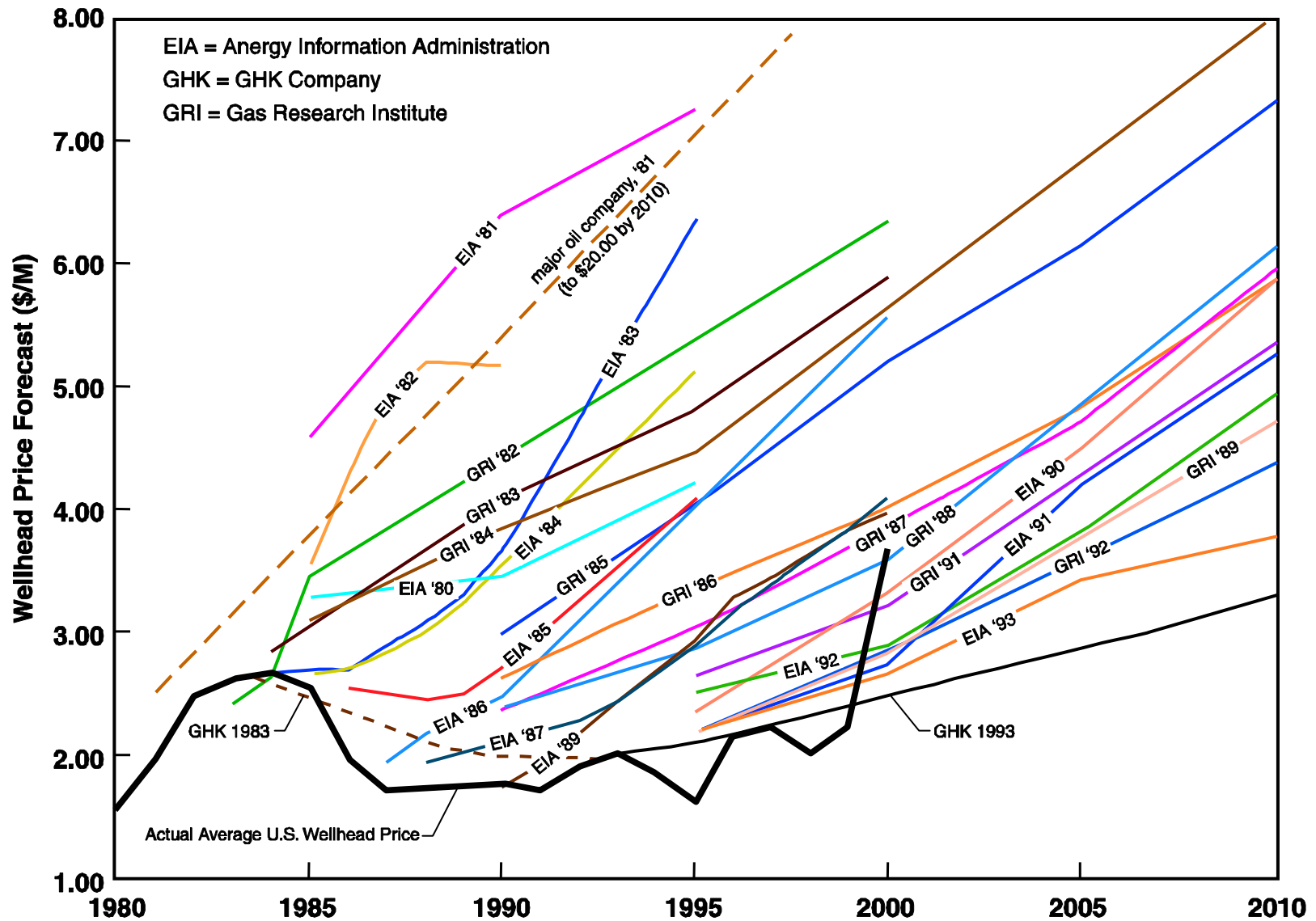
U.S. Natural Gas Demand and Supply Sources



Primary Messages

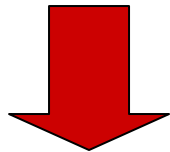
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Forecasts of U.S. Natural Gas Prices, 1980-1993



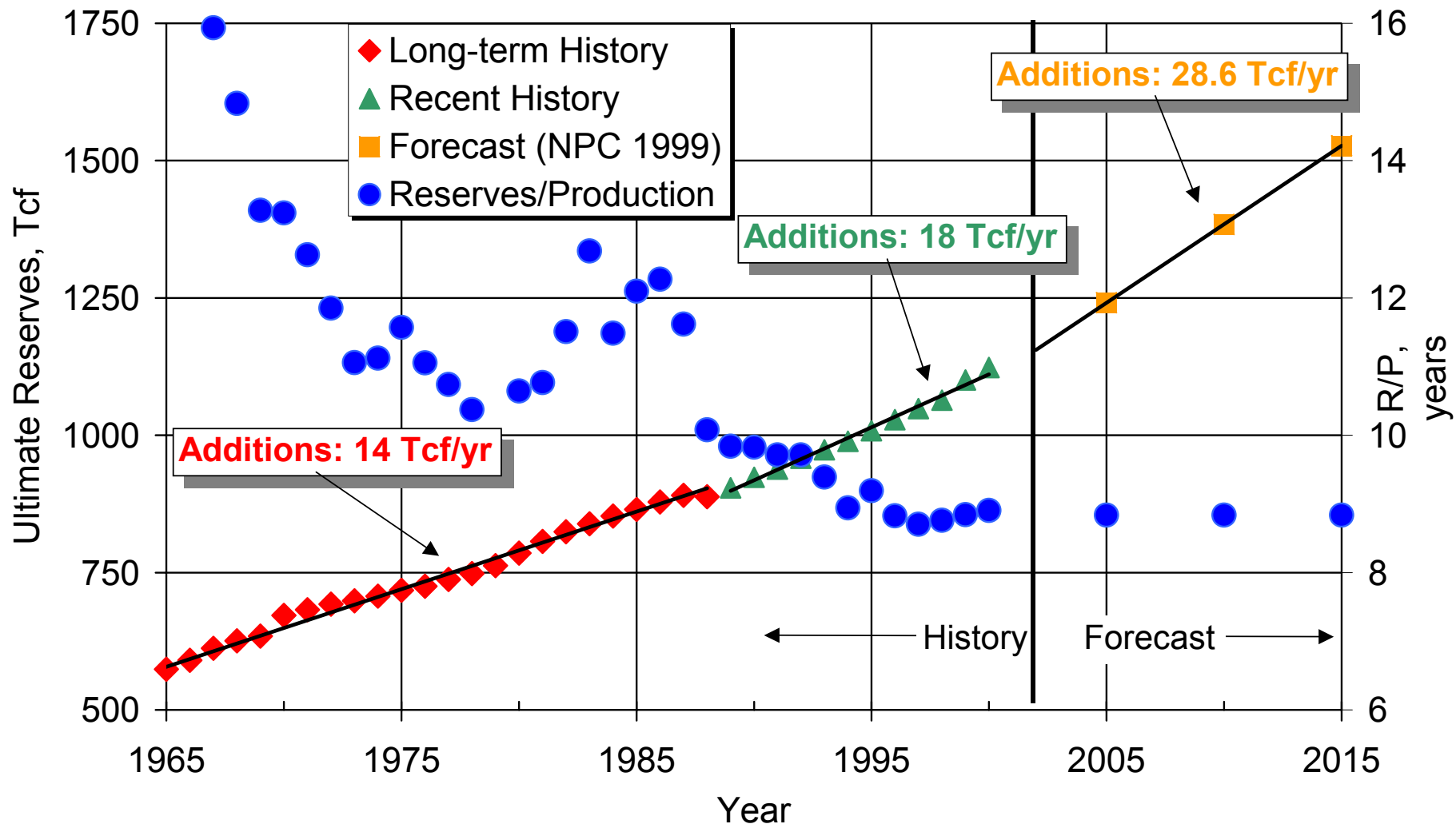
U.S. Supply and Demand Analysis

- Potential Gas Reserves
- Proved Gas Reserves
- Gas Deliverability
- Activation Index

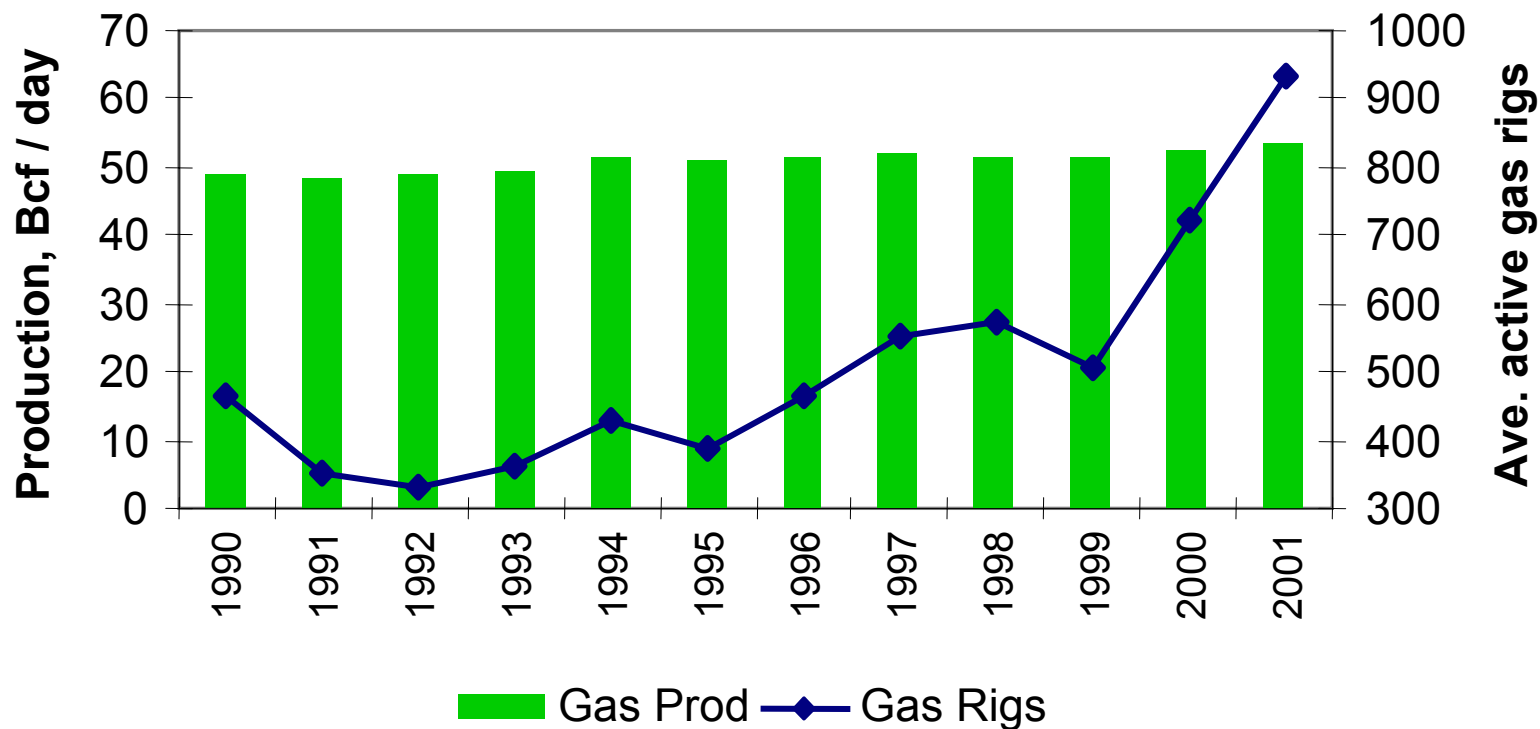


- Gas Price, \$/Mscf

Proved US Natural Gas Reserves, Historical and Forecast

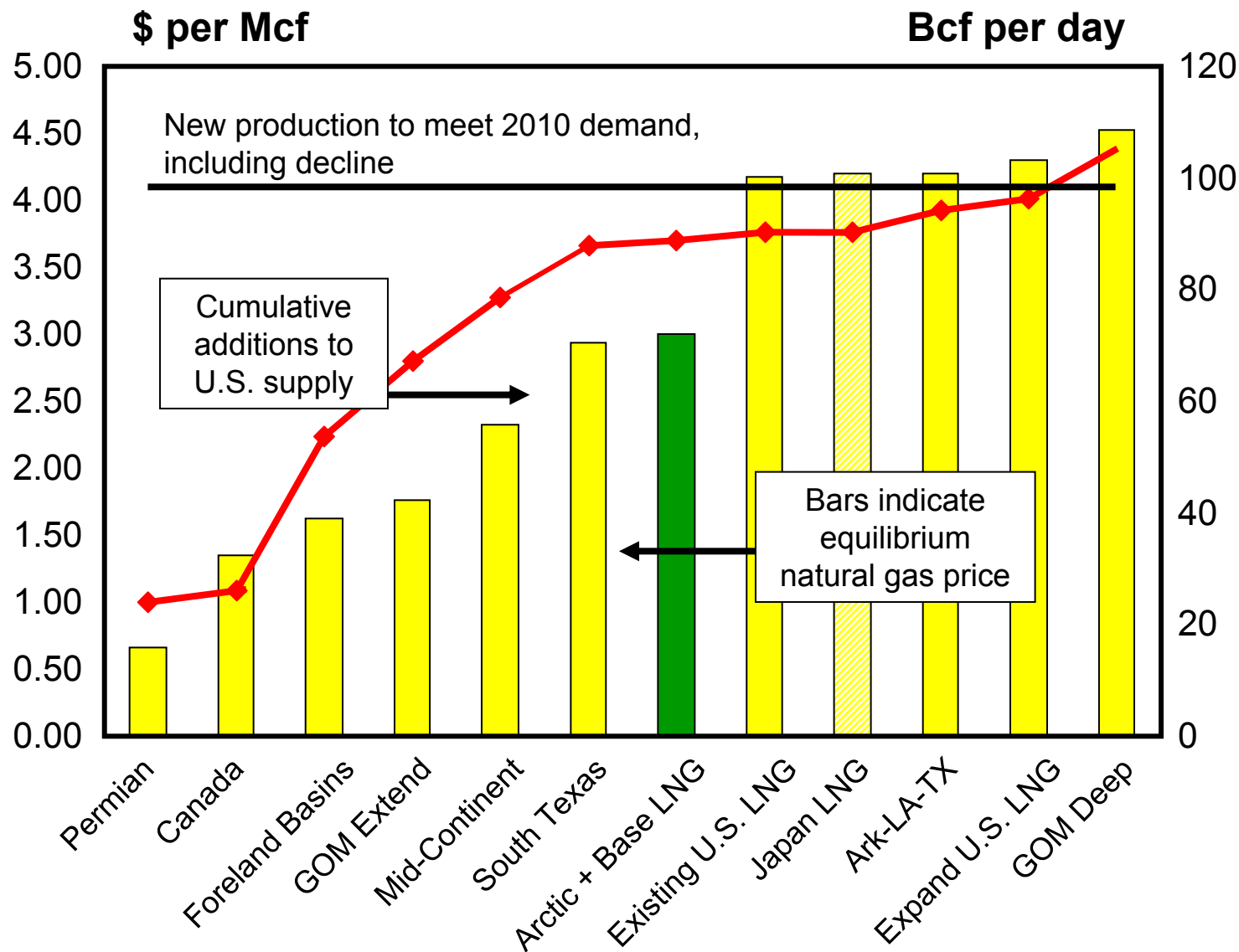


U.S. Gas Production versus Rig Count



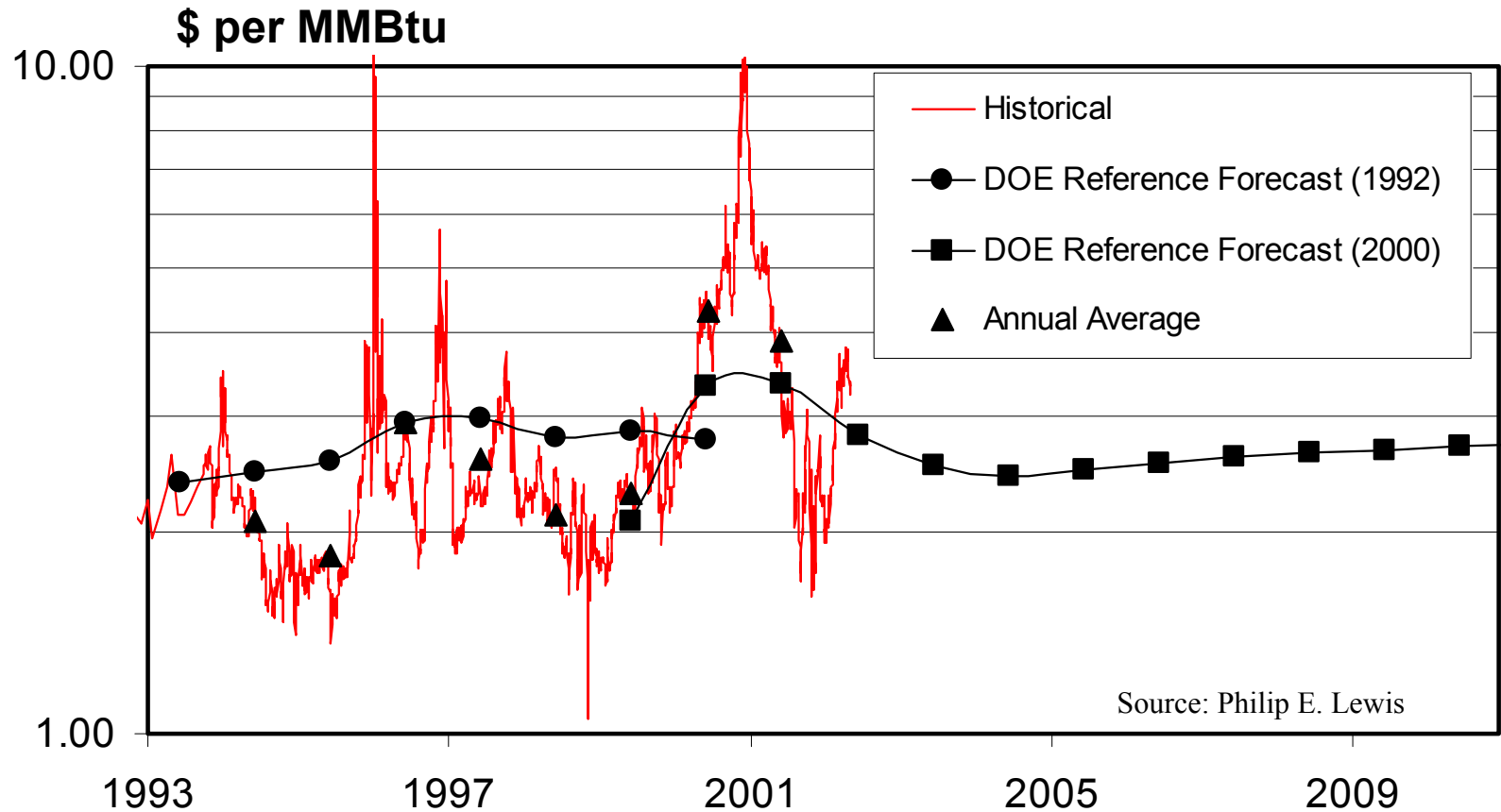
Source – EIA, Baker Hughes

Forecast U.S. Natural Gas Supply and Prices— Moderate Demand and Mild Decline Rate



