



State of Alaska

Department of Natural Resources

Division of Oil and Gas

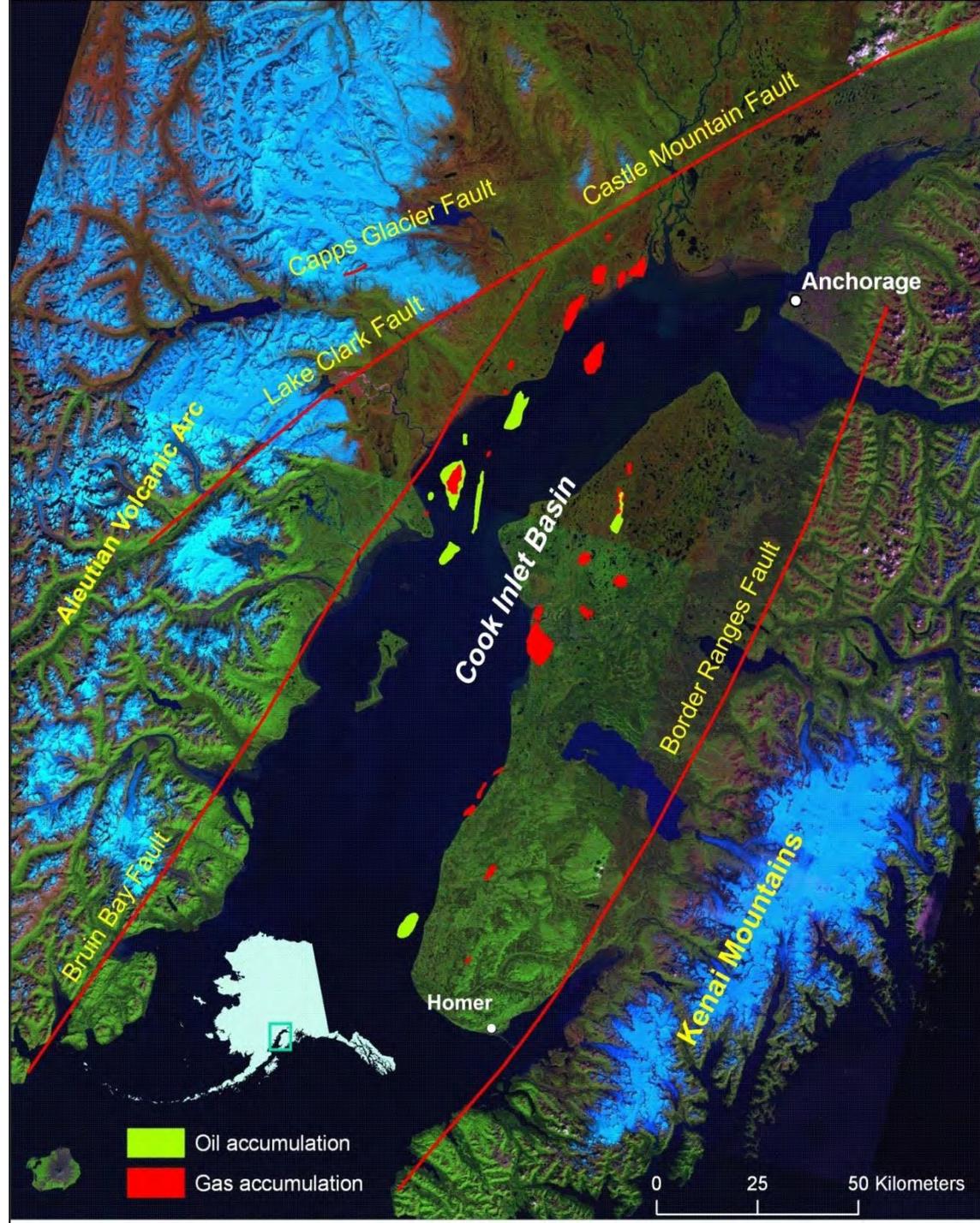
Division of Geological & Geophysical Surveys

Cook Inlet Activity and Natural Gas Resource Update

Alaska Legislature

House Energy Committee

Tuesday, April 10, 2012



2009 and 2011 DNR Cook Inlet Natural Gas Studies

- 2009 Study

- Integrated engineering and geological analysis to determine how much gas remains **in known fields** (reserves and potentially recoverable resources).
- Also provided examples of undeveloped gas leads indicated by previous drilling (potential resource).
- **Did not attempt to include undiscovered gas resources (this is USGS assessment's goal).**

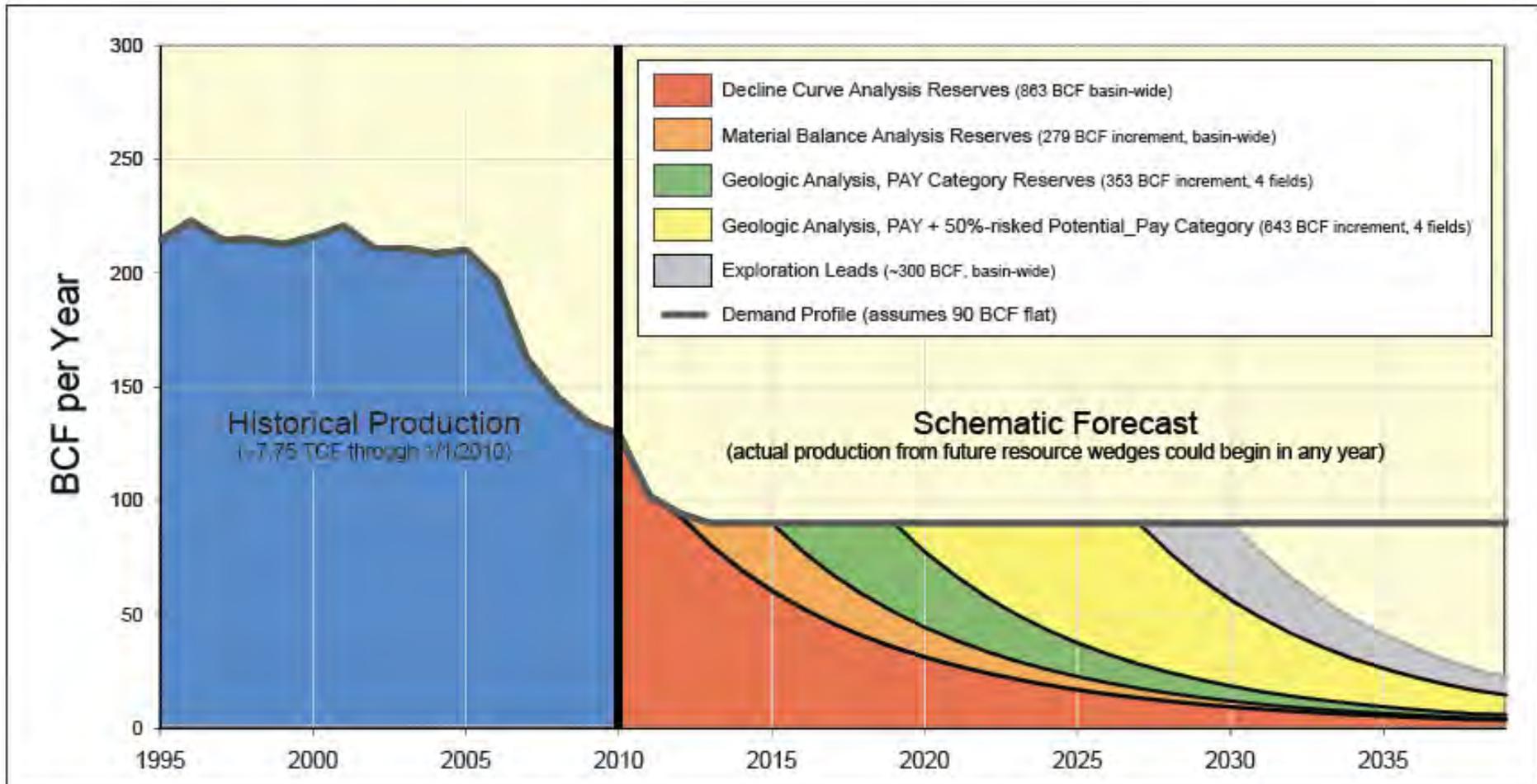
- 2011 Study

- What investment and associated producer revenue would be required to generate specific rates of return from developing DNR-identified gas reserves (2009 study) to meet existing demand requirements of 90 BCF per year through 2025?
- Generated dozens of development scenarios (“projects”) for recovering resources identified in 2009 study, and used Monte Carlo simulation to model their commerciality and production outcomes.