Cash Natural Gas Price

(1999 dollars)



Primary Messages

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Summary of Results from Other Studies— AKA “A Pig’s Breakfast”

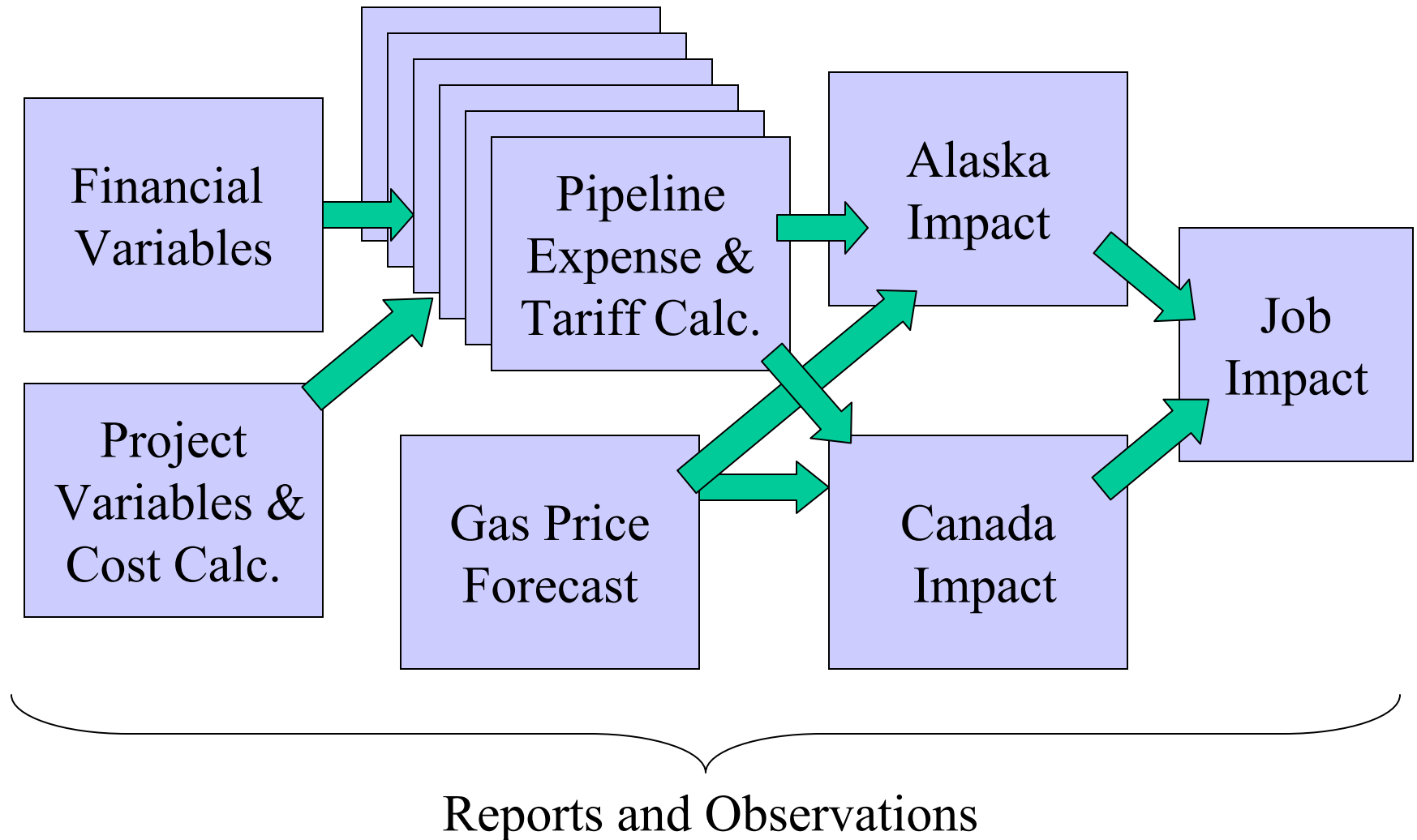
	CERI	CERI	AGPPT	AGPPT	Purvin & Gertz	Purvin & Gertz	INGAA	INGAA
Route	Northern	Southern	Northern	Southern	Northern	Southern	Northern	Southern
Miles	1218	2450	1803	2139			1220	2725
Size (inch)	42/48	36/48/30	52	52			42/2x30	42/48/30
Alaska Capacity (Bcf/d)	2.5	2.5	4	4	2.5	4.0	4	4
Canadian Capacity (Bcf/d)	1.6	1.6	0.8	0.8	1.5	0	2	2
Pipeline Cost	\$5.570B CAD	\$8.100B CAD	\$7.7B	\$11.3B	\$7.1B	\$12.0B	\$7.4B	\$10.3B
Tariff per mmBtu	\$0.53* CAD/gj	\$1.26* CAD/gj	\$1.29	\$1.61	\$1.14	\$1.41	\$0.53†	\$0.74†
Gas Price			\$3.00	\$3.00	\$2.59	\$2.59		
Netback to Alaska			\$0.93**	\$0.61**	\$0.77	\$0.50		

*Tariff given for only Canadian gas in Canadian dollars with no mention of gas conditioning cost or its impact on tariff

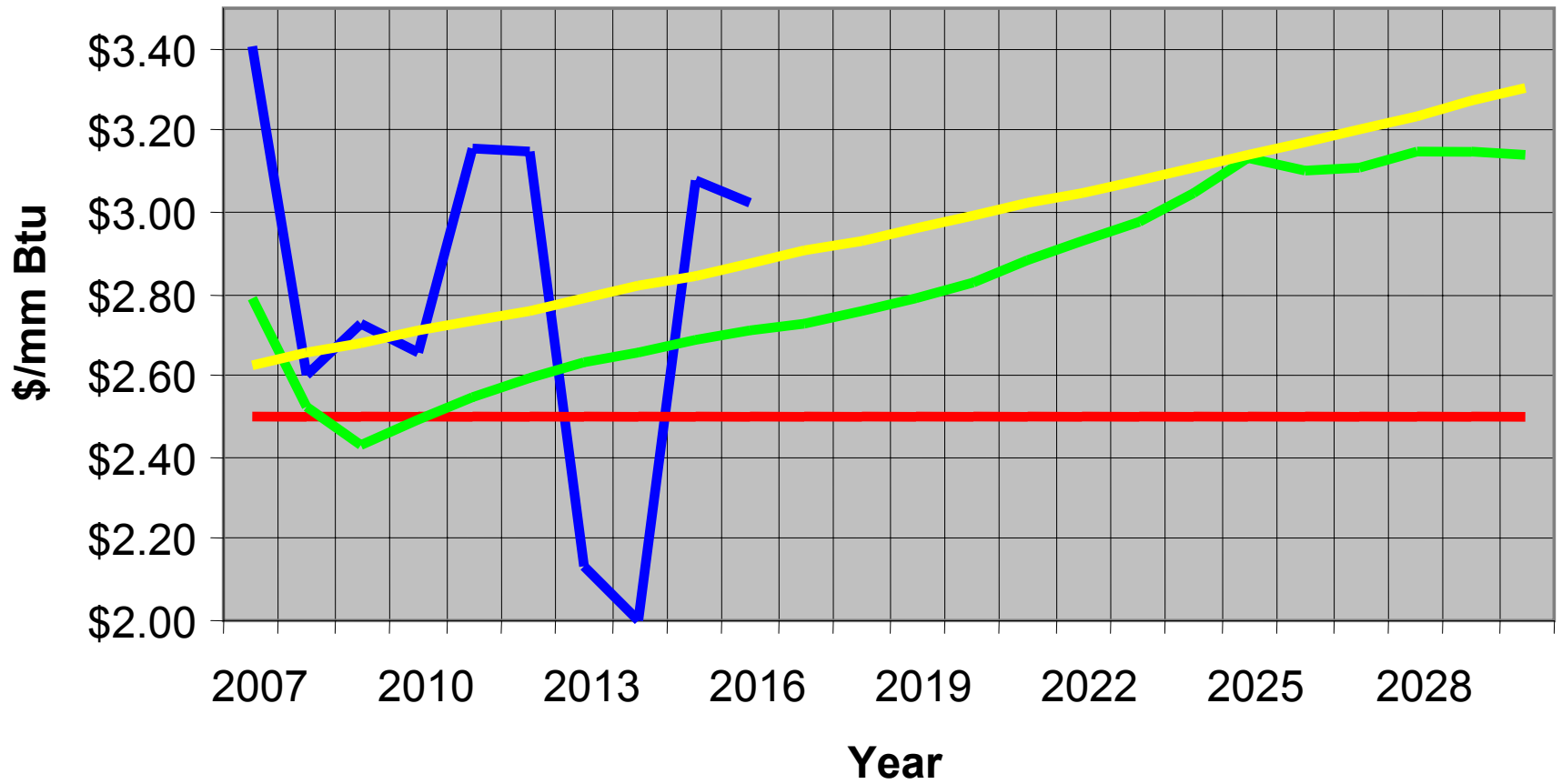
** No experience with 52” high pressure gas lines, 4.8 bcf/d requires new takeaway capacity with notional \$0.78/mcf toll

† No mention of gas conditioning plant cost, 6 bcf/d rate not compatible with 42” line unless pressure extreme

Our Modeling Process



Gas Prices

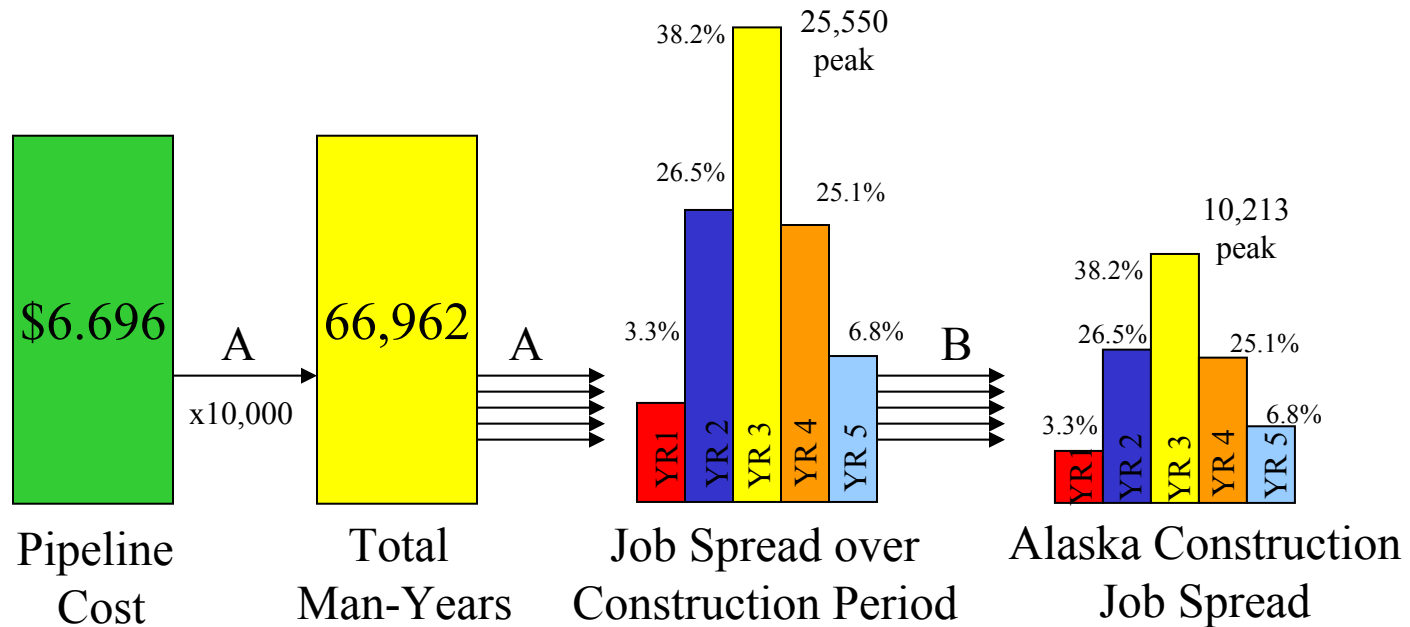


— EIA — \$2.50 Flat — IEA — 1% Inflated

Key Assumptions

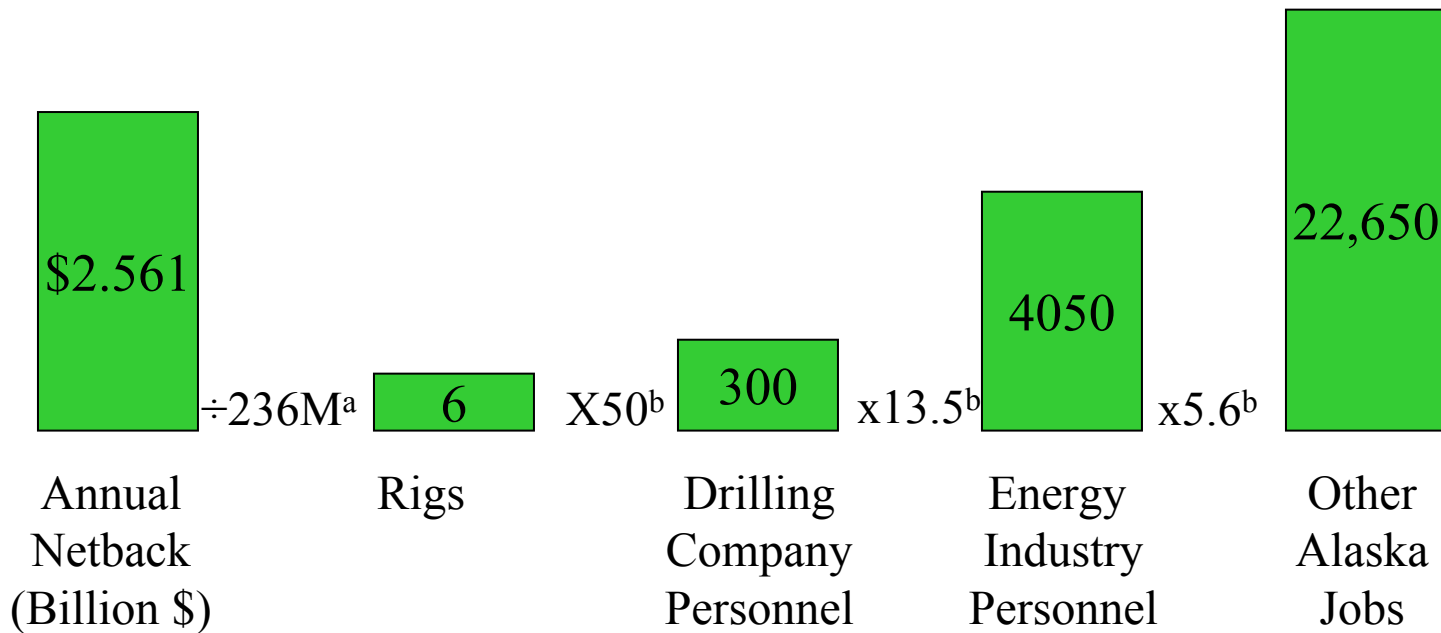
- Pipeline life is 25 years
- Interest on debt is 7.5%
- Expected ROE is 15%
- Gas conditioning plant costs are included in pipeline tariff
- Annual O&M cost for pipeline is 2.2% of capital cost
- Annual O&M for gas conditioning plant is 5.4% of plant capital cost
- Pipeline load factors in years 1/2/3 are 85/90/95 percent
- Canadian federal and provincial income taxes are 37%
- U.S. federal corporate income tax rate is 35%
- Alaska state corporate income tax is 9.4%

Drivers Used in Calculation of Alaska Construction Jobs



- A. 10,000 man-years labor required per billion U.S. dollars un-inflated capital cost with distribution over 5 years, based on TAPS job and capital history as reported by Alyeska Pipeline and recent reports by Alaska Gas Producer Pipeline Team
- B. Alaskan and Canadian jobs split based on cost incurred within each state/country (cf. modeling results)

Drivers Used to Calculate Employment Impact



- a. Based on Alaska Oil and Gas Association report, “Economic Impact of the Oil and Gas Industry on Alaska.” Also reference producer spending and Baker Hughes rig count from Alaska during same period as reported on internet.
- b. Based on employment statistics from Alaska Department of Labor.

Southern Route Not Economic—Even at \$3.00

	Southern	Northern
Capital Cost (Billions)*	\$10,906	\$8,500
Length (miles)	2139	1700
Alaska Capacity (Bcf/d)	4.0	4.0
Canada Capacity (Bcf/d)	0	0
Pipeline Size (inches)	42	42
Tariff to Lower 48*	\$2.20	\$1.91
Tariff to Alberta*	\$1.48	\$1.19
Assumed Gas Price	\$3.00	\$3.00
Netback to Producer (\$/mcf)	\$0.80	\$1.09

* Includes gas conditioning plant

Mr. Knowles, gas prices make an \$8 billion gas pipeline a huge gamble. What's your solution?

I'm proposing a \$20 billion pipeline.

Tony ... today
the key is flexibility,
not scale.



Soviet-style economics resurface in Alaska.