Cook Inlet Natural Gas Reserves and Resources

Hypothetical Production Forecast

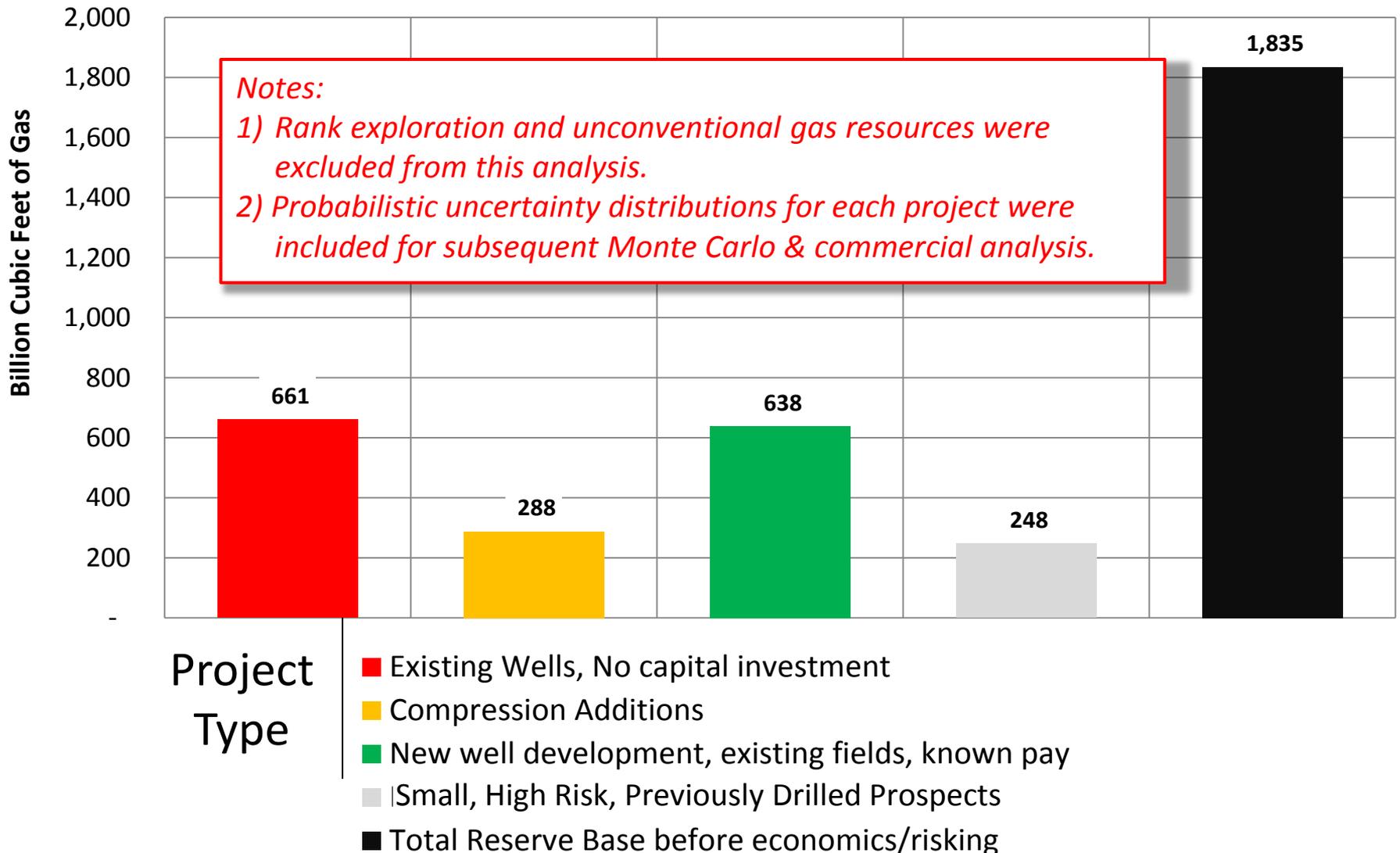
(Assumes aggressive redevelopment activity in existing fields + some exploration success)



2011 DNR CI Gas Production Cost Study

Base Case Production Estimates by Project Type, 2010-2039

(sums of all conceptual scenario projects before Monte Carlo modeling and commercial analysis)



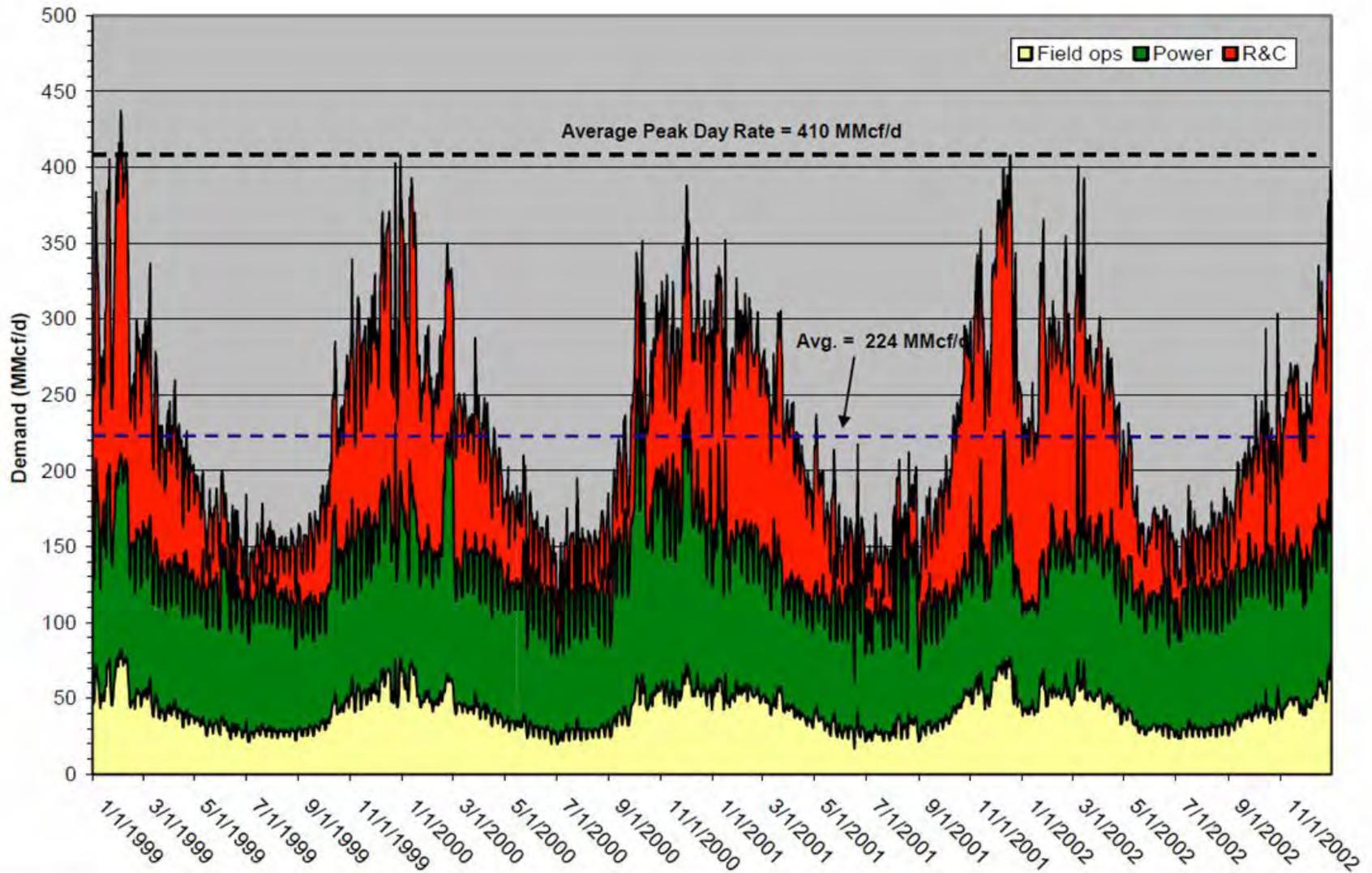
Summary and Conclusions

2011 DNR Study

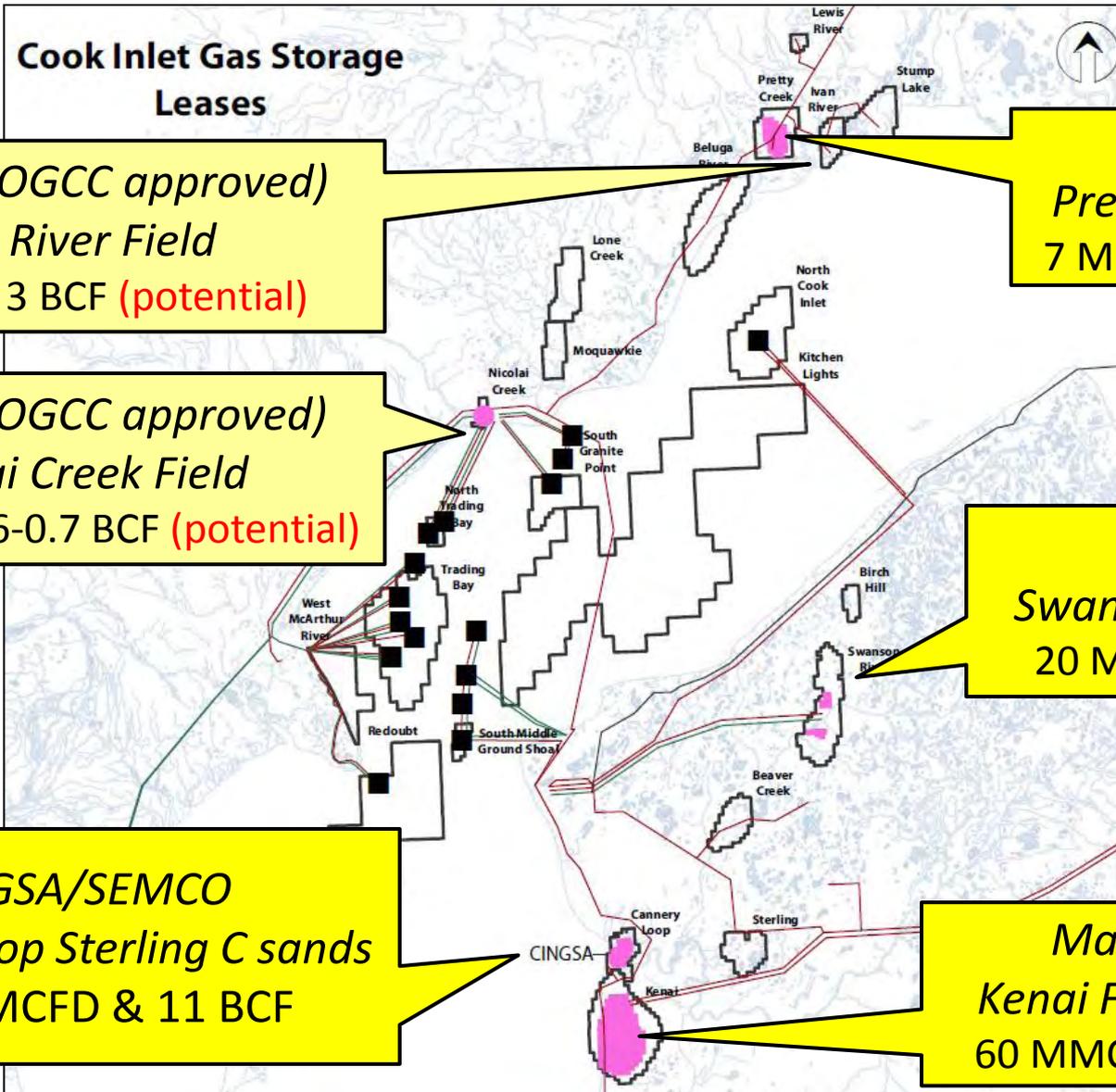
The Cook Inlet basin is capable given sufficient continued investments of supplying the regional natural gas needs until 2018-2020 timeframe. Exploration success would extend the timeframe further out into the future.

Natural gas storage will play an increasing important role in optimizing and managing deliverability and economics of the natural gas supply for south-central Alaska.

Illustrative South-Central Alaska Daily Demand



Gas Storage Design Rate & Capacity



Hilcorp (AOGCC approved)
Ivan River Field
Rate TBD, 3 BCF (potential)

Hilcorp
Pretty Creek Field
7 MMCFD & 0.7 BCF

Aurora (AOGCC approved)
Nicolai Creek Field
Rate TBD, 0.6-0.7 BCF (potential)

Hilcorp
Swanson River Field
20 MMCFD & 2 BCF

CINGSA/SEMCO
Cannery Loop Sterling C sands
150 MMCFD & 11 BCF

Marathon
Kenai Field Pool 6
60 MMCFD & 6 BCF

Cook Inlet 2011 Lease Sale Results

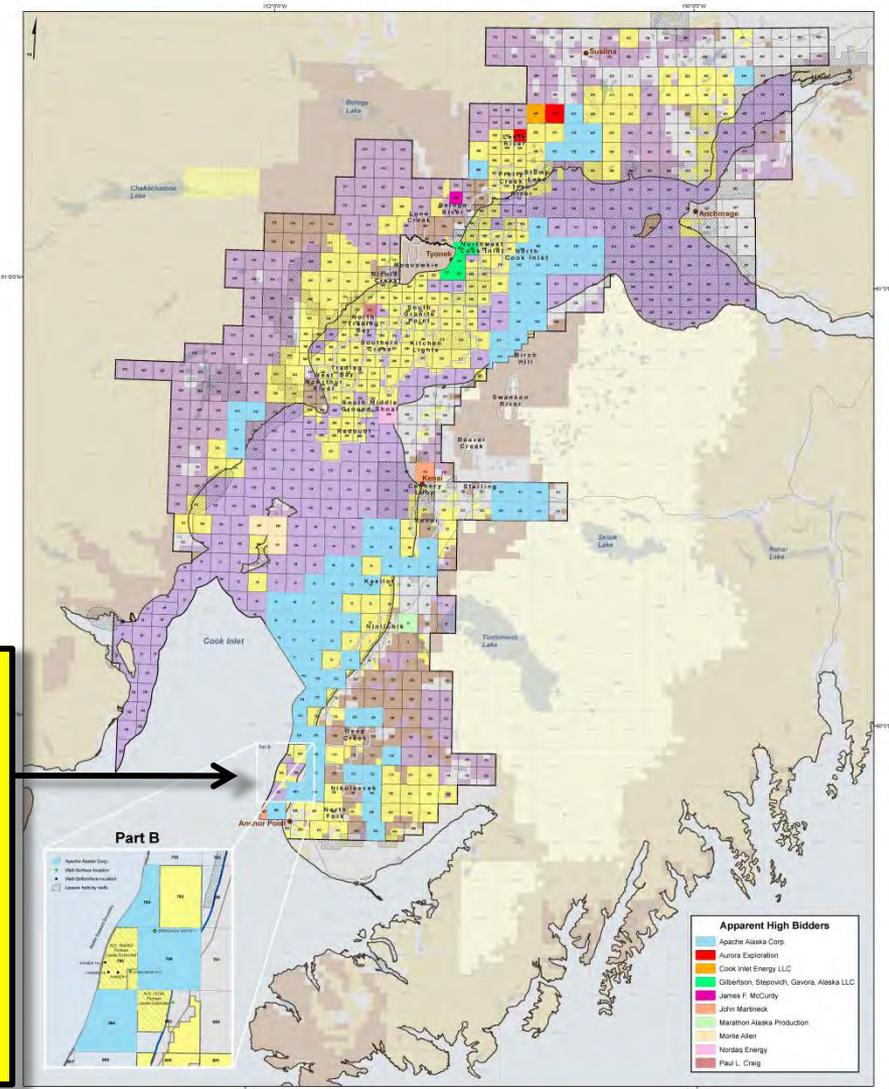
- Total tracts sold: 109
- Total acres sold: 575,202
- Total number of valid bids: 112
- Total high bonus bids: \$11,125,063.80
- Exempt sale (Part B) for Cosmopolitan
- Apache showed largest interest (\$9 MM)



Cosmopolitan: Known Oil

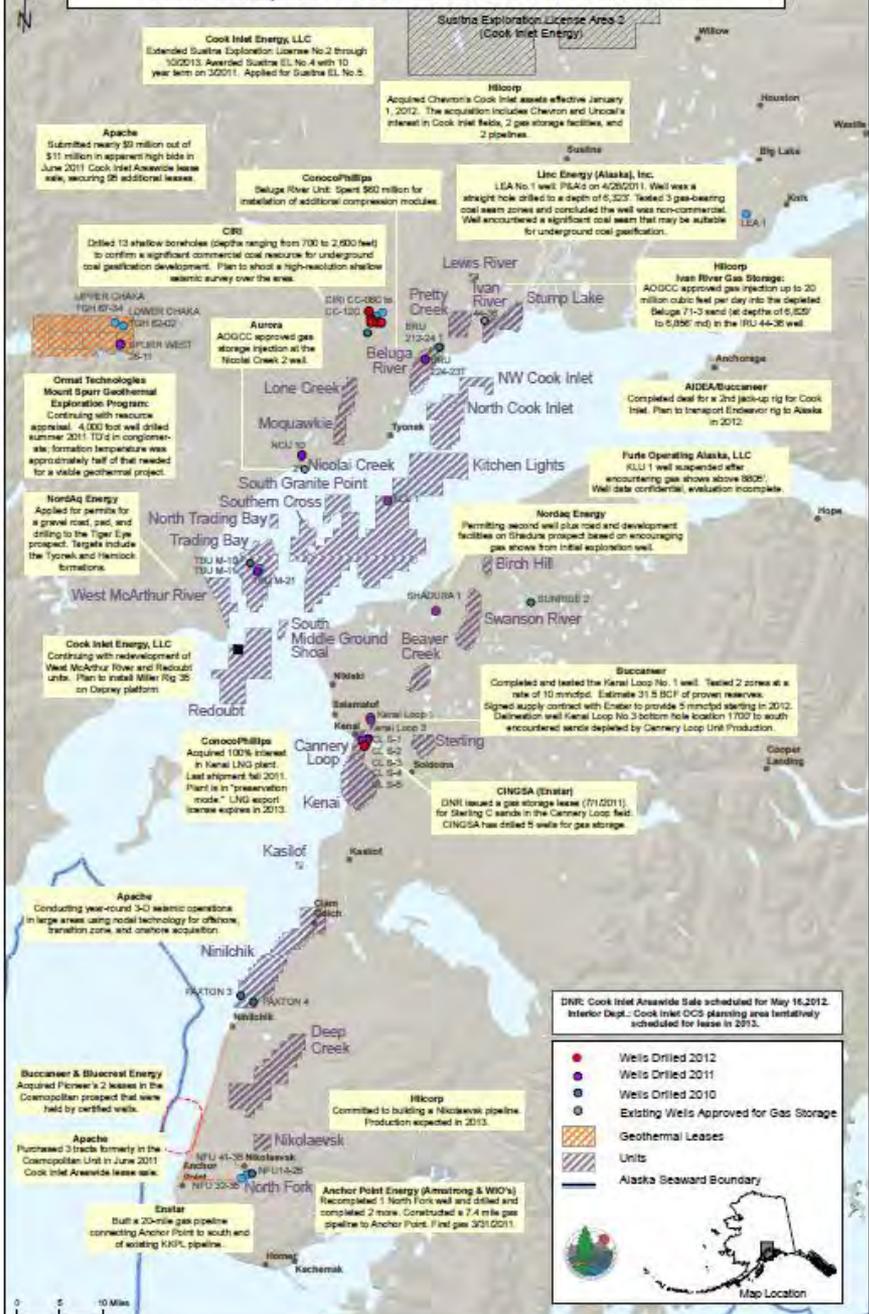
- bundled leases
- raised min bid
- raised rentals
- 5 yr primary term
- Work commitment
 - POE in < 6 months
 - Well to oil zone

Cook Inlet Areawide Lease Sale 2011 Part A & Part B



Cook Inlet Oil and Gas Activity 2012

State of Alaska, Department of Natural Resources, Division of Oil and Gas, March 2012



Apache

- Purchased 95 additional State leases in June, 2011 lease sale. Now holds ~800,000 acres (State, Mental Health)
- Shooting 3-D nodal seismic year-round, 2 wells planned in 2012.