A New Strategy

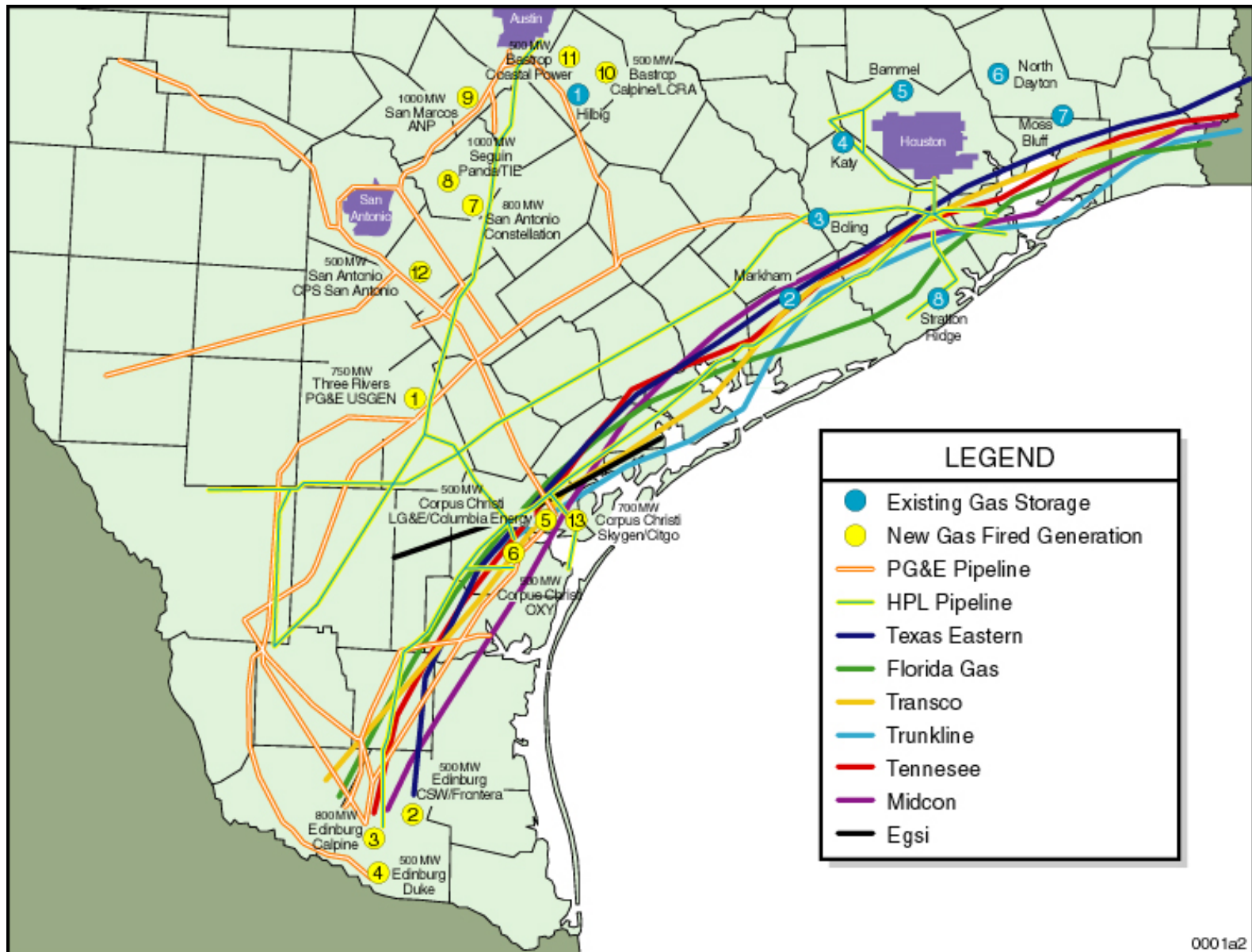
- Use a staged development approach to address the price and environmental/regulatory risk with reduced emphasis on financial variables.

“Opportunity cost is highly sensitive to uncertainty over future value of a project. New economic conditions that may affect the perceived riskiness of future cash flows can have a large impact on investment spending... Much larger than interest rates. Viewing investment as an option puts greater emphasis on the role of risk and less emphasis on interest rates and other financial variables.” – *Harvard Business School Press*

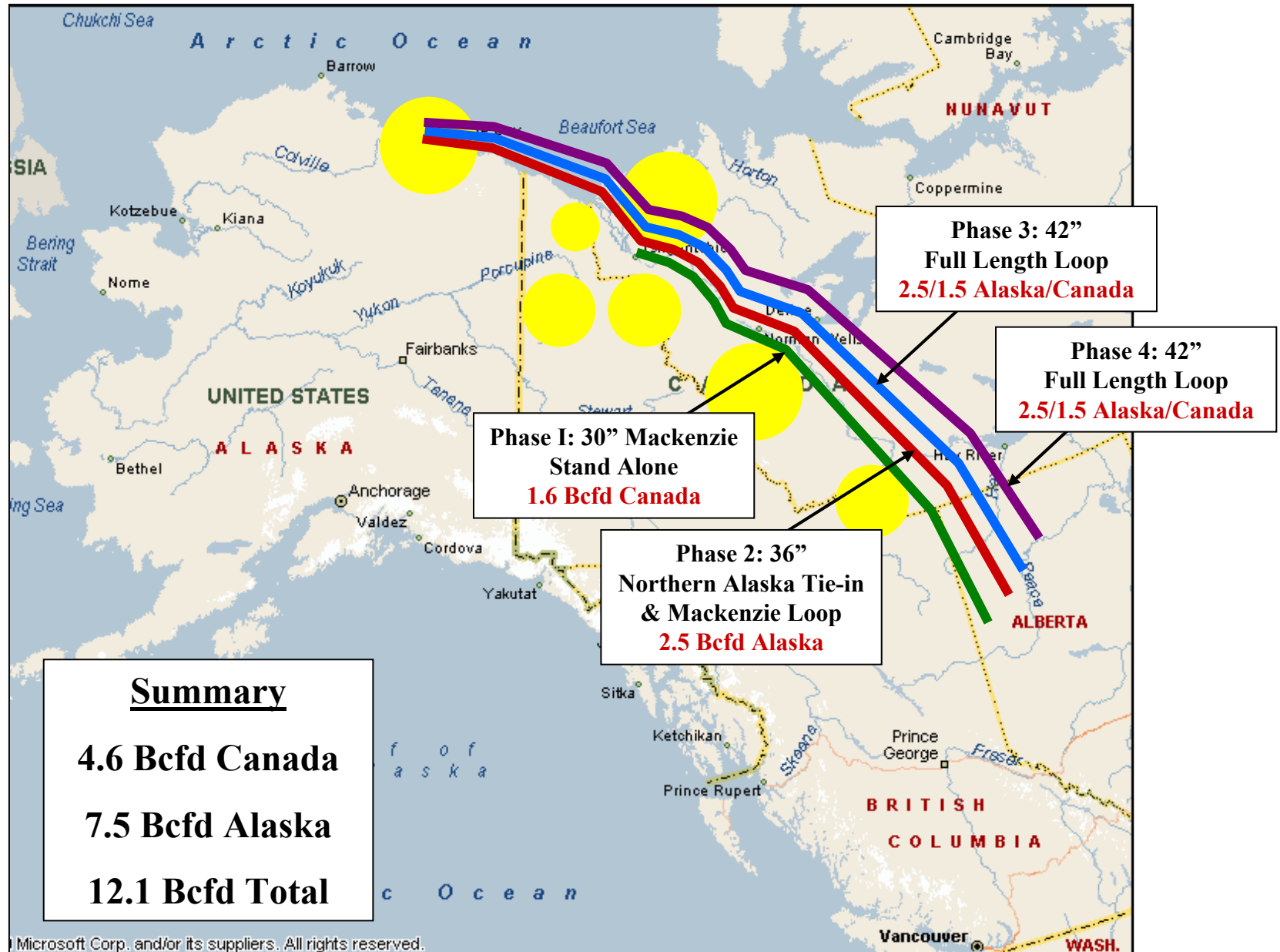
Strategy

1. Access arctic gas in multiple stages.
2. Expand deliverability target to 12 Bcf/d; Arctic reserves are sufficient.
3. Finance Phase I with 100% debt in bite-size Canada-only line that squarely attacks producer risk.

What a market-driven pipeline corridor looks like.



Multiple Pipeline Stages Used to Access Arctic Gas



The Value of Project Staging

Phase 1: 30” **Mackenzie Stand Alone**

- Establish M. Delta ROW
- Clear Canadian regulatory path
- Establish roads, camps, route details for Mackenzie corridor
- Identify and solve real M. Delta technical challenges
- Create clearly lower cost option for additional infrastructure expansion
- Defer larger capital deployment until more data available on gas price/demand trends and risk is reduced

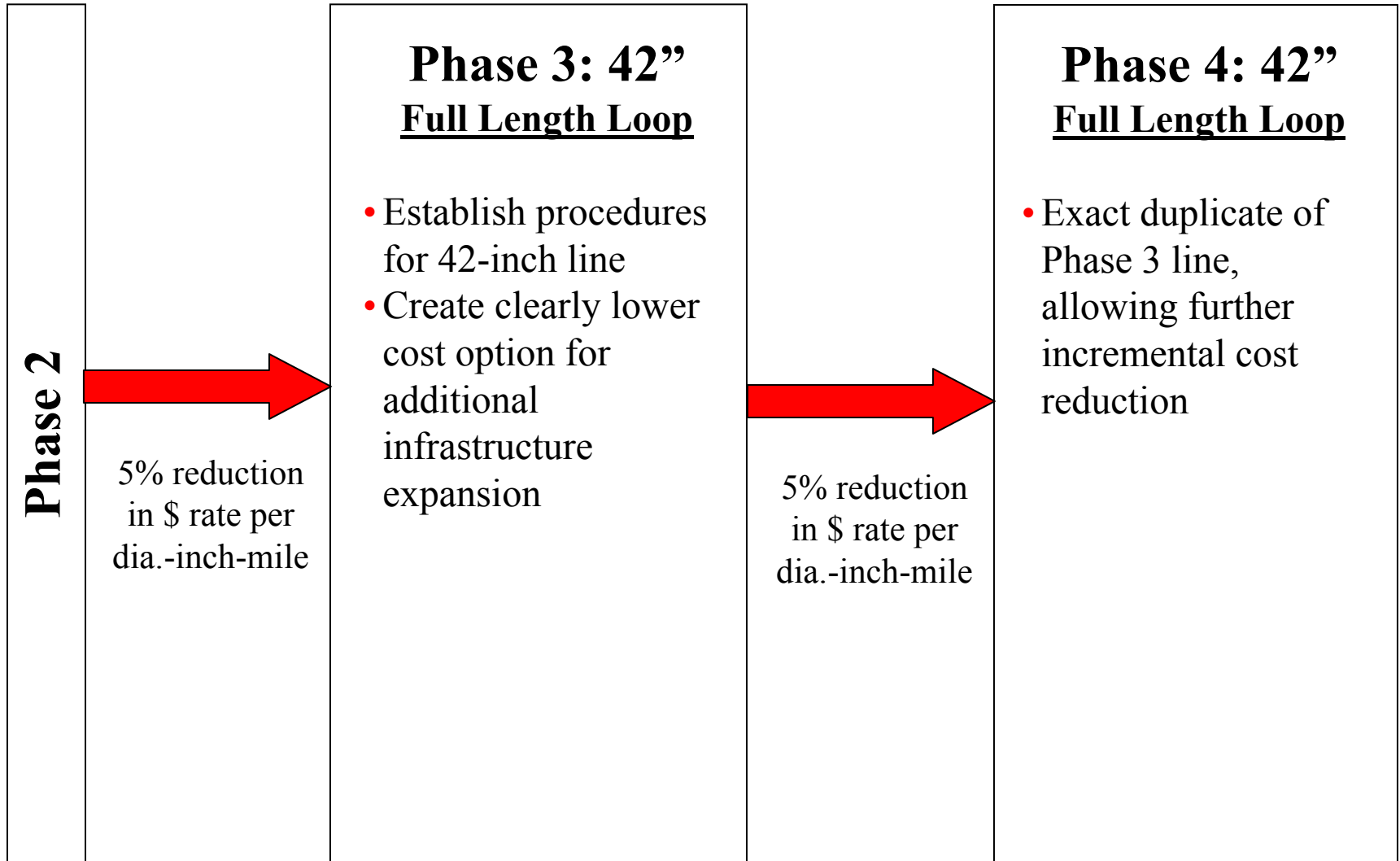


15% reduction
in \$ rate per
dia.-inch-mile

Phase 2: 36” **Northern Alaska Tie-in & Mackenzie Loop**

- Establish Beaufort Sea ROW
- Clear U.S. regulatory path
- Establish roads, camps, route details for northern tie-in
- Identify and solve real arctic offshore technical challenges
- Create clearly lower cost option for additional infrastructure expansion
- Defer larger capital deployment until more data available on gas price/demand trends and risk is reduced

The Value of Project Staging

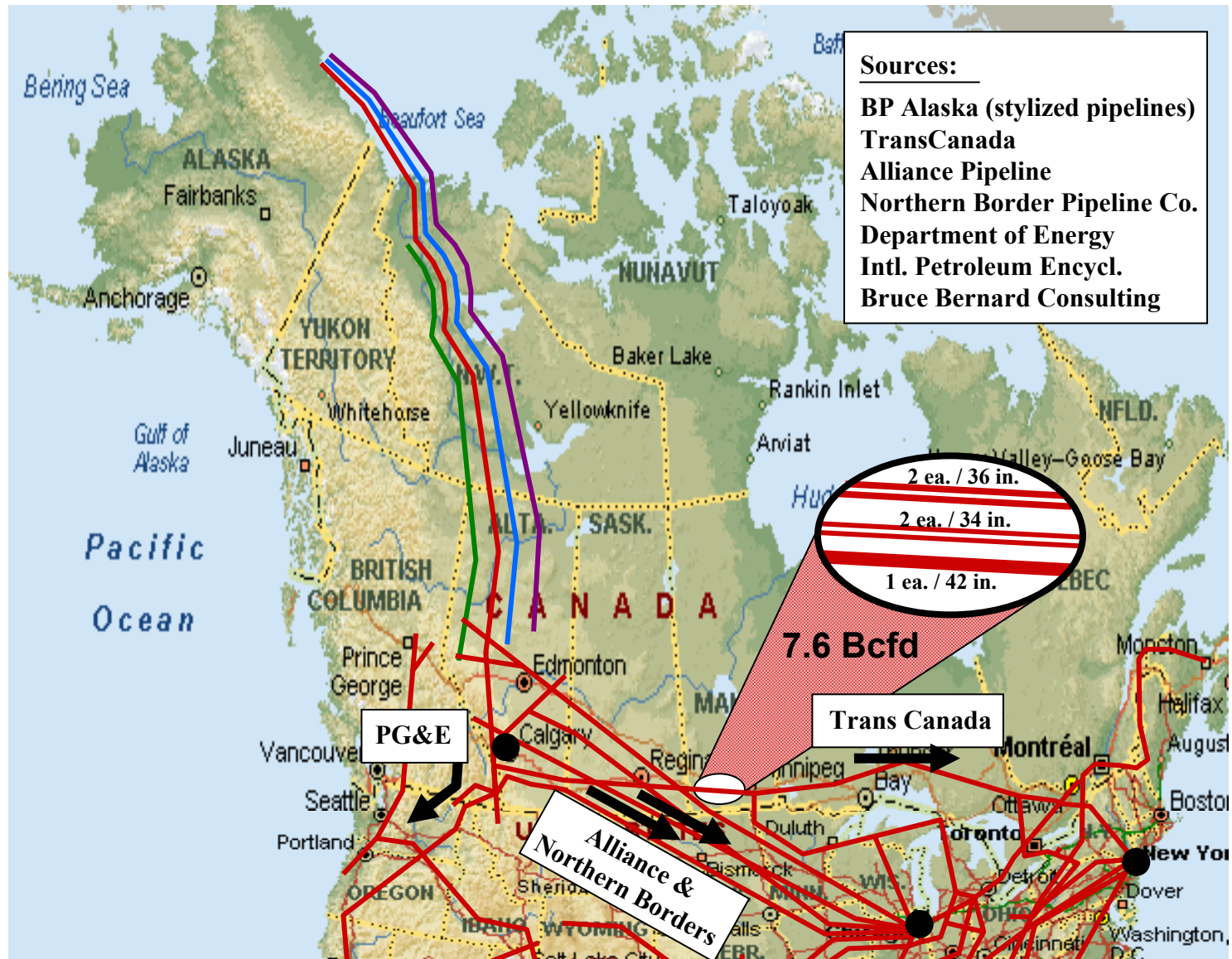


Model Results of Recommended Capacity Additions

	Mackenzie Only	Northern Tie-in + Loop	Full Length Loop	Full Length Loop
Capital Cost (Billion USD)	\$3.353	\$6.128	\$8.326	\$8.572
Length (miles)	1040	1700	1700	1700
Alaska Capacity (Bcf/d)	0	2.5	2.5	2.5
Canada Capacity (Bcf/d)	1.6	0	1.5	1.5
Size (inches)	30	36	42	42
Tariff Prudhoe to L48 (\$/Mcf)	NA	\$1.83	\$2.22	\$2.27
Tariff Mackenzie to L48 (\$/Mcf)	\$0.96	NA	\$1.45	\$1.50
Assumed Gas Price (\$/Mcf)	\$2.63	\$2.71	\$2.85	\$2.93
Netback to Producers (\$/Mcf)	\$1.07	\$0.88	\$0.63	\$0.66
Recommended On-line Date	2007	2010	2015	2018
Cumulative Capacity (Bcf/d)	1.6	4.1	8.1	12.1

Model Results of Recommended Capacity Additions

	Alberta to Chicago Phase 1	Alberta to Chicago Phase 2
Capital Cost (Bil.)	\$4.562	\$4.886
Length (miles)	1857	1857
Capacity (Bcf/d)	4.0	4.0
Size (inches)	30	36
Tariff (\$/Mcf)	\$0.72	\$0.77
Recommended On-line Date	2010	2015
Cumulative Capacity (Bcf/d)	4.0	8.0



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Excerpt from H.R. 4 (Passed Aug.1 , 2001)

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No license, permit, lease, right-of-way, authorization or other approval required under Federal law for the construction of any pipeline to transport natural gas from lands within the Prudhoe Bay oil and gas lease area may be granted for any pipeline that follows a route that traverses—

(1) the submerged lands (as defined by the Submerged Lands Act) beneath, or the adjacent shoreline of, the Beaufort Sea; and

(2) enters Canada at any point north of 68 degrees North latitude.



A \$50 billion gift 'Big Oil' didn't even ask for?

**BY MICHAEL ECONOMIDES
and RONALD OLIGNEY**

ENERGY policy is front and center in our national political debate. That means special interests and pork-barrel politics are front and center, too, led by Senate Majority Leader Tom Daschle, D-S.D., and Alaska's two senators.

A Senate amendment calls for construction of a "Southern route" pipeline to bring natural gas from the North Slope of Alaska. The amendment is a thinly disguised compromise that would "give" the Alaskans something without agreeing to oil exploration in the Arctic National Wildlife Refuge.

This is an eminently uneconomical project that would require massive government subsidies. Those are in the pipeline, too, and could eventually cost taxpayers more than \$50 billion. Ironically, these billions in subsidies would go to oil companies that are not even asking for it.

This story goes back to the very beginnings of the Bush administration's energy policy, which was quarterbacked by Vice President Dick Cheney last spring. The House of Representatives moved fairly quickly and approved a \$23 billion energy bill in July. Thus, the ball rolled squarely into the court of the newly Democrat-controlled Senate.

The Senate was slow to follow the lead of the administration and the House, primarily because both had supported devel-

Economides and Oligney are professors at the University of Houston and authors of *The Color Of Oil — The History, the Money and the Politics of the World's Biggest Business*. Oligney was born and reared in Alaska. Economides was a professor at the University of Alaska from 1980-1984.

traditionally Democratic group, organized labor, used a late and vocal push, based on the number of jobs created by ANWR development, to keep the ANWR provision in the House energy bill.

Then came Sept. 11, which only worsened Daschle's predicament. With 15 of 19 hijackers hailing from Saudi Arabia, Americans became acutely aware of the exposure to Middle East oil supply interruptions. The previous modest plurality of opposition to ANWR in the Senate gave way to modest majority approval to opening the refuge for oil development.

Daschle sensed the sea change and introduced his own 500-plus page energy bill to the Senate floor. Last week, the majority leader offered the first amendment to his own bill, mandating the so-called Southern route, a pipeline that would traverse half of Alaska, veer into Canada and eventually to the Lower 48 states.

This pipeline, debated now for 20 years, is one of two things that Alaskans and their legislators desperately want, the other being ANWR. Alaska Sens. Frank Murkowski and Ted Stevens, both Republicans, became co-sponsors of the Daschle amendment. It passed 93 to five.

million last year studying the options for bringing their Alaska natural gas to market and concluded that neither pipeline is economically attractive, but clearly the northern route is much closer to being so.

Daschle, aided by his Alaskan Republican colleagues, has painted a pretty picture of high-paying union jobs, a huge new market for U.S. steel (notwithstanding that no U.S. mill is capable of rolling the required 48- to 52-inch pipe) and much-needed clean energy.

Unfortunately, the true picture is far more somber. The pipeline cannot happen without a huge government subsidy. The math is indisputable. Let's say the pipeline, which would carry 4 billion cubic feet per day, will cost \$20 billion, which is conservative by our estimates. This cost equates to a tariff of \$2.83 per thousand cubic feet of gas. Add \$1.20 at the well-head, and the natural gas price becomes \$4-plus.

With gas trading today in the \$3 range, with liquid natural gas (LNG) or compressed natural gas (CNG) imports planned for mid-decade at less than \$3, this price guarantee will cost the U.S. taxpayer an estimated \$5 million to \$7 million per day, or \$40 billion to \$50 billion over 20 years (in 2002 dollars).

A huge subsidy such as this is possible because of the "scoring rules" used in Washington, D.C., which only require that the financial impact of new legislation be tracked for 10 years. Because the pipeline will not be completed for seven years, this means only three years of subsidies get "scored." Thus, at \$1.8 billion per year, this

Arctic Natural Gas Options

Block Northern route	Government subsidies	Mackenzie Valley line	Alaska gas reaches market
No	Yes	Yes	2008
No	No	Yes	2010
Yes	Yes	Yes	2020
Yes	No	Yes	2030

Other options:

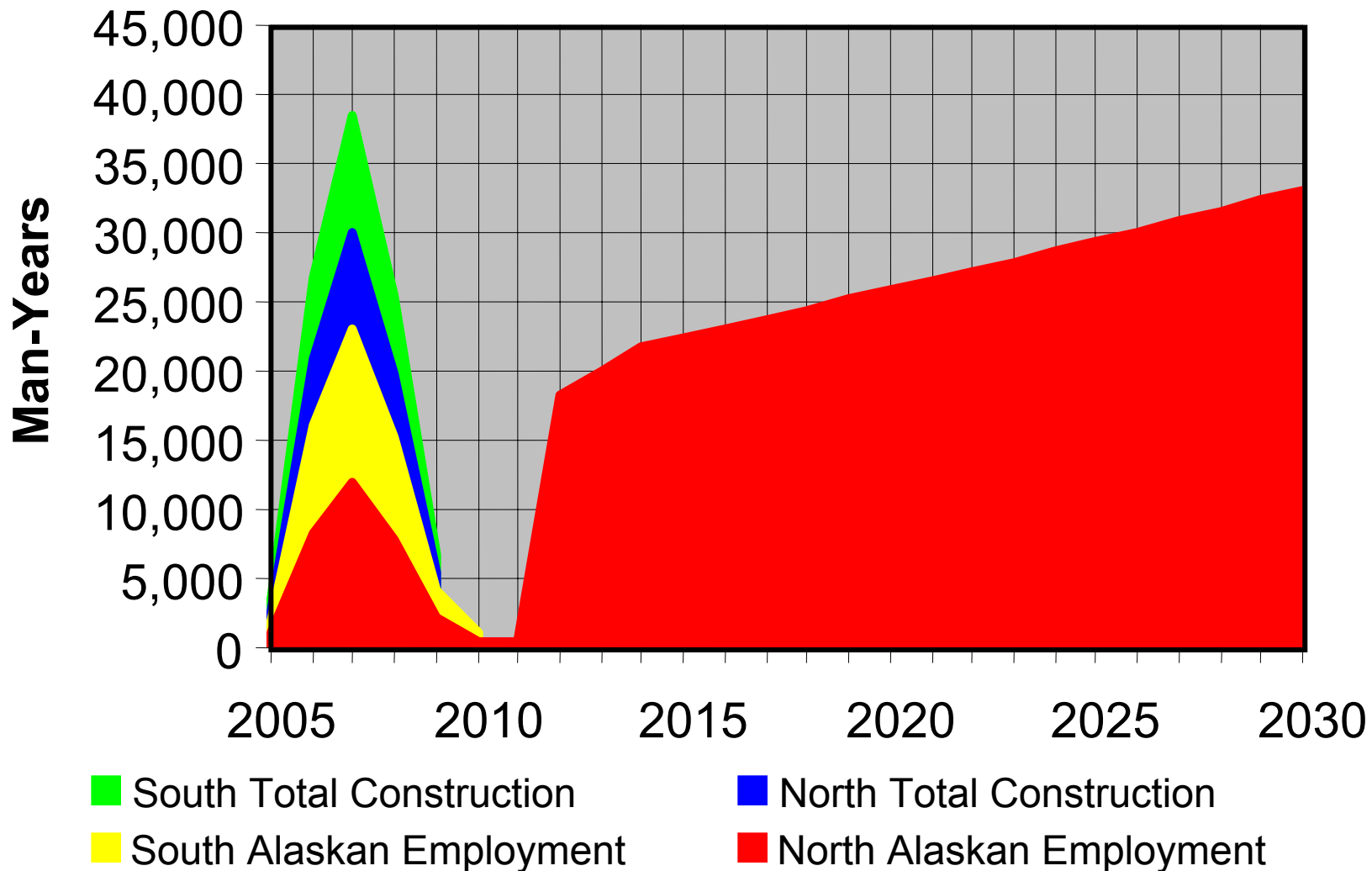
- All-Alaska gas line
- Murkowski corridor concept
- Cook Inlet development

(NASA-style investment)
(More Soviet-era planning)
(Market-based solution)

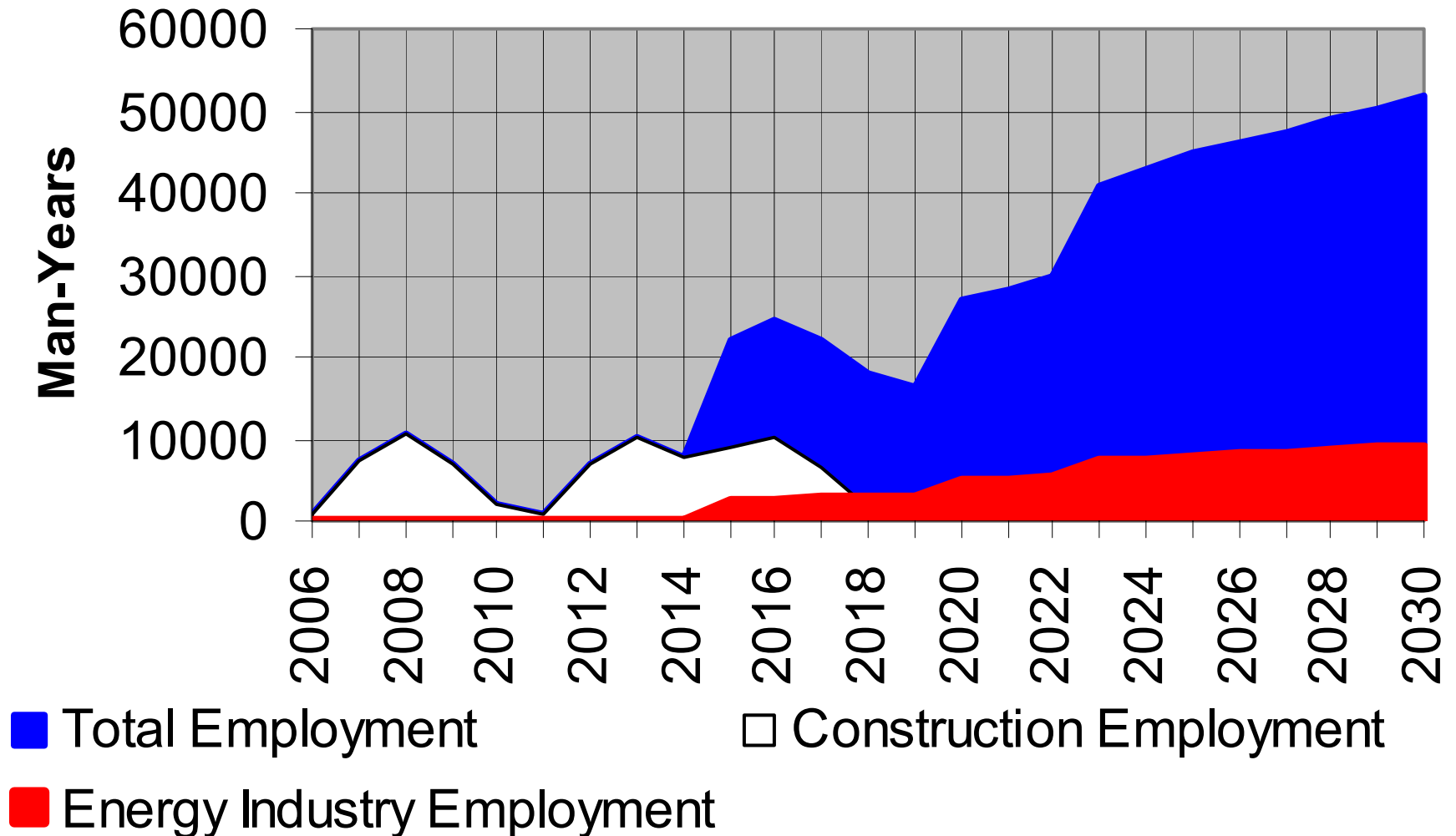
Message to Alaskans

1. Near-term stable jobs involving Alaskan gas should focus on Kenai development rather than a North Slope gas pipeline.
2. Any pipeline route from the North Slope will be 60 percent or more in Canada:
 - Routing decisions based on Alaska construction jobs do not serve your long-term financial interests.
 - Canada will ultimately have the final say on routing decisions.
3. Support the lowest-cost, highest-netback pipeline solution:
 - Generates the greatest corporate revenues and State income.
 - Translates to permanent jobs and a strong Alaska economy.
 - Prevents job leakage to out-of-state commuters.
4. False environmental claims made today may be your undoing later when ANGTS route is dead and you change your vote to “Over-the-top”—be careful!

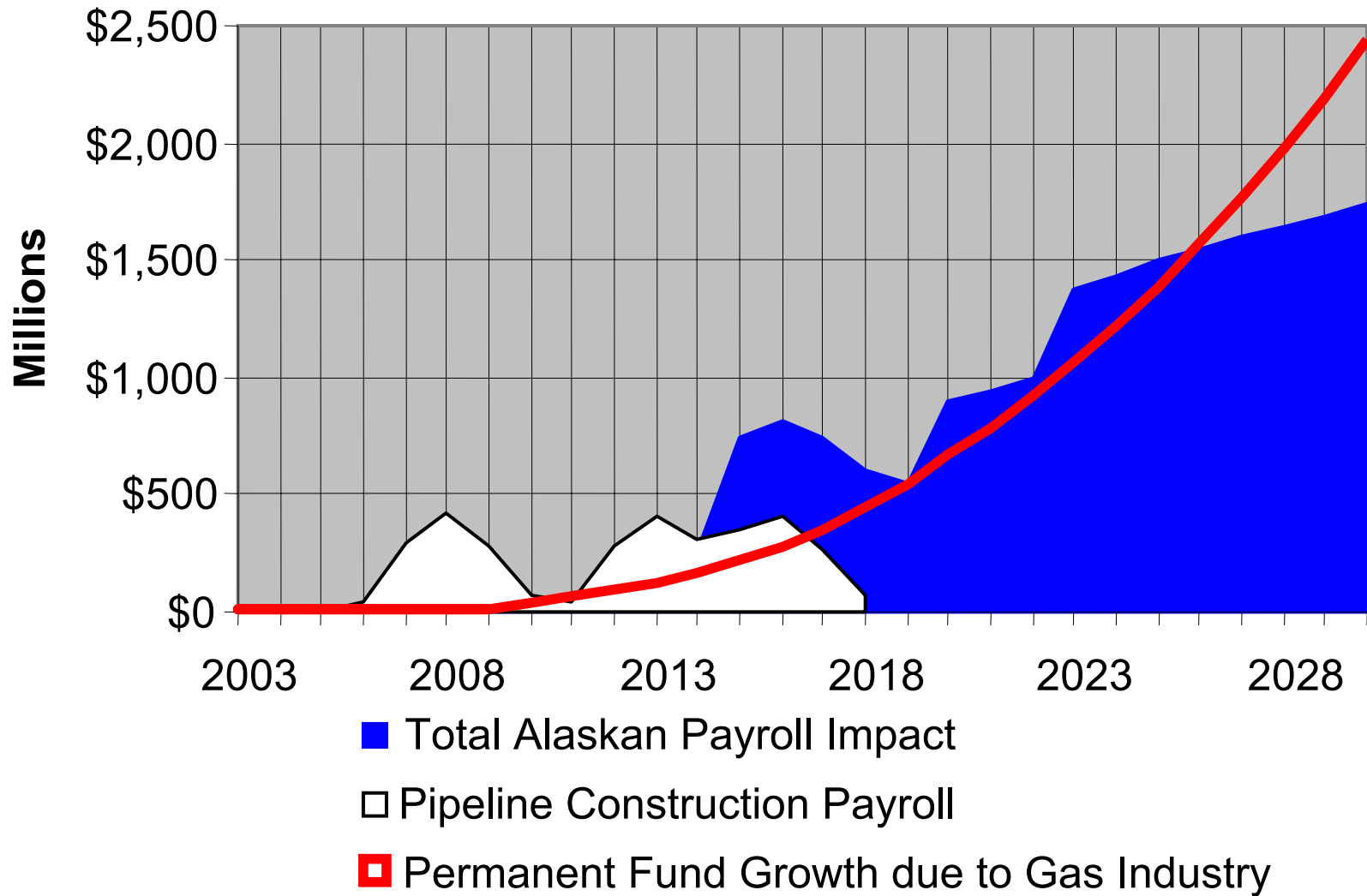
Which Route Creates Most Permanent Jobs for Alaskans?