Hilcorp

- Operating former Chevron/Unocal assets
- Constructing a pipeline to bring Nikolaevsk Unit on in 2013.

Furie

- Spartan 151 jack-up rig drilling to resume at Kitchen Lights Unit
- Recently reduced estimate of KLU #1 gas discovery by ~ 80%

Buccaneer

- Kenai Loop #1: 31.5 BCF proven reserves
- Second well Kenai Loop #3 was dry hole (depleted by Cannery Loop)
- Planning to bring AIDEA-subsidized Endeavor jack-up to basin in 2012

Nordaq Energy

- Shadura Prospect: permitting 2 more wells, development road, pads.
- Permitting Tiger Eye prospect onshore near West Foreland

Anchor Point Energy

- Recently drilled and completed 2 wells, recompleted 1
- North Fork gas now on production through new 7.4 mile pipeline to Anchor Point (2011)

Cook Inlet Energy

- Restarted 4 oil wells in West MacArthur River Unit, 2 oil wells in Redoubt Unit (2011)
- Custom rig for Osprey Platform
- Permitting 3 exploration wells at Sting Ray prospect

CIRI

- Underground Coal Gasification (UCG) project -- shallow core drilling

Linc Energy

- LEA 1 plugged & abandoned (2011)
- Planned well in Trading Bay area
- Long-term interest in UCG in Cook Inlet

Gas storage

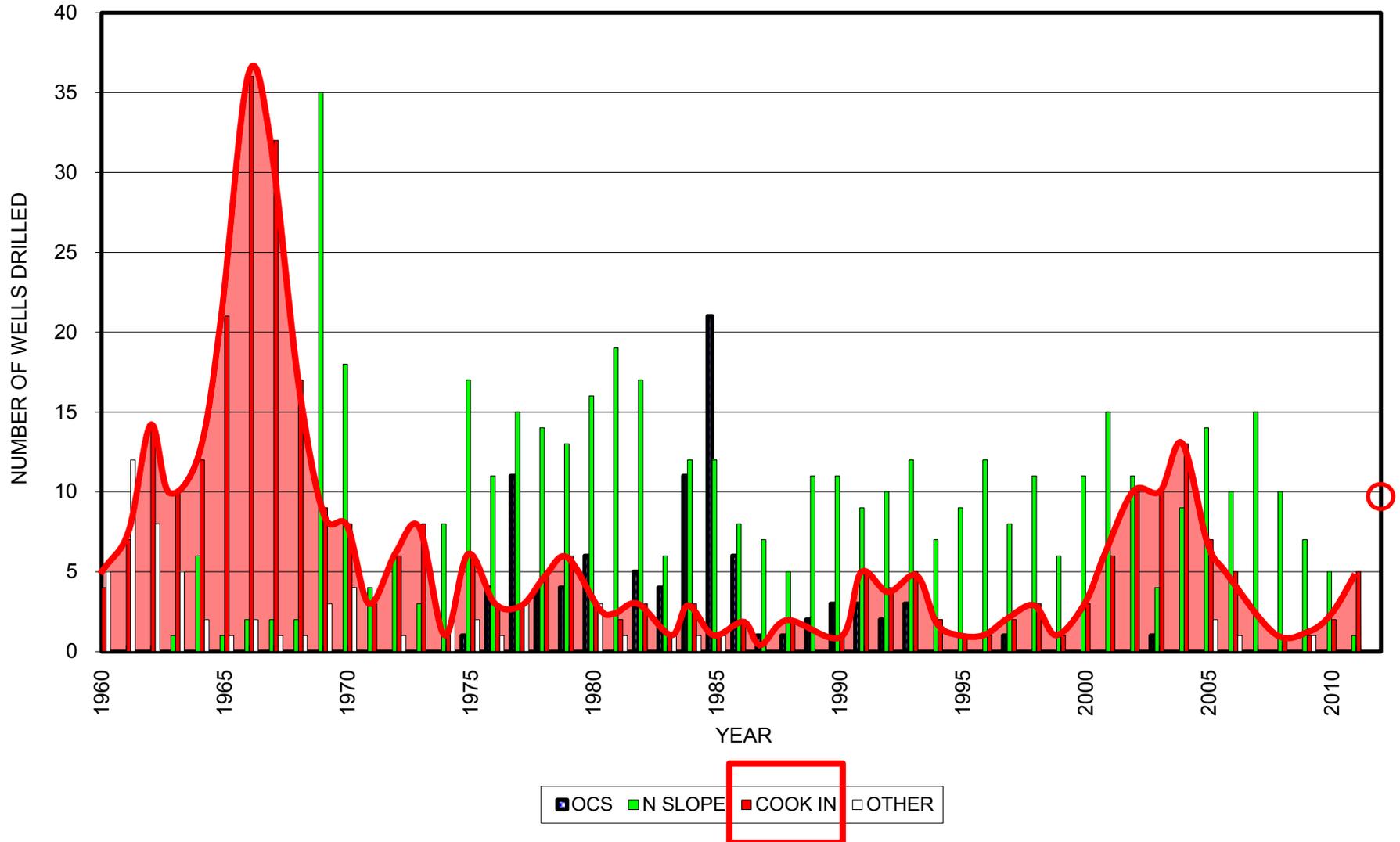
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- Existing: Swanson River, Pretty Creek, Kenai

Michael Armstrong/Homer News



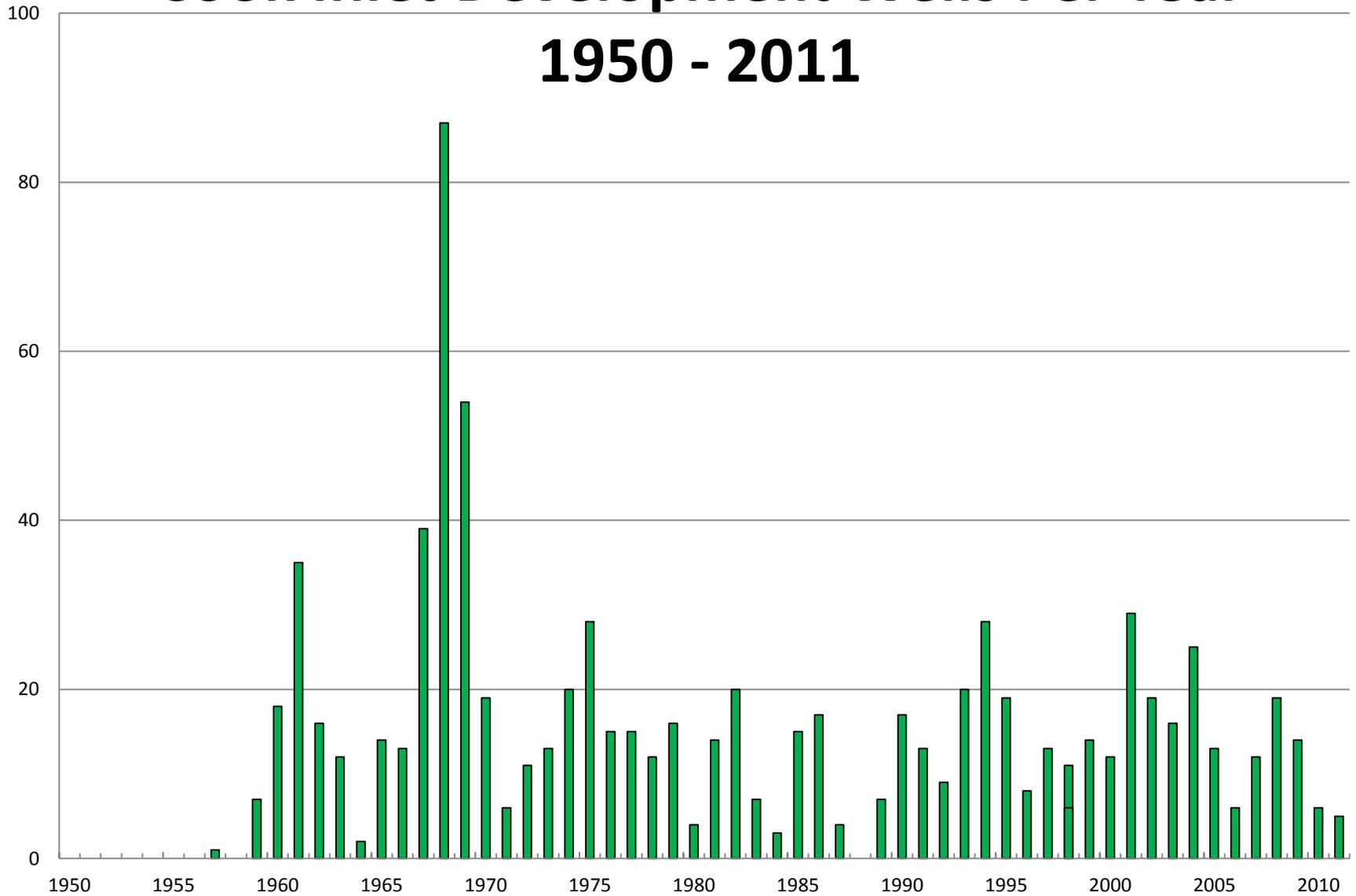
Spartan 151 jack-up rig at anchor in Kachemak Bay

Alaska Exploration Wells Per Year 1960-2011



Cook Inlet Development Wells Per Year

1950 - 2011



Oil and Gas Resources vs. Reserves

Undiscovered, Technically Recoverable Resource:

- Oil and gas estimated to exist in accumulations that have not yet been found by drilling, but if found, could be potentially produced using current technology and industry practices.
- Only an unknown fraction of this category will be commercially viable to find, develop, and produce. Sometimes called **Prospective Resources**.

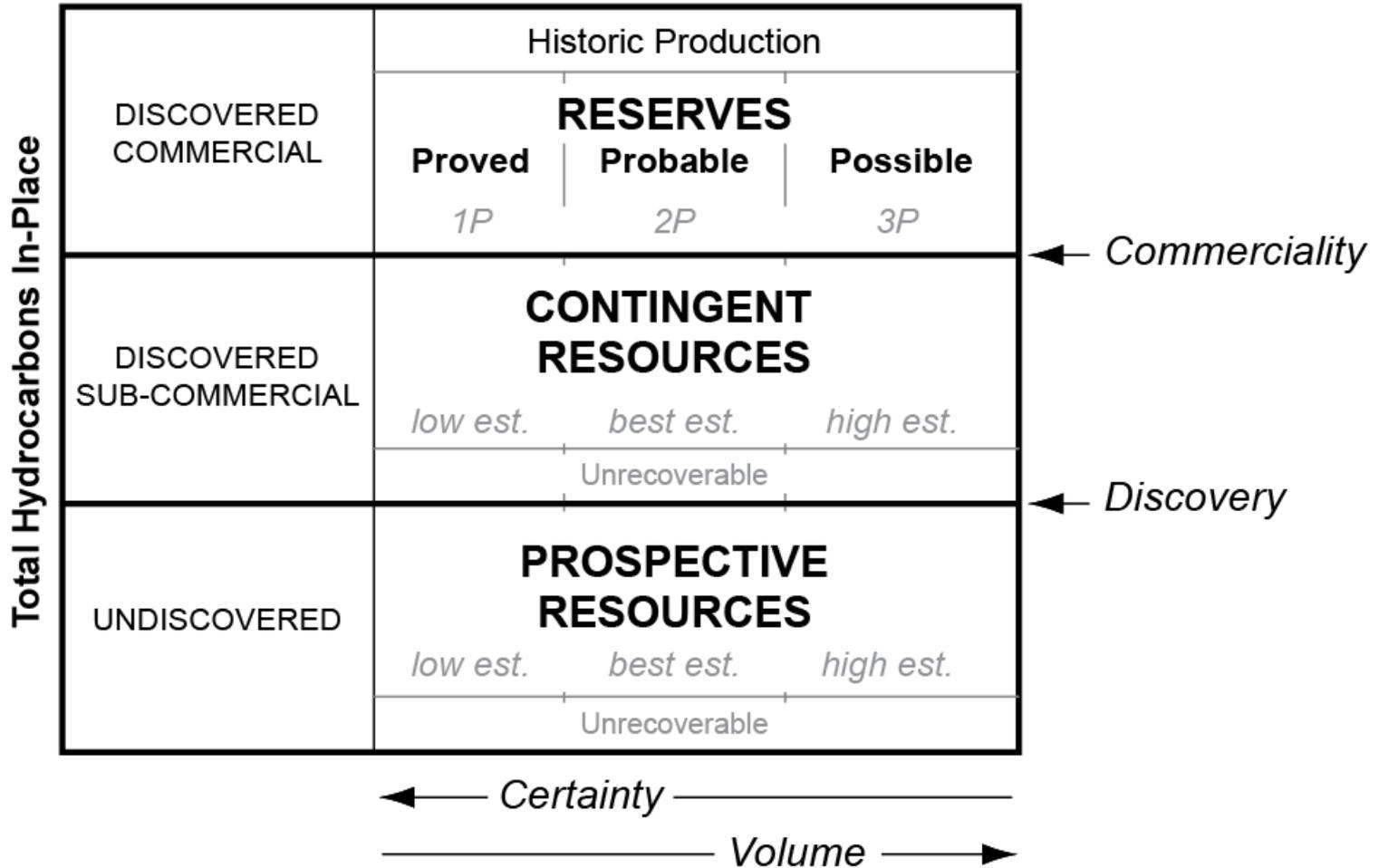
Proved Reserves:

- “oil and gas, which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be economically producible—from a given date forward, from known reservoirs, and under existing economic conditions, operating methods, and government regulations...” (*Securities Exchange Commission, 2008*).
- Sometimes called **1P Reserves**, with a 90% certainty of meeting or exceeding the quoted value (SPE, 2007).

Proved Developed Reserves:

“Proved reserves that... can be expected to be recovered through existing wells with existing equipment and operating methods...” (*Securities Exchange Commission, 2008*)

Reserves and Resources Terminology



Adapted from SPE and others, 2007

Getting From Undiscovered Resources to Proved Developed Reserves

The keys are exploration success and commercial validation

1. Find and Map Prospects with Seismic Data

- Recon seismic acquisition and G&G interpretation (coarse 2-D grid)
- Prospect-scale seismic acquisition and GG&E interpretation (tight 2-D grid or 3-D)

2. Land/Lease Access to Prospect

- Competitive lease sale (e.g., DNR, BOEM, BLM)
- Private lease (e.g., Native corporations)
- Exploration license (DNR)

3. Exploration Drilling → Reservoir Discovery

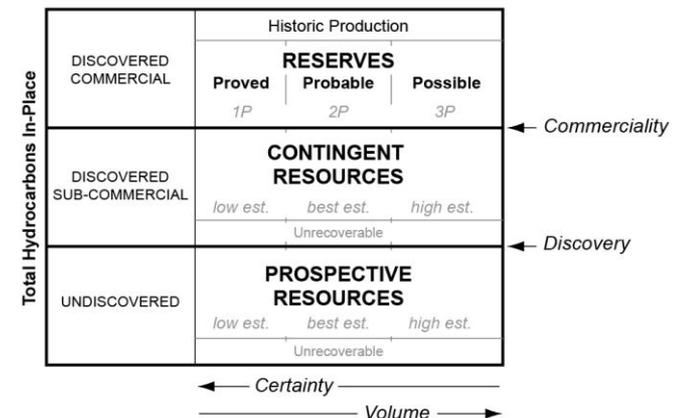
- Wildcat exploration drilling, logging, testing (80-90% failure rate); refine prospect model
- Appraisal and delineation drilling of discovery; extensive logging, testing; refine model

4. Project Sanction

- Engineering analysis, design, costing
- Environmental/Permitting feasibility
- Commercial hurdles, board/investor approval

5. Development

- Gravel construction
- Facilities & pipeline construction and installation
- Development drilling

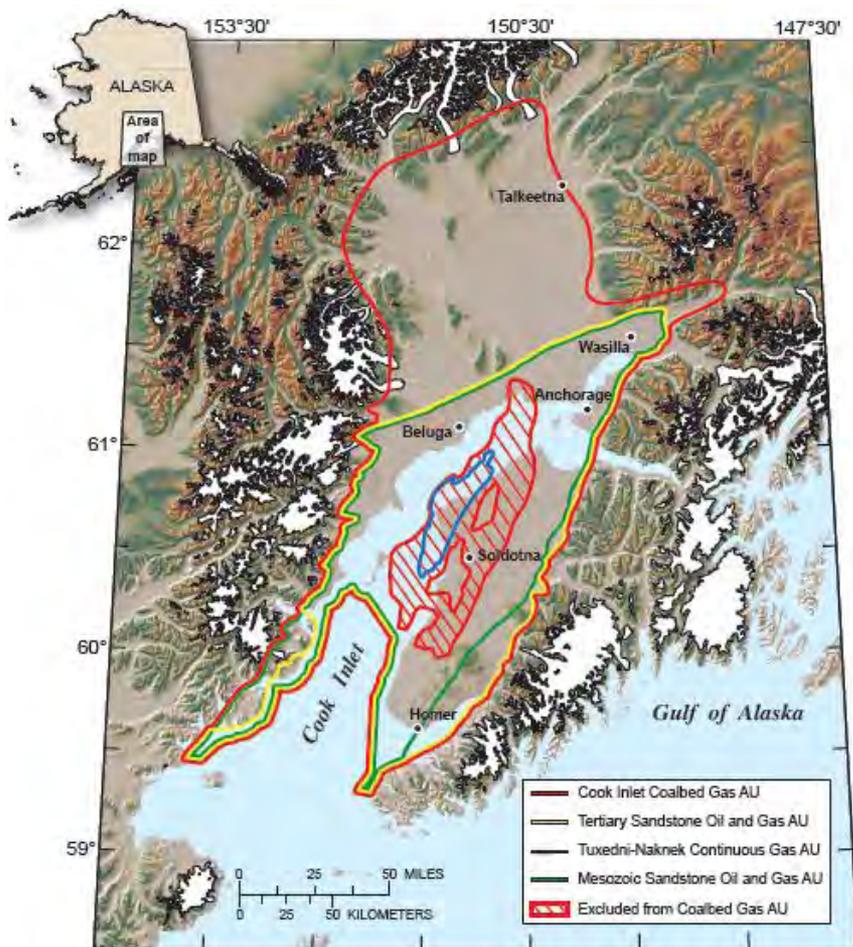


Cook Inlet Gas Exploration Statistics

- 85% of gas discovered early in exploration cycle while drilling for oil
- Only structural traps had been explored for or developed – stratigraphic trap potential essentially untapped
- Nearly one in ten fields >2 tcf
- 4 largest fields have 86% of reserves
- Field-size distribution lacks discoveries in 300-1300 bcf range → yet to be discovered?