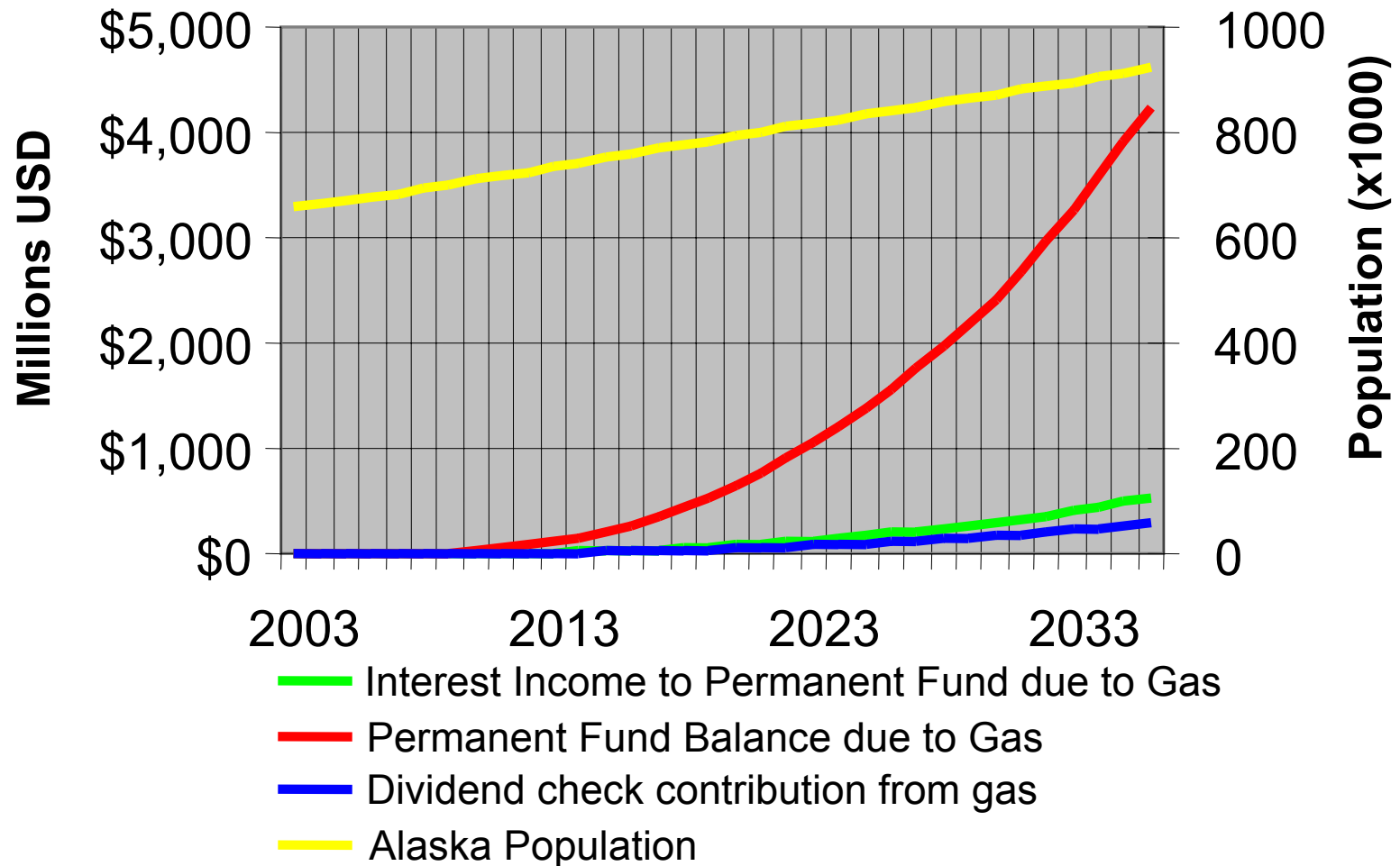
Alaska Gas Employment Impact



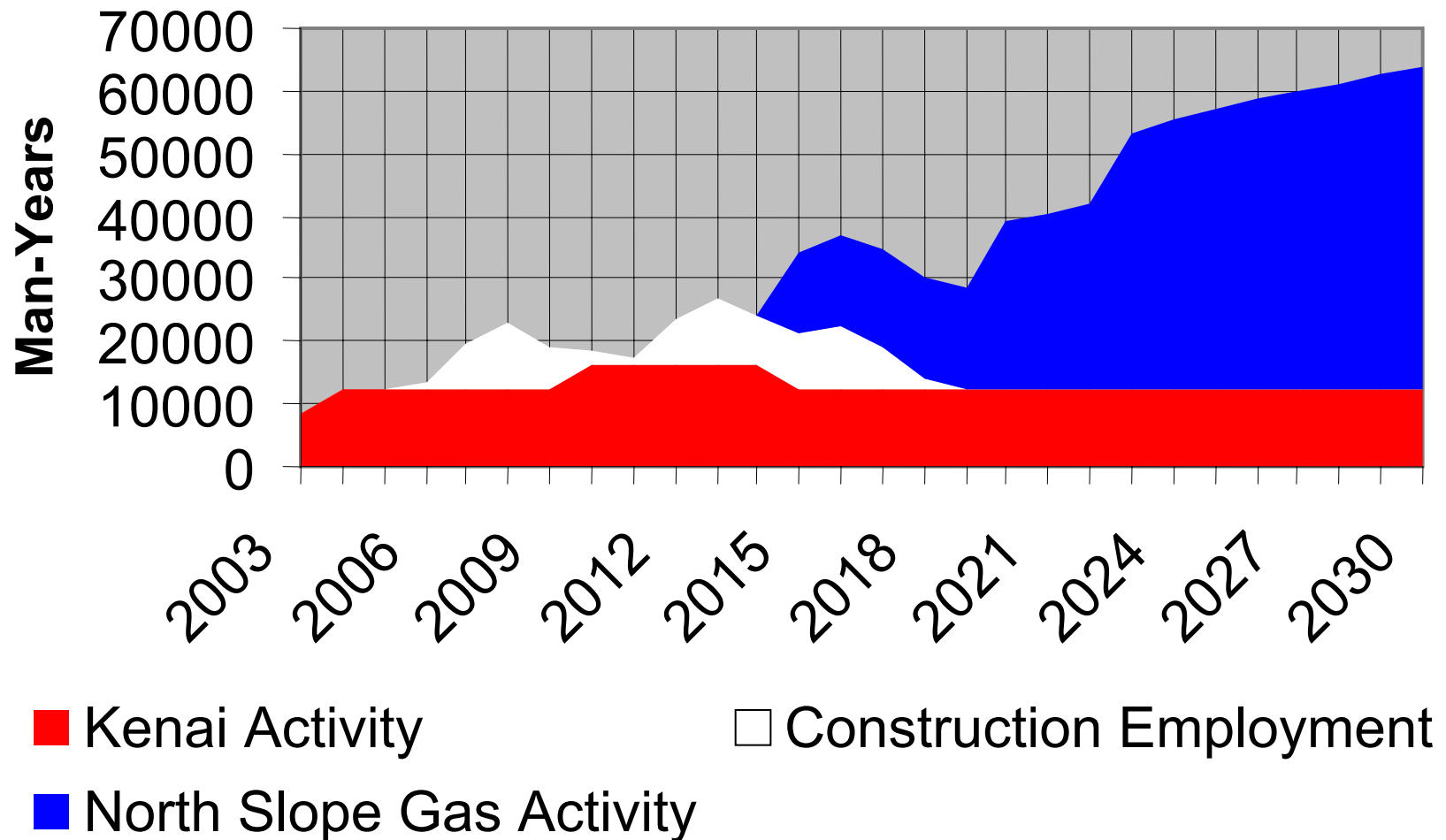
Alaska Gas Industry Impact in Dollars



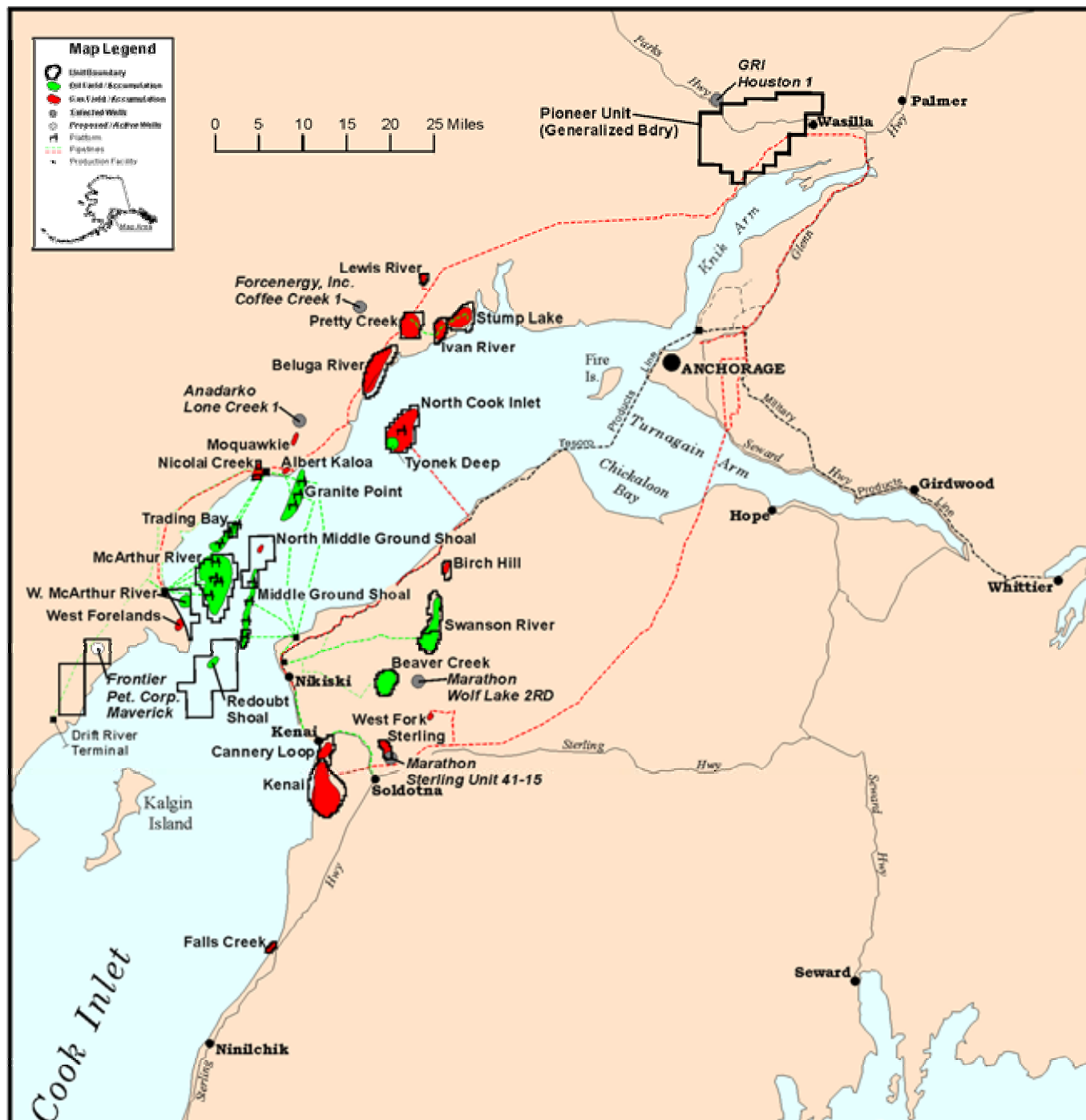
Gas Contribution to Permanent Fund



Alaska Gas Employment Impact, including Kenai



Cook Inlet Oil and Gas Activity, September 1999

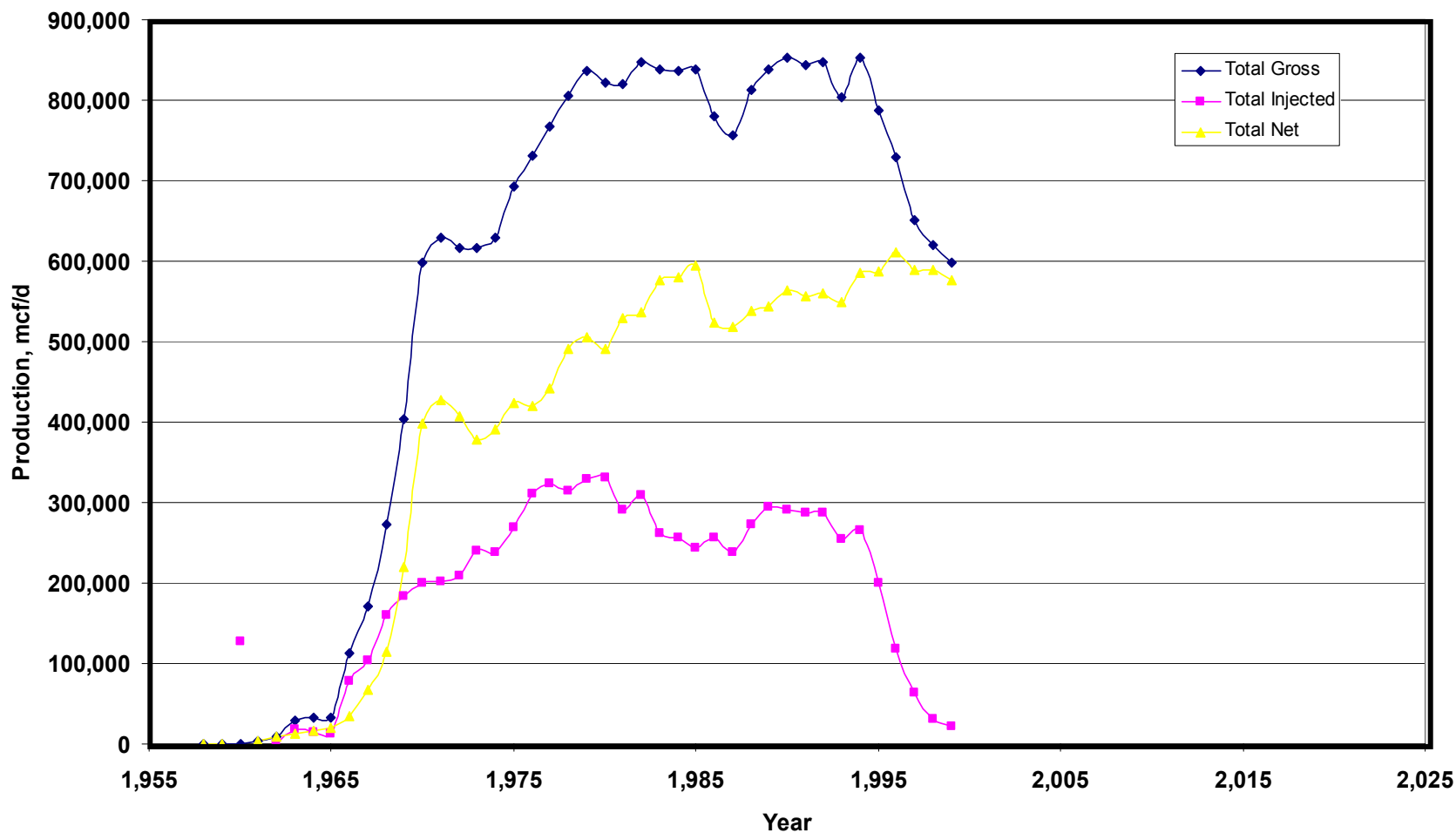


Cook Inlet Reserves (1998)

• Original Reserves	8,468 Bcf
• Produced	5,493 Bcf
• Remaining	2,975 Bcf
<hr/>	
• Estimated reserve life @ 214 Bcf/year	13 years (thru 2011)
• Undiscovered Recoverable	7,720 Bcf

Source: MMS

Cook Inlet Production History



Cook Inlet Consumption

• LNG Exports	34%
• Ammonia/Urea	24%
• Electrical Power	18%
• Gas Utilities	13%
• Field Operations	8%
• Miscellaneous	3%

Source: Anchorage Economic Development Council

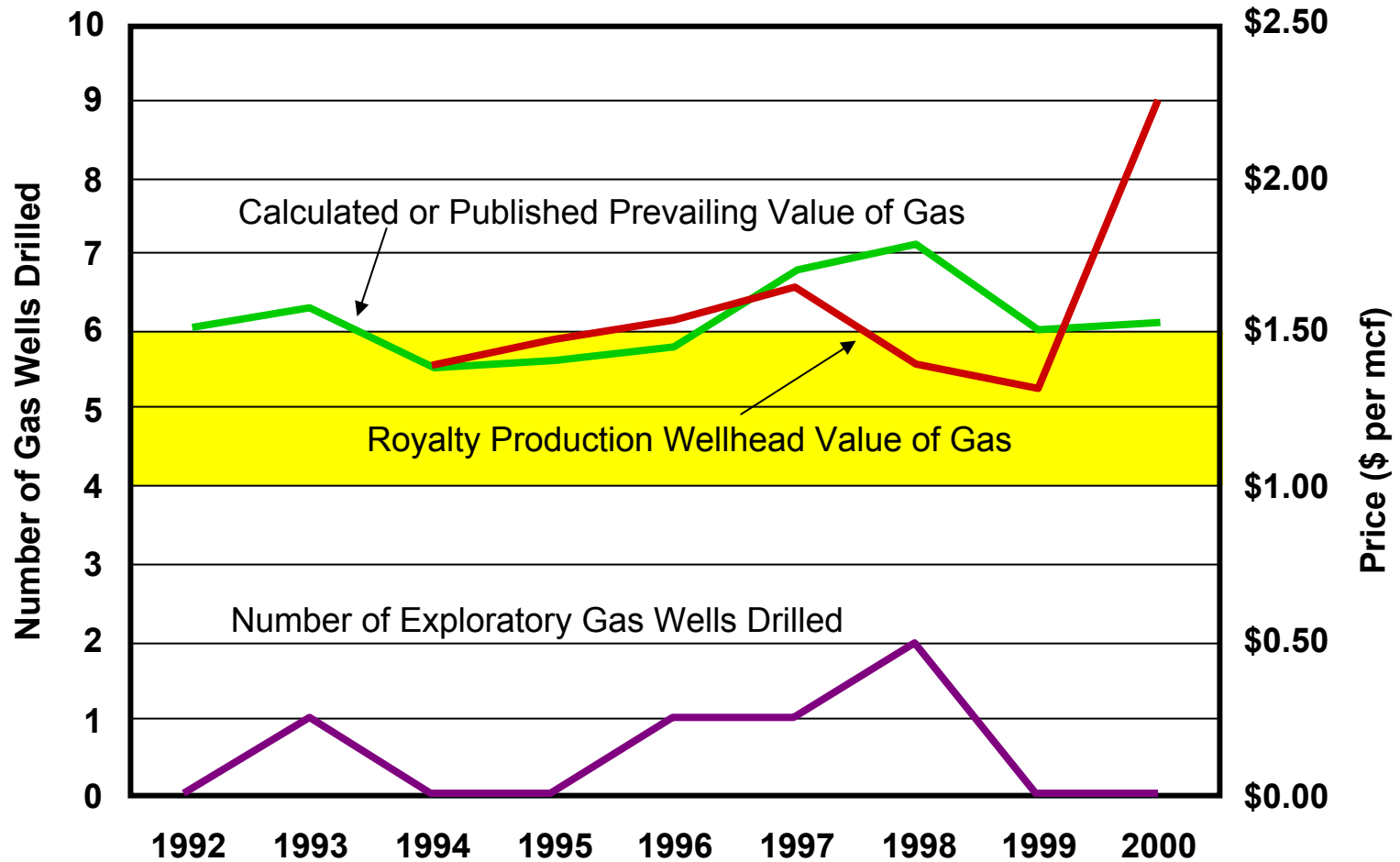
Hand Wringing in Kenai/Anchorage

- During last round of permit extension hearings, local opposition to LNG exports surfaced in response to fears of supply constraints.
- Study done by Anchorage Economic Development Corporation advocates that industrial use of natural gas be cut in half in 2010.
- Sen. Torgerson afraid Kenai will become a “ghost town” after 2009, introduced legislation to prohibit construction of Northern route pipeline.

Prudhoe-Sized Reserves Still to be Discovered in Cook Inlet

- While 7 or 8 years of excess supply is very short in, for example, a Soviet-style planning cycle, it is closer to eternity in a market-driven environment.
- The Reserves-to-Production ratio in Cook Inlet is 14, much higher than the national average of 9.
- A positive price signal to the E&P sector in 2000 has already led to new exploration activity.
- Exploration activity now underway by Phillips, Forest Oil, Unocal and Escopeta.
- Anticipate 20 Tcf+ reserves to be announced in Cook Inlet over the next 24-36 months.

Number of Exploratory Gas Wells Drilled in Cook Inlet, and the Calculated/Prevailing Value and Royalty Production Wellhead Value of Cook Inlet Gas, 1992-2000



Source: Anchorage Economic Development Corporation

Escopeta Oil & Gas and B.B.I., Inc.
Announce Exploration Results in Cook Inlet Basin, Alaska
Estimated 12 Tcf of Recoverable Natural Gas Reserves Located

FOR IMMEDIATE RELEASE
September 26, 2001

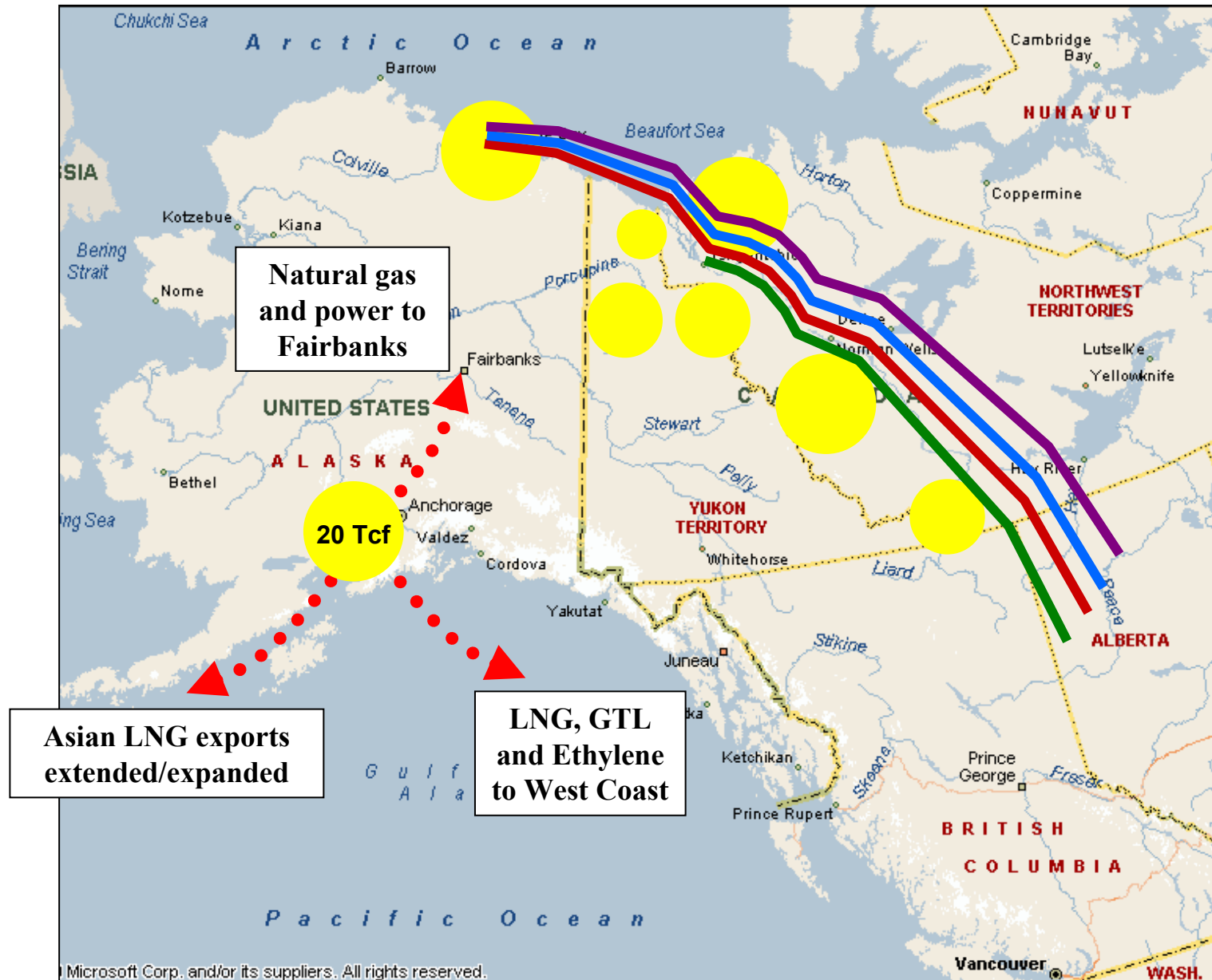
Contact: Mr. Danny Davis
(713) 623-2219

Houston, TX – Escopeta Oil & Gas and BBI, Inc. of Houston, Texas, today announced new seismic reprocessing results that show estimated recoverable reserves of 12 trillion cubic feet (Tcf) of natural gas near the East Forelands area of Alaska's Cook Inlet Basin, at depths of 18,000 to 21,000 ft. Known producing horizons in the same structural trend would likely recover 1.35 billion barrels of oil and an additional 6.1 Tcf of gas.