Cook Inlet Resource Potential

USGS Resource Assessment, 2011



Undiscovered, Technically Recoverable Oil and Gas

- mean conventional oil 599 MMBO

372 MMBO in Tertiary Ss play

227 MMBO in Mesozoic Ss play

- mean conventional gas 13.7 TCF

12.2 TCF in Tertiary Ss play

1.5 TCF in Mesozoic Ss play

- mean unconventional gas 5.3 TCF

0.6 TCF Mesozoic tight ss play

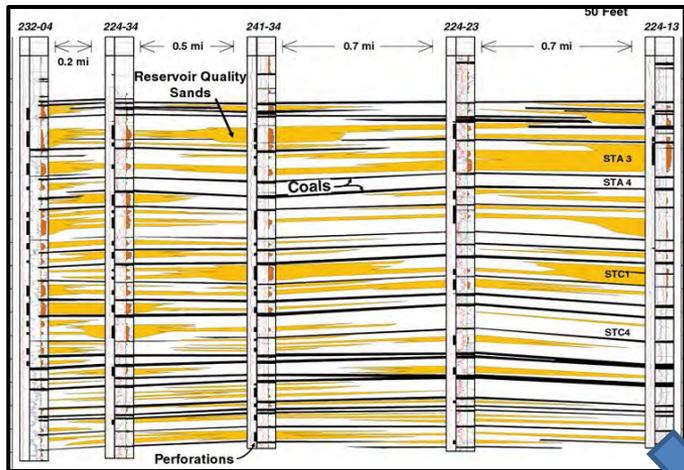
4.7 TCF Tertiary Coalbed play

USGS 2011 Assessment of Cook Inlet Undiscovered Technically Recoverable Resources

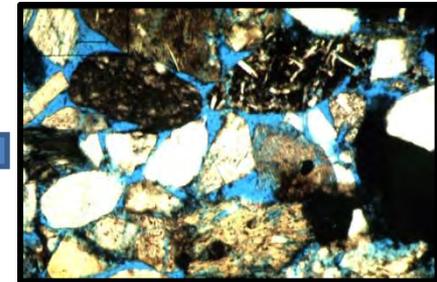
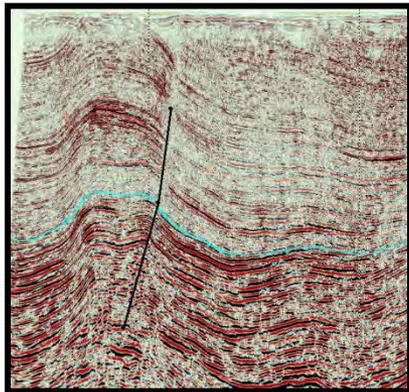
Cook Inlet assessment results.

[MMBO, million barrels of oil. BCFG, billion cubic feet of gas. MMBNGL, million barrels of natural gas liquids. Results shown are fully risked estimates. For gas accumulations, all liquids are included as NGL (natural gas liquids). Undiscovered gas resources are the sum of nonassociated and associated gas. F95 represents a 95 percent chance of at least the amount tabulated; other fractiles are defined similarly. Largest expected oil field in MMBO; largest expected gas field in BCFG. TPS, total petroleum system; AU, assessment unit. Gray shading indicates not applicable]

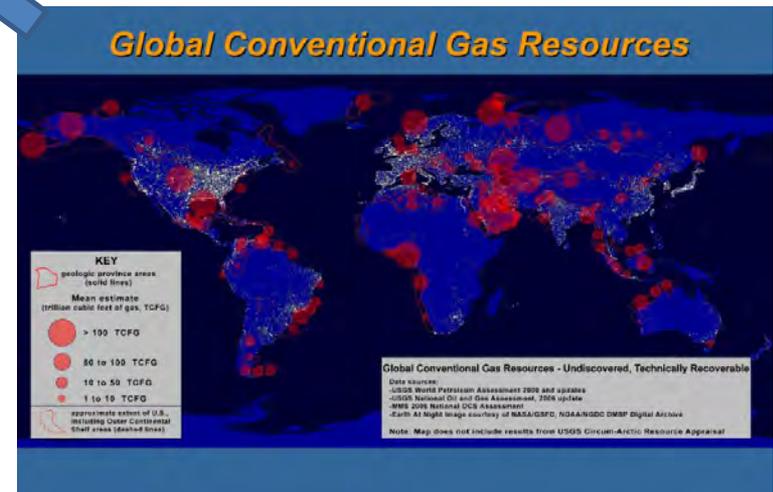
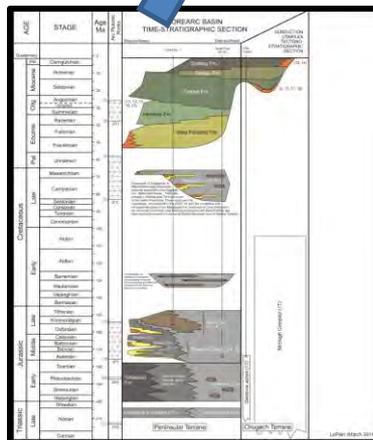
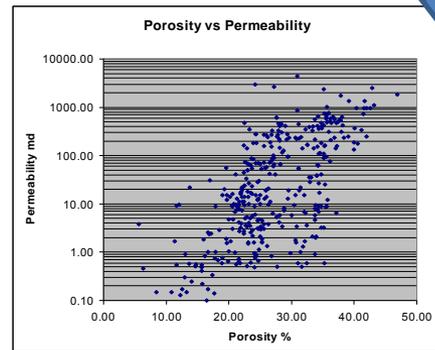
	Total Petroleum Systems (TPS) and Assessment Units (AU)	Field type	Largest expected mean field size	Total undiscovered resources											
				Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
				F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Conventional Oil and Gas Resources	Cook Inlet Composite Total Petroleum System														
	Tertiary Sandstone Oil and Gas AU	Oil	111	68	322	844	372	32	156	443	186	0	2	5	2
		Gas	2,002					2,836	11,004	24,422	11,992	1	14	60	20
	Mesozoic Sandstone Oil and Gas AU	Oil	65	40	197	515	227	19	96	269	114	0	1	3	1
		Gas	426					251	1,241	3,280	1,434	2	12	34	14
Total Conventional Resources			108	519	1,359	599	3,138	12,497	28,414	13,726	3	29	102	37	
Continuous Oil and Gas Resources	Tuxedni-Naknek Continuous Gas Total Petroleum System														
	Tuxedni-Naknek Continuous Gas AU	Gas					257	568	1,254	637	3	8	19	9	
	Cook Inlet Coalbed Gas Total Petroleum System														
	Cook Inlet Coalbed Gas AU	Gas						1,581	3,989	10,069	4,674	0	0	0	0
	Total Continuous Resources							1,838	4,557	11,323	5,311	3	8	19	9
Total Undiscovered Oil and Gas Resources			108	519	1,359	599	4,976	17,054	39,737	19,037	6	37	121	46	