The reprocessed seismic data reveal the presence of a significant complex fault system on the east flank of the Middle Ground Shoal Field (200 million barrels reserves), forming an immense trapping mechanism, possibly the largest untested structural fault block in the Cook Inlet Basin. Geophysical and geological mapping reflect approximately 9000 feet of vertical closure against this fault system representing approximately 69,000 acres of structural closure. The depth of the main targets suggests accumulations of thermogenic gas.

(cont.)

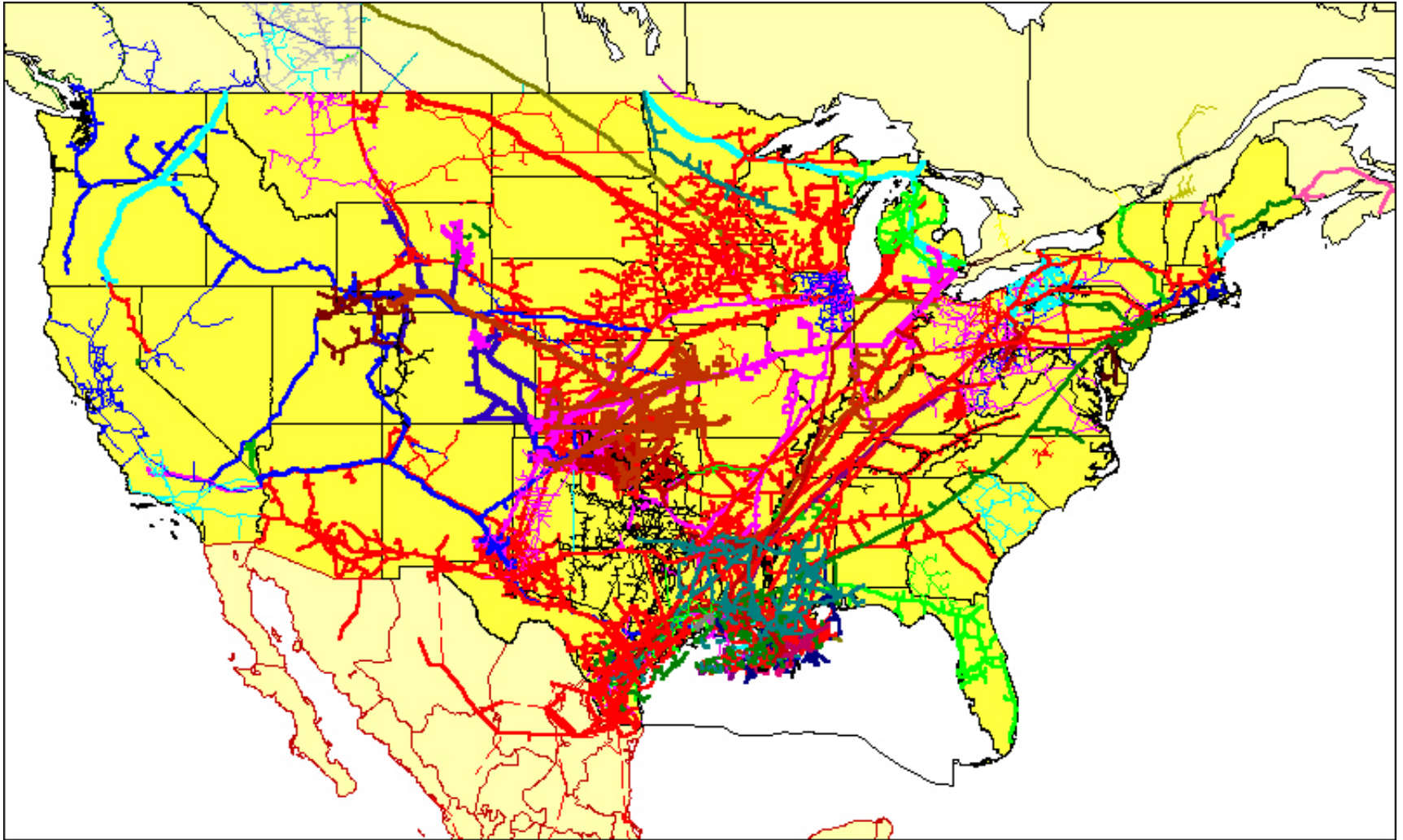
Cook Inlet Natural Gas Changes the Picture



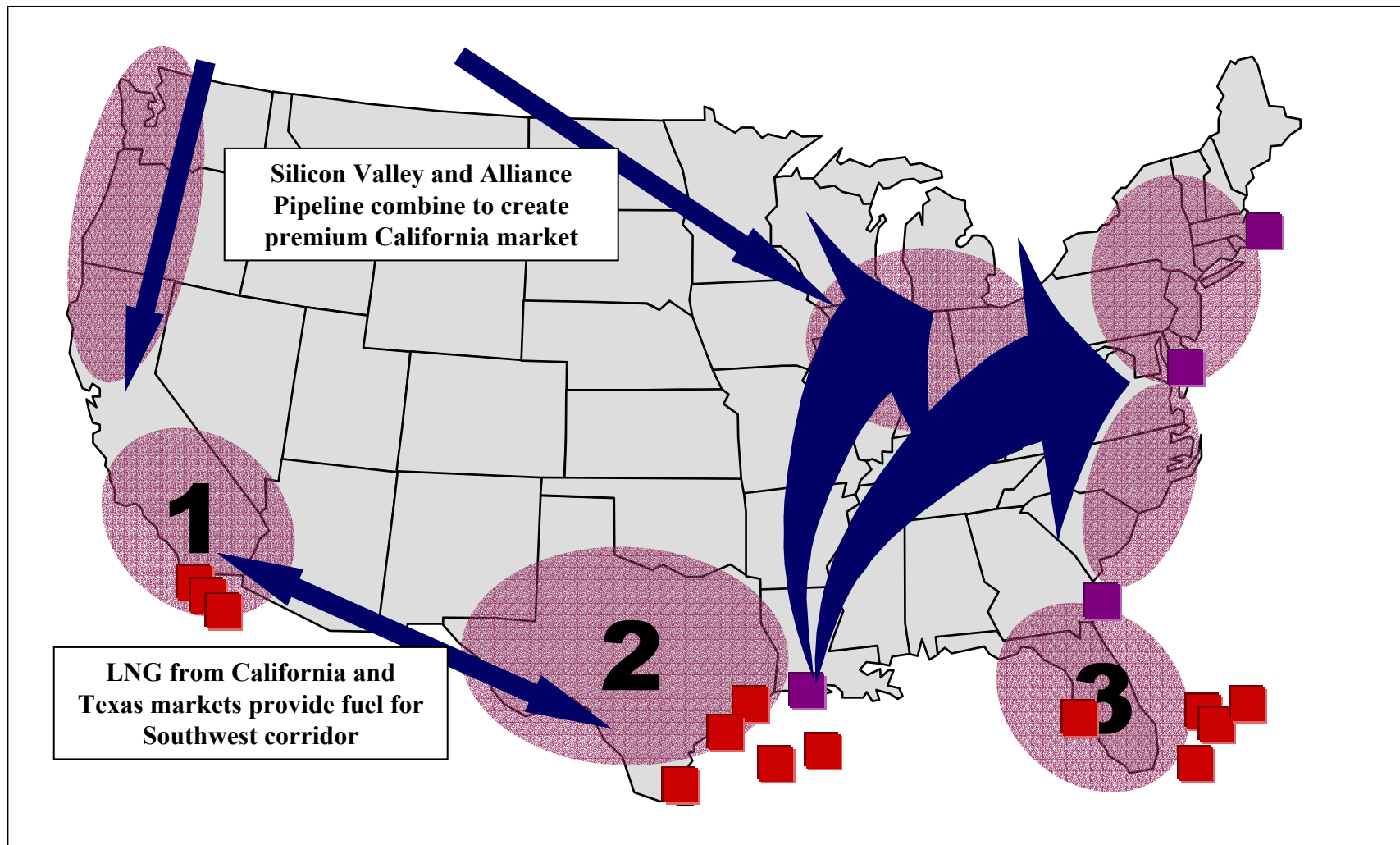
LNG addresses 3 key elements of U.S. energy debate

- Natural gas price
- Bulk gas supply and demand
- **U.S. market “regionality”**

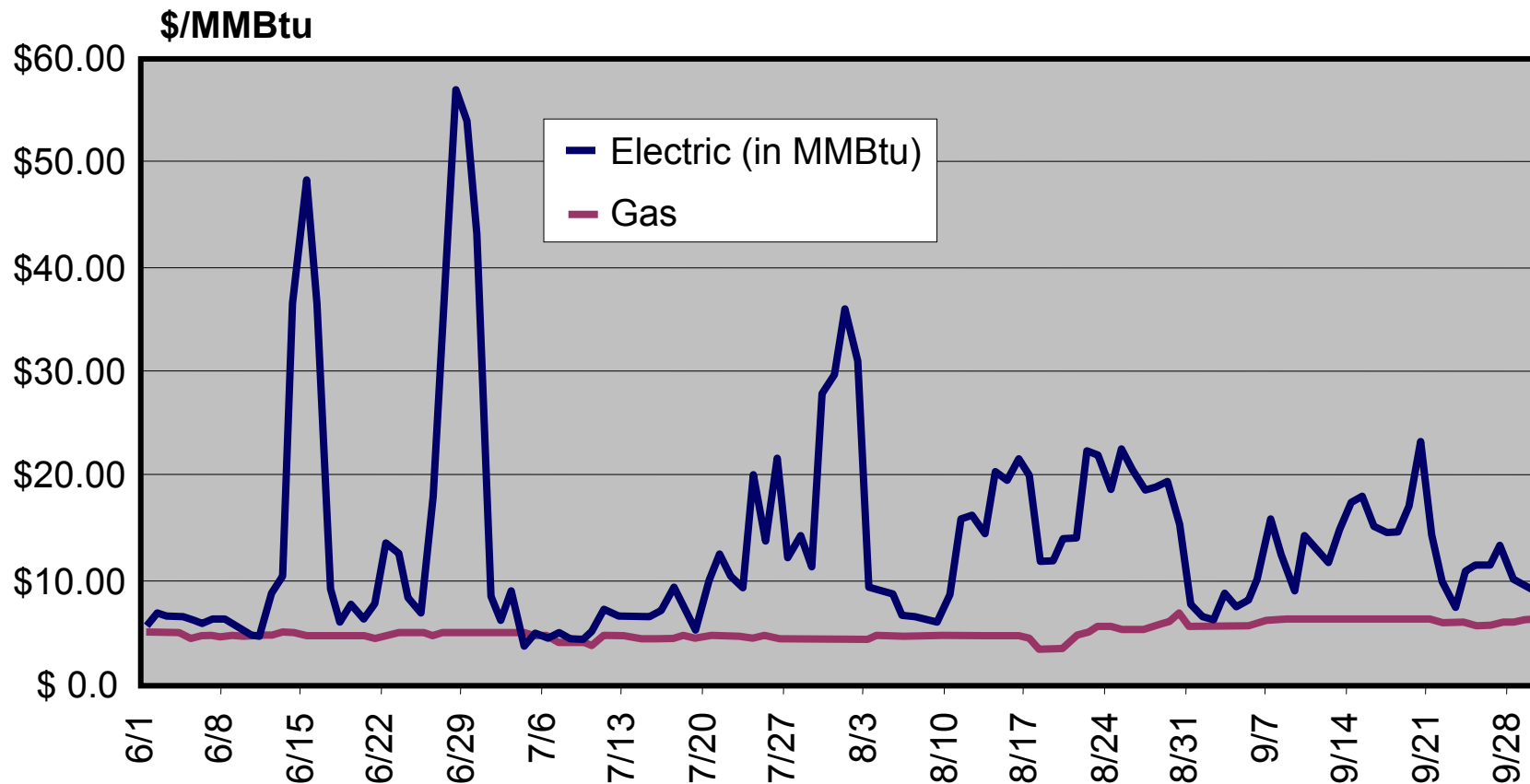
Natural Gas Interstate Transportation by Pipeline



Premium U.S. Natural Gas Markets, Old and New

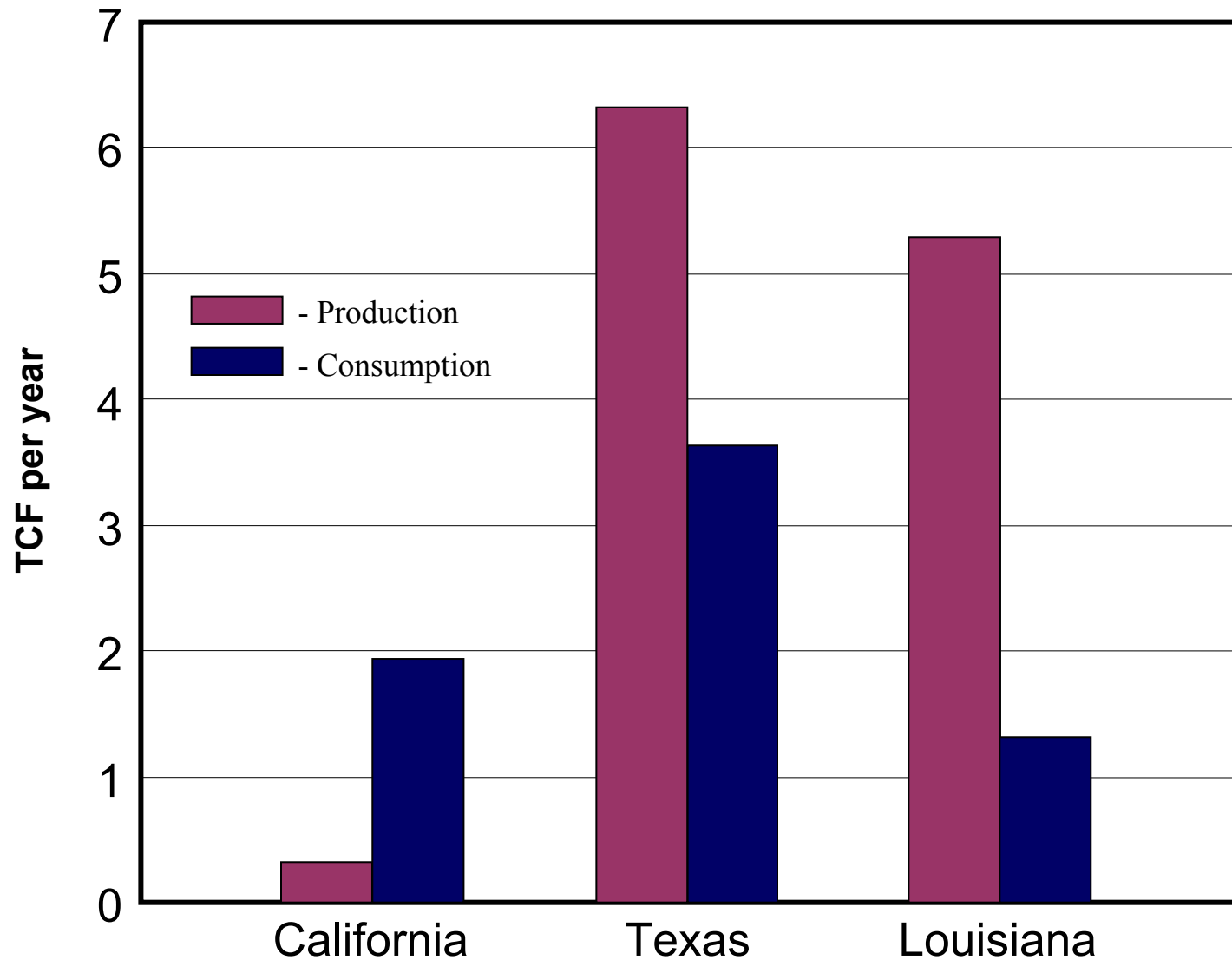


California Day-Ahead Pricing vs. PG&E Citygate Pricing



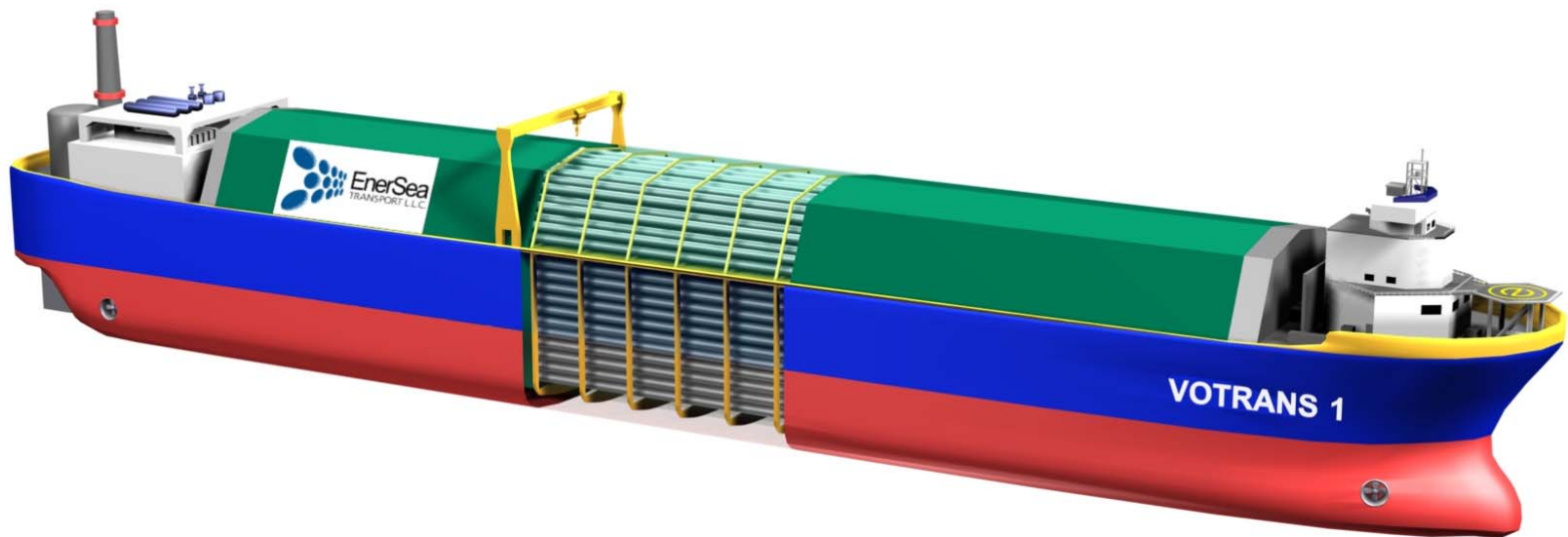
* Using a 7,000 Heat Rate

Natural Gas Production and Consumption, 1999

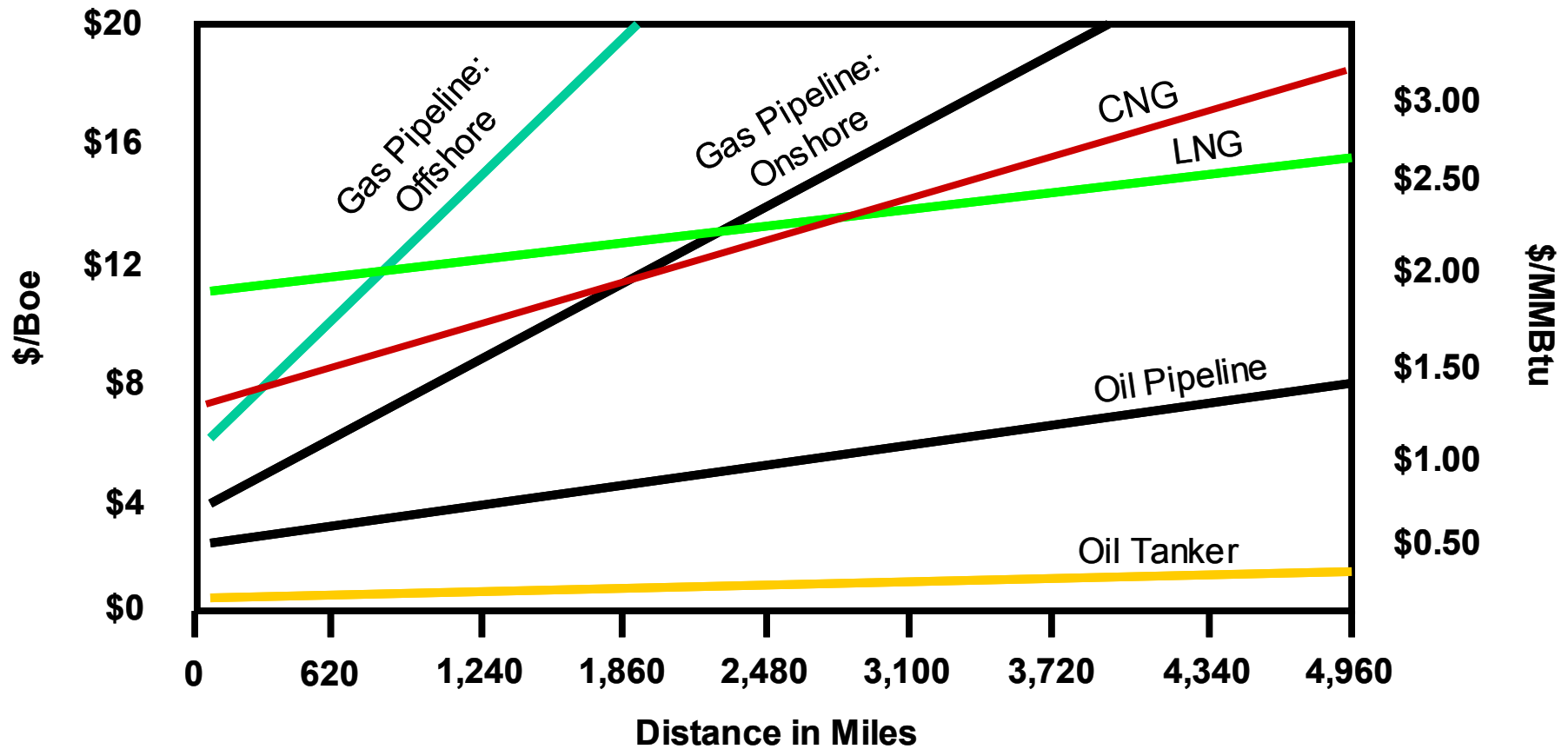


CNG vs. LNG

- Renewed interest, everyone is getting some
- Major advantage in terms of market entry
- Much less capital deployed in country
- Up to 2 Bcf on a ship, no boiloff
- Ideal for limited supply, limited consuming markets
- Preferential to LNG for short hauls (cost of CNG transport is all in the boats)

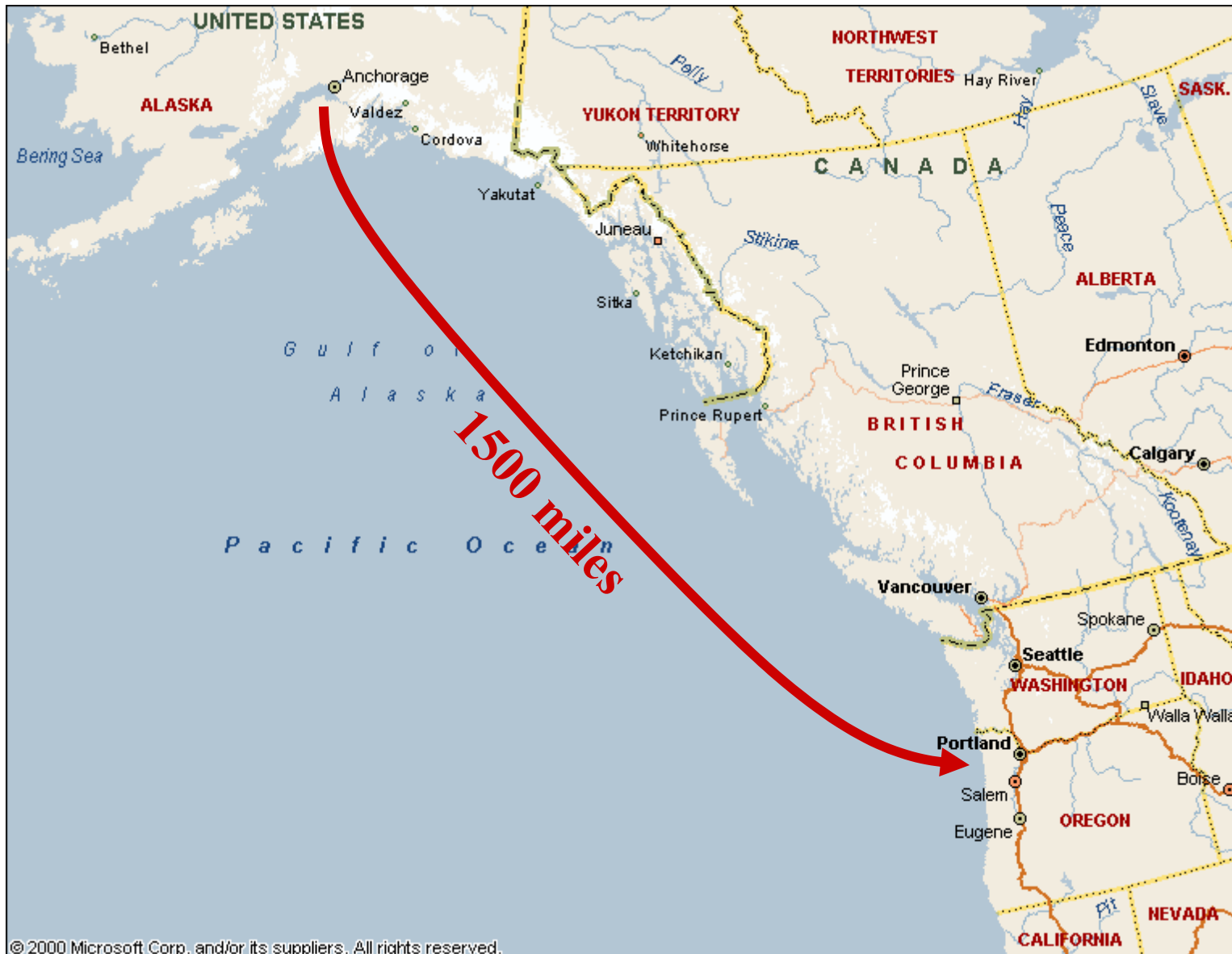


Bringing stranded gas to market

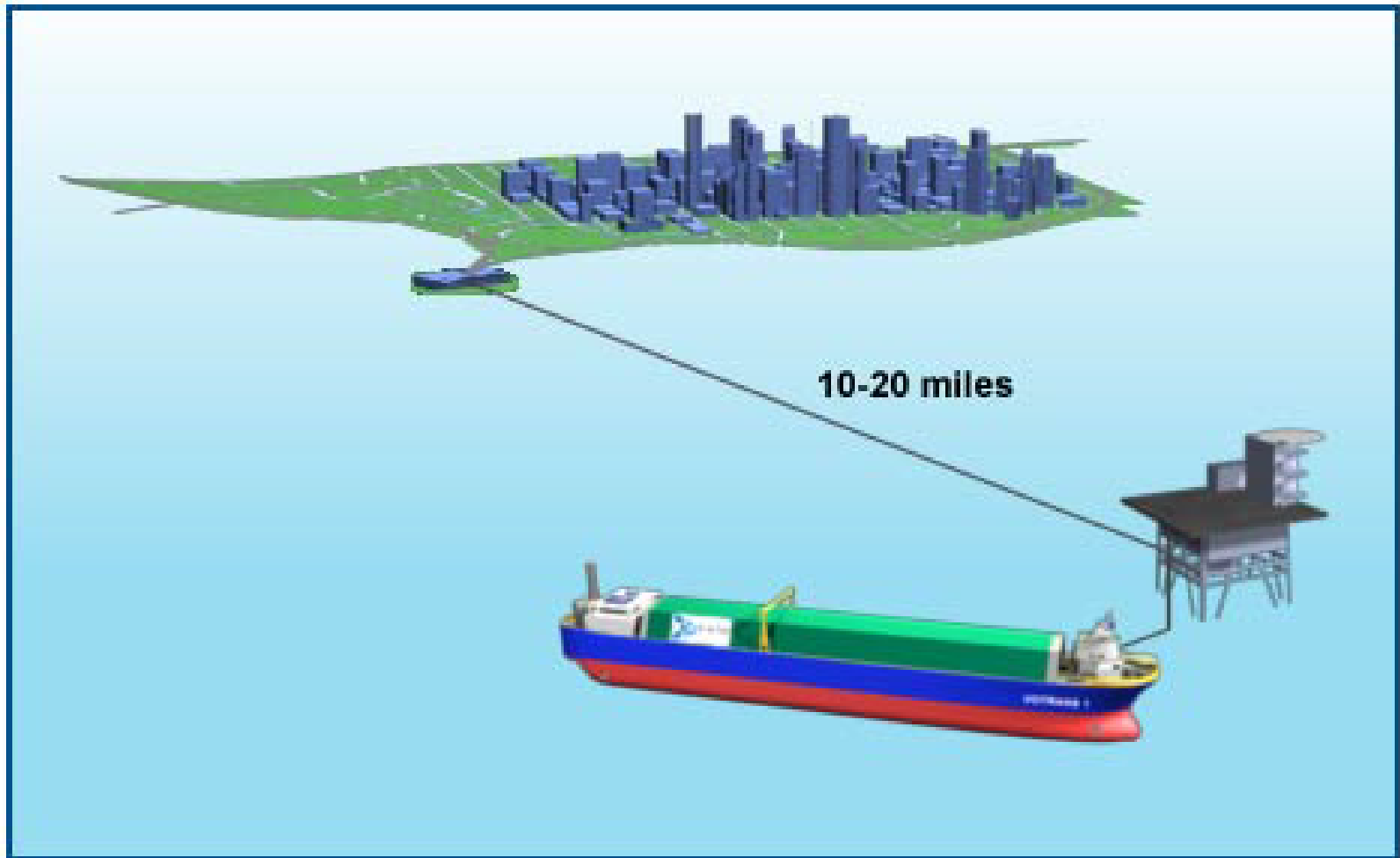


Source: Institute of Gas Technology; CNG line added

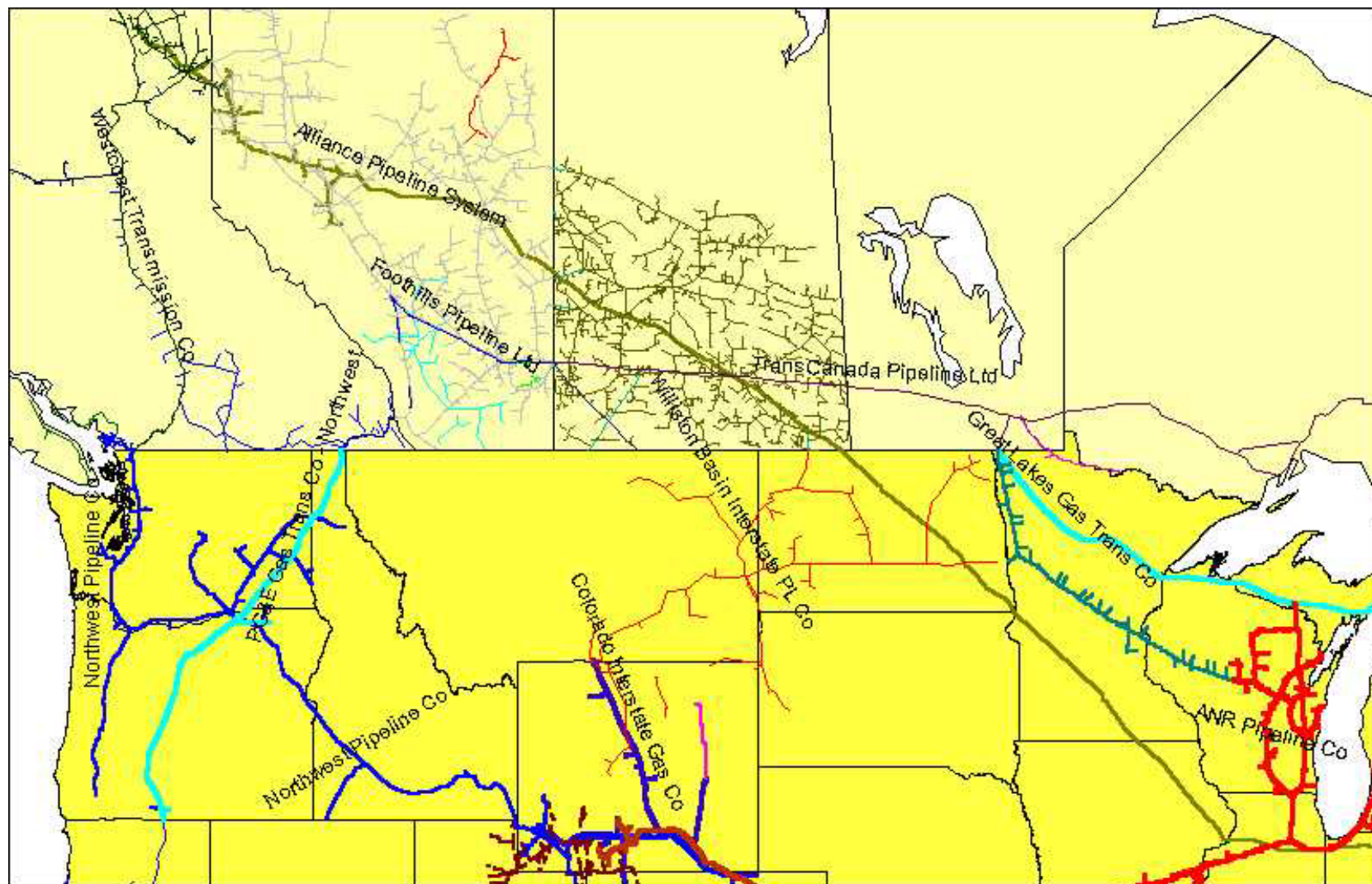
Kenai as the “Trinidad” of the West Coast



Remote Offloading of CNG

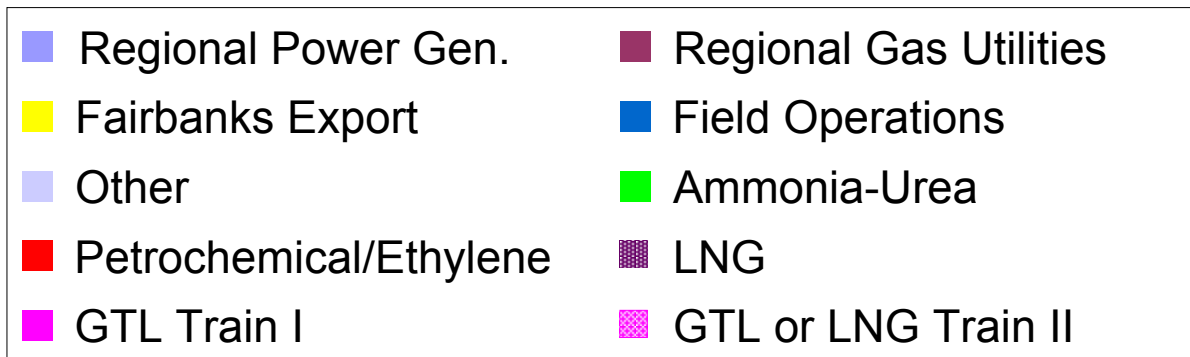
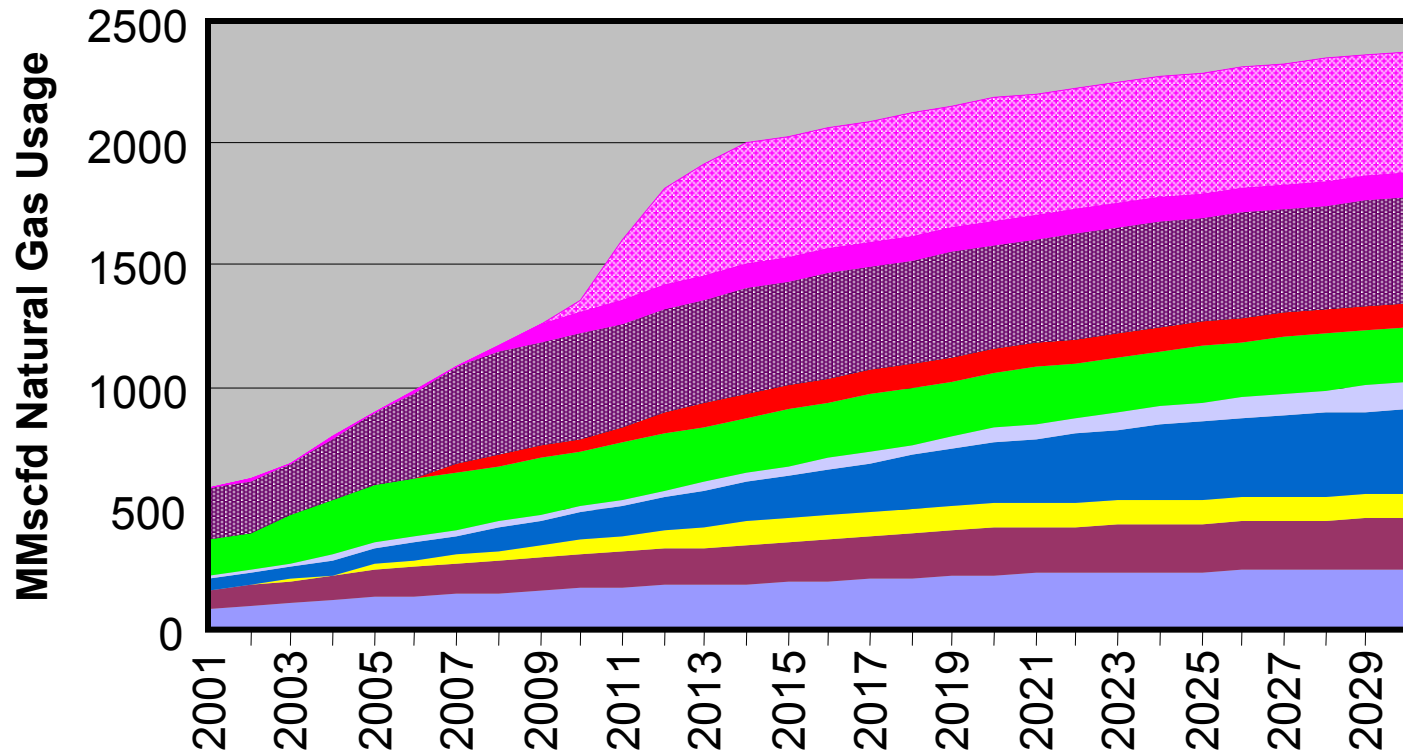