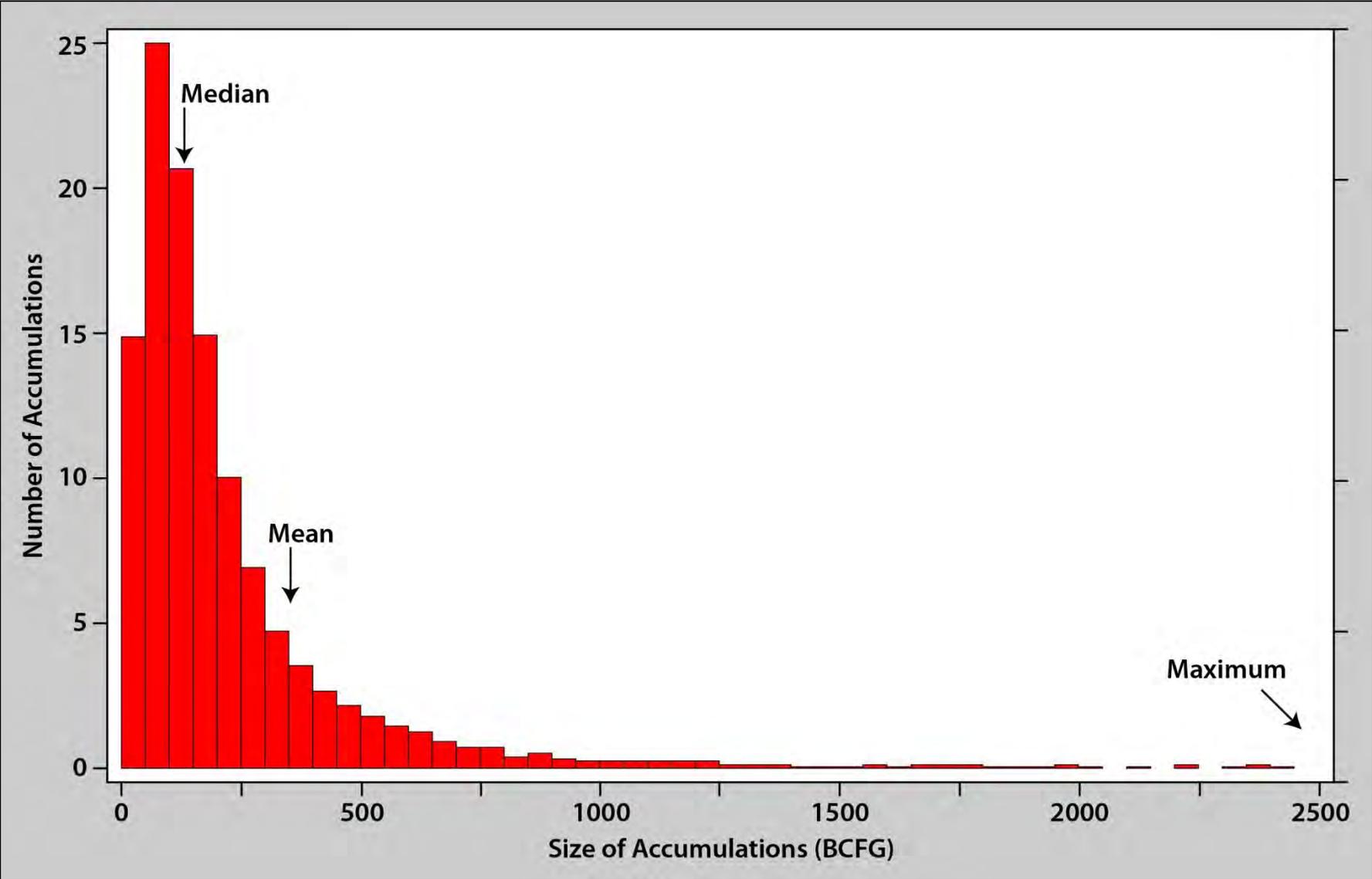
**Assessment
Inputs**



**Petroleum
System
Model**

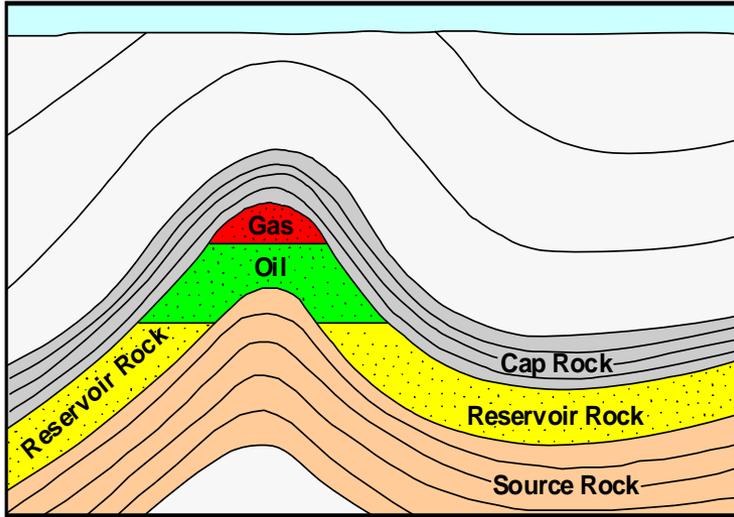


Log Normal Distribution of Gas Accumulation Size

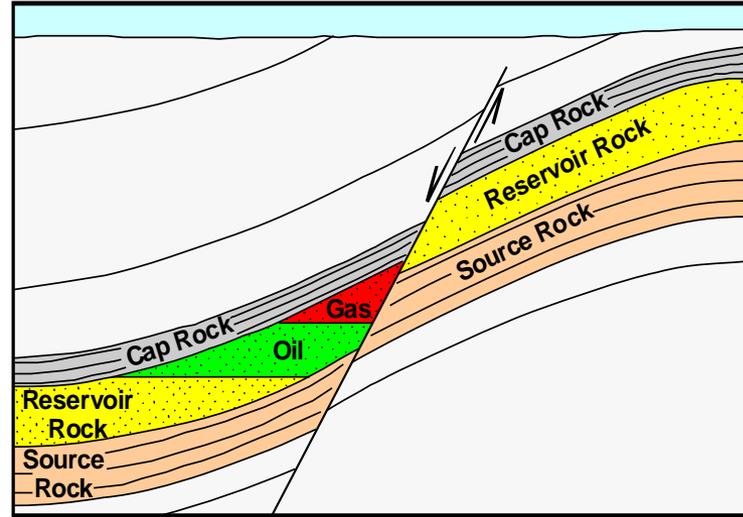


New Gas from New Exploration Play Types

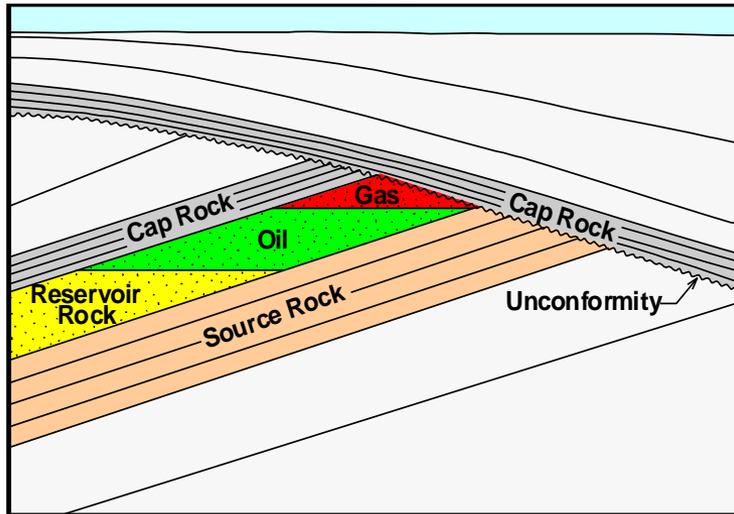
Anticline



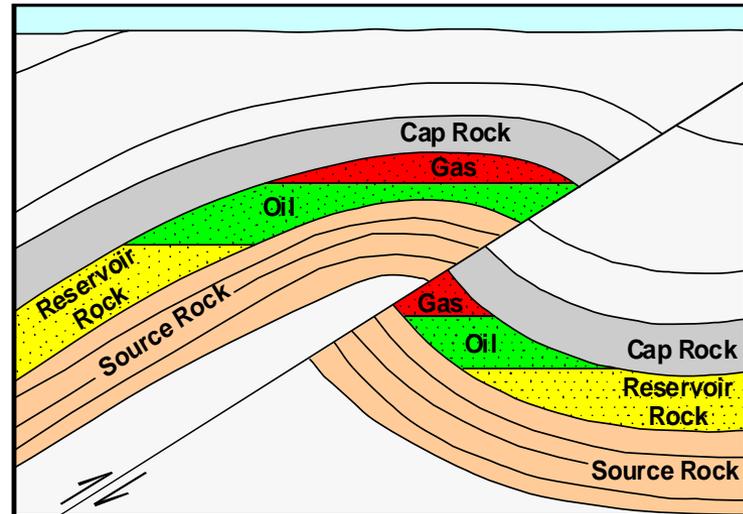