Pipeline Connections in Oregon and Northern California



Source: EIA, plotted by Bruce Bernard Consulting

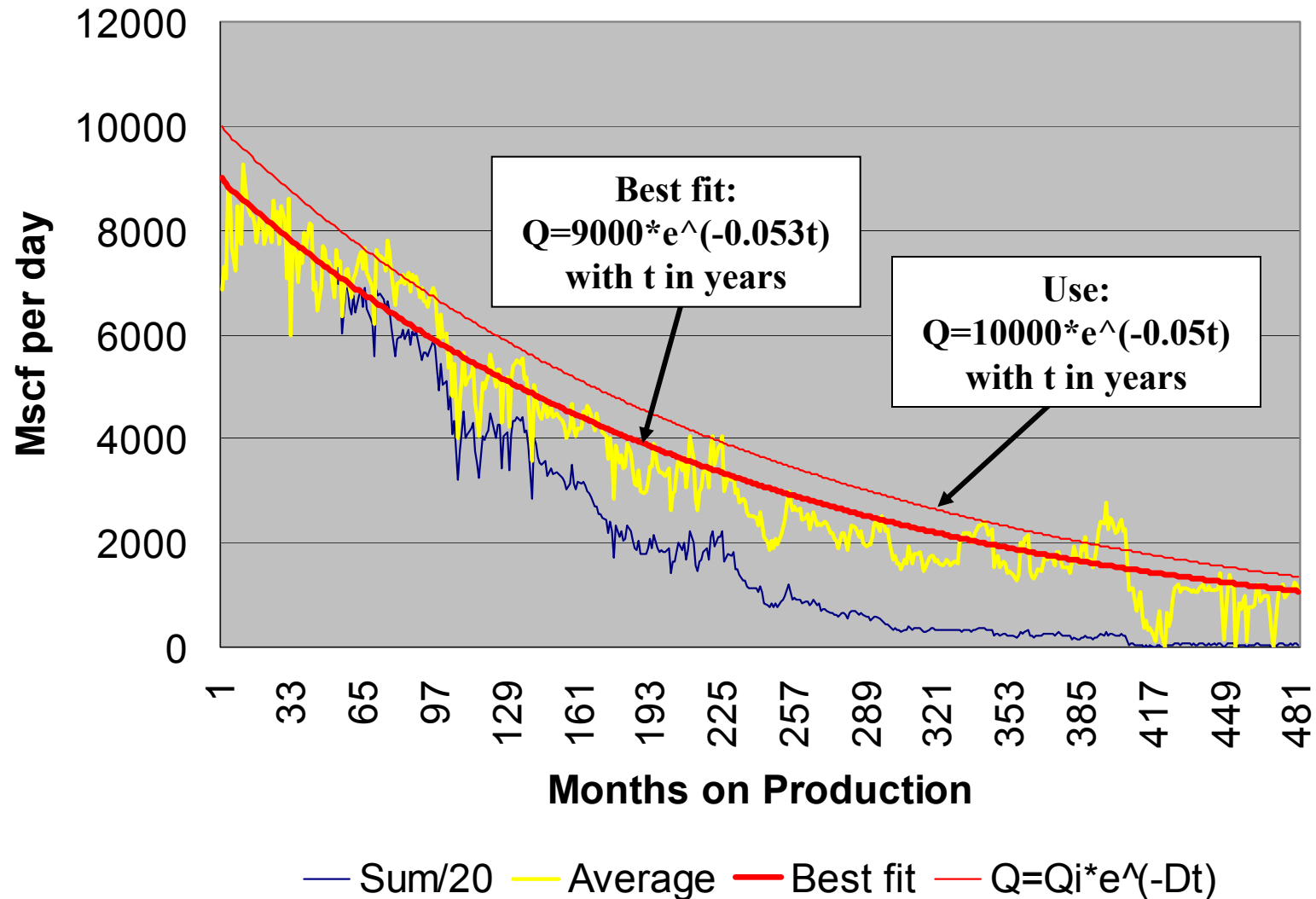
Kenai Development



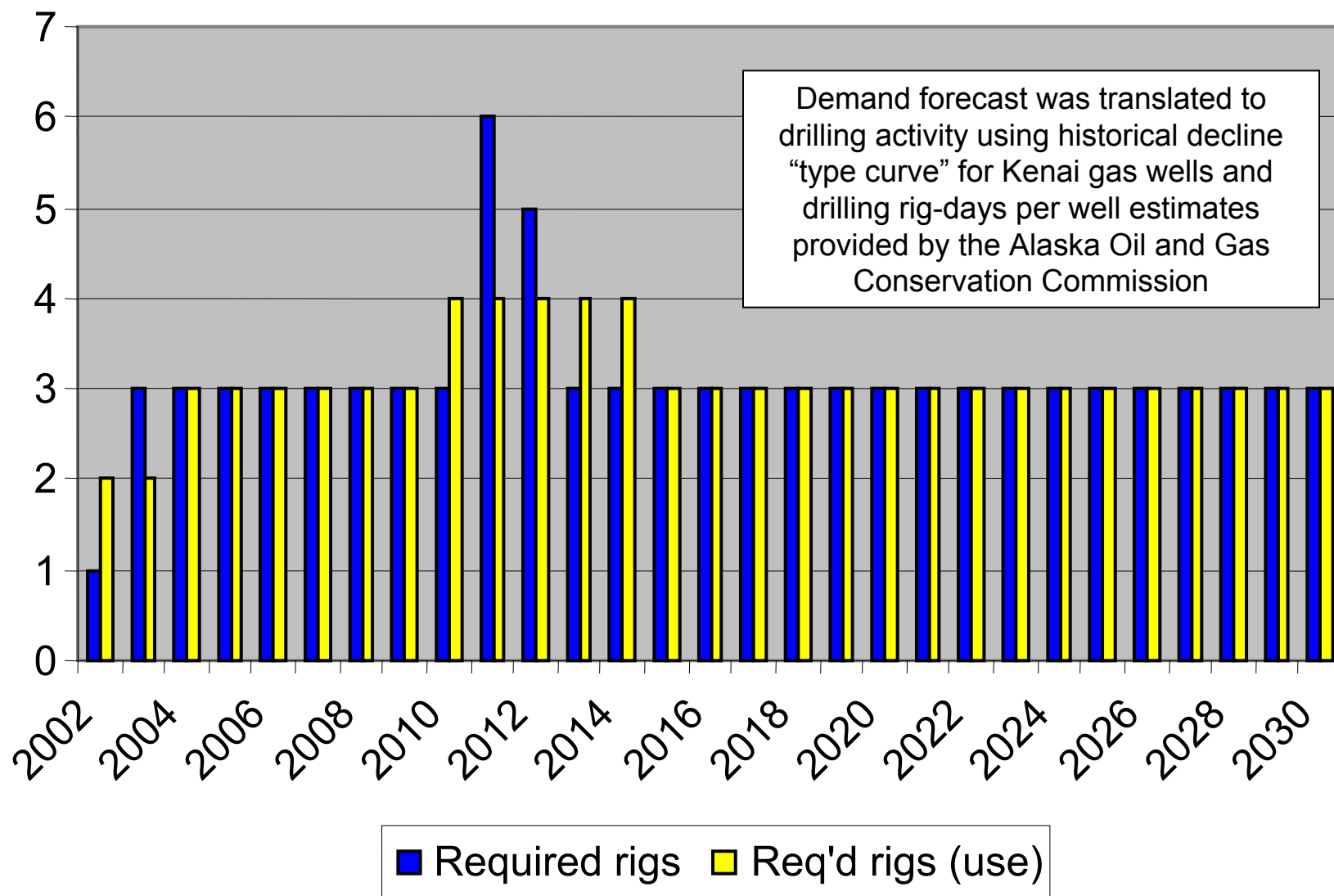
Kenai Development Assumptions

- Base of electric power generation and gas utilities in Anchorage area.
- Fairbanks consumption grows ultimately to 100 MMscfd.
- Field operations use of natural gas grows back to 1990s levels following second round of Cook Inlet oilfield development.
- Ammonia-Urea production expands by 30 Bcf annually beginning in 2004, expansion already on drawing board at Agrium.
- Ethylene production of 2 billion lb/yr established by 2009, with ultimate expansion to 4 billion lb/yr, Williams petrochemical study ongoing.
- LNG exports expand gradually to a still-modest 0.5 Bcf per day by 2008.
- GTL production in Kenai starts with 300 bpd pilot in 2002, followed by a 10,000 bpd (100 MMscfd) unit in 2010 and (subject to reserve base and market demand) a 50,000 bpd (0.5 Bcfd) unit in 2014.

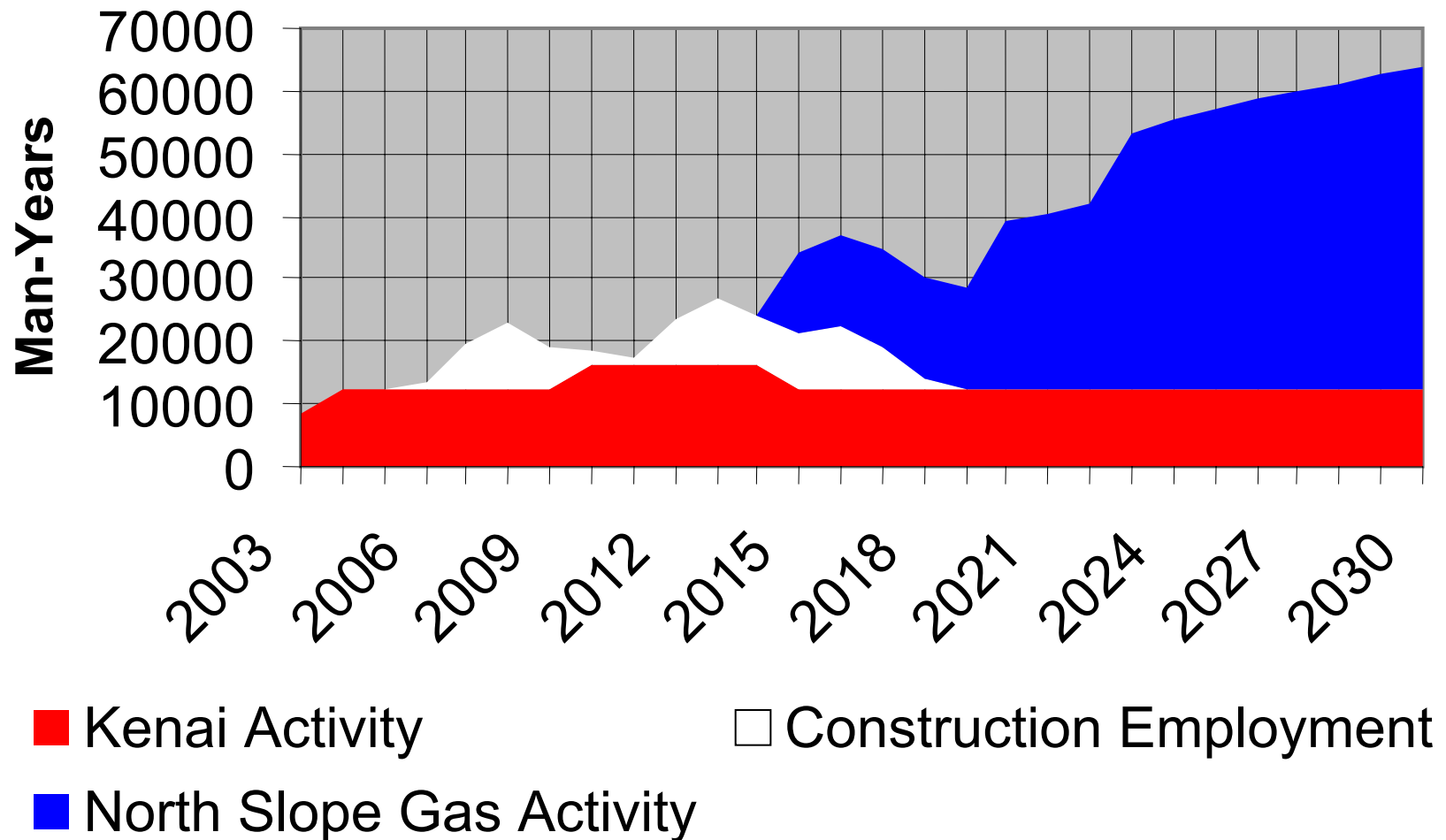
Kenai Gas Field 'Type Curve'



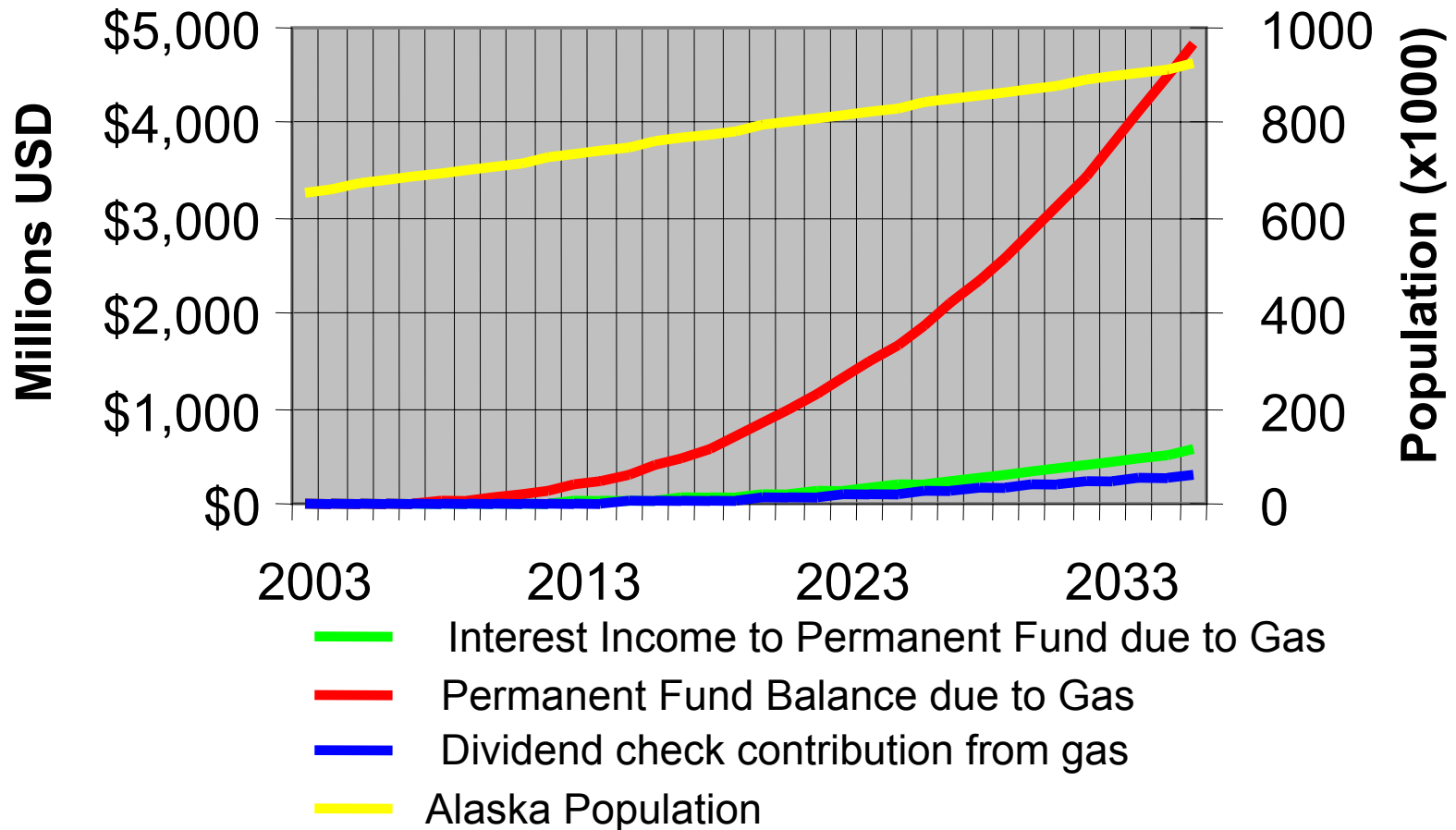
Rigs Required for Kenai Development



Alaska Gas Employment Impact, including Kenai



Gas Contribution to Permanent Fund, including Kenai



Arctic Natural Gas Options

Block Northern	Government subsidies	Mackenzie Valley line	Cook Inlet development	Alaska gas to market
No	Yes	Yes	Yes	Now!
No	No	Yes	Yes	Now!
Yes	Yes	Yes	Yes	Now!
Yes	No	Yes	Yes	Now!

Other options:

- All-Alaska gas line
- Murkowski corridor concept
- Cook Inlet development

(NASA-style investment)
(More Soviet-era planning)
(Market-based solution)