Normal Fault



Stratigraphic



Thrust Fault



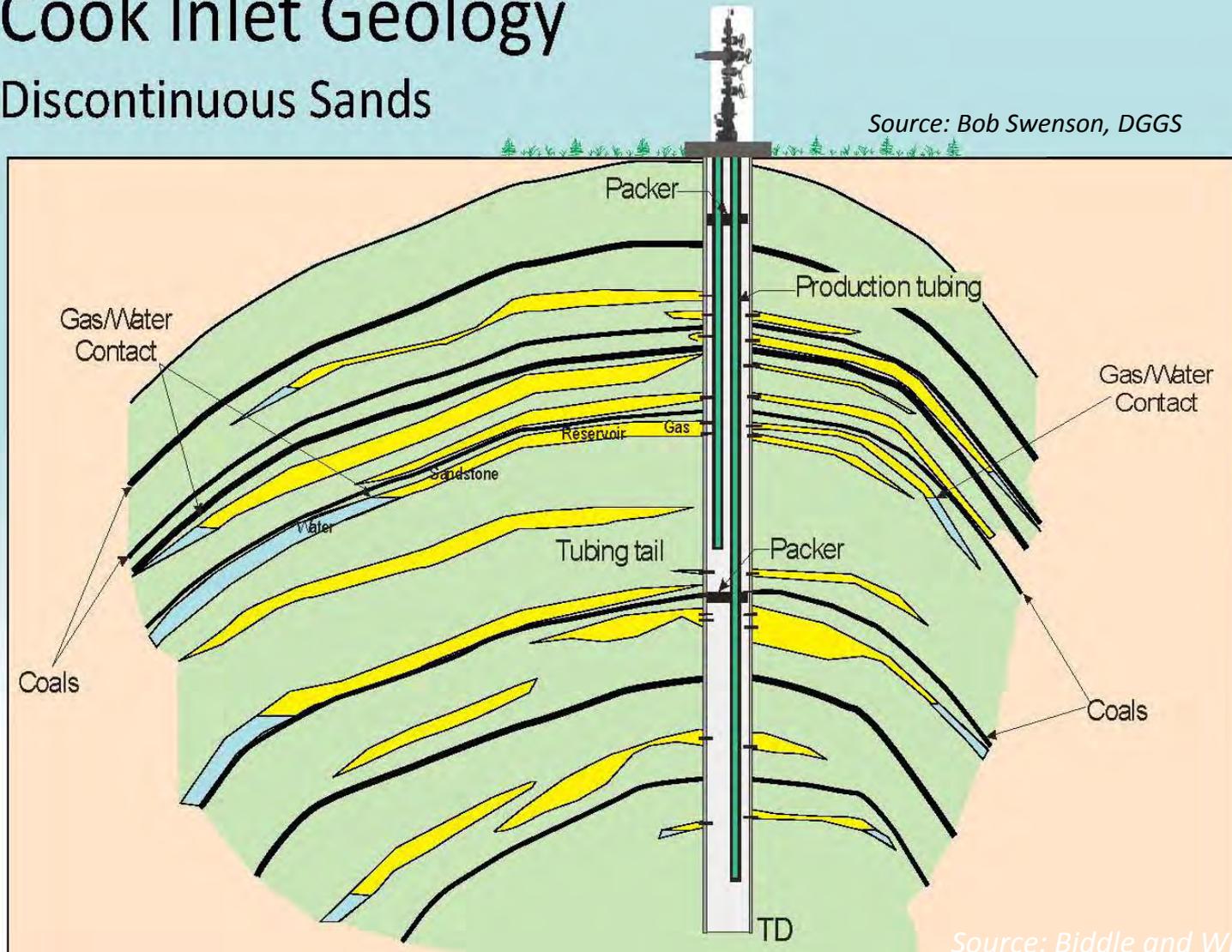
Oil and Gas Trapping Mechanisms

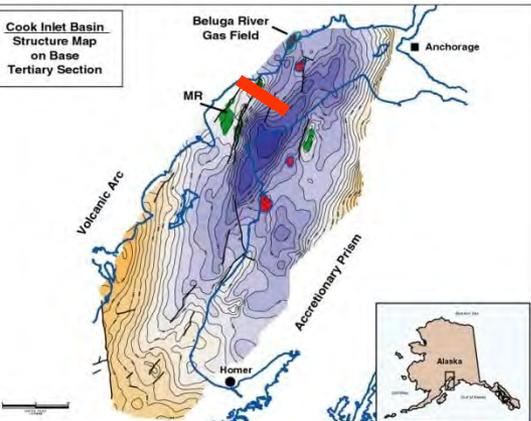
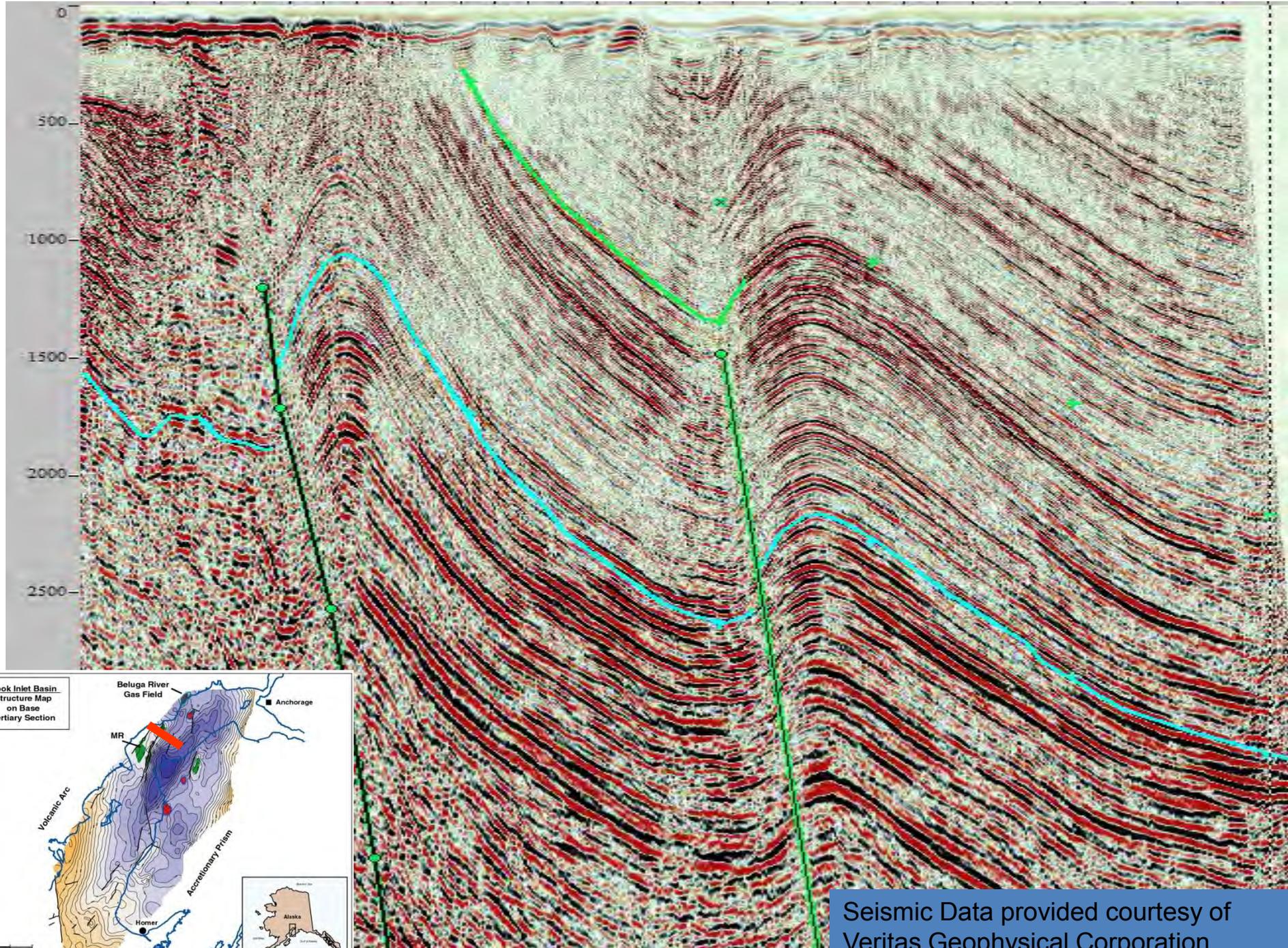
'New' Gas in Existing Fields

Cook Inlet Geology

Discontinuous Sands

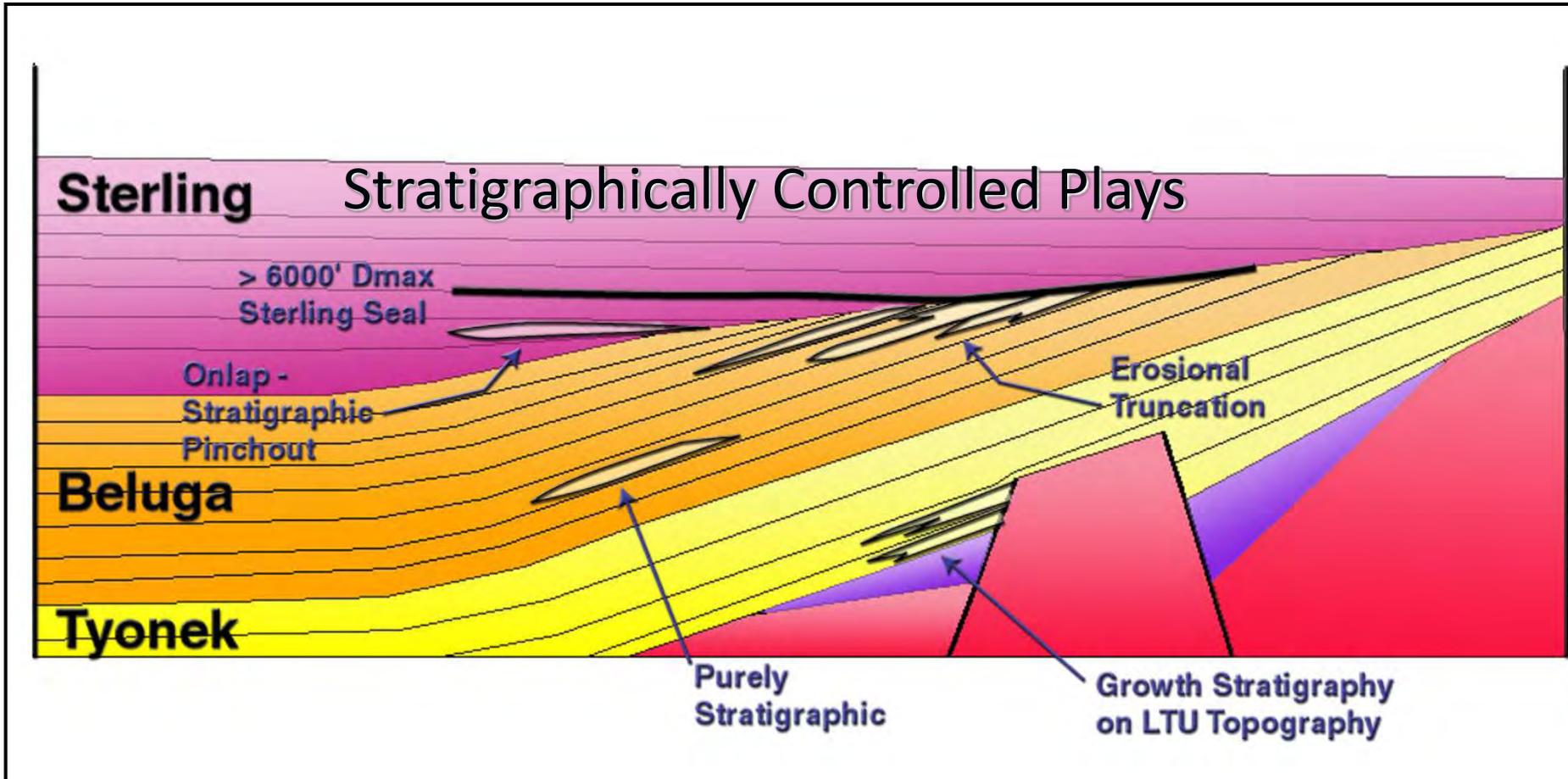
Source: Bob Swenson, DGGS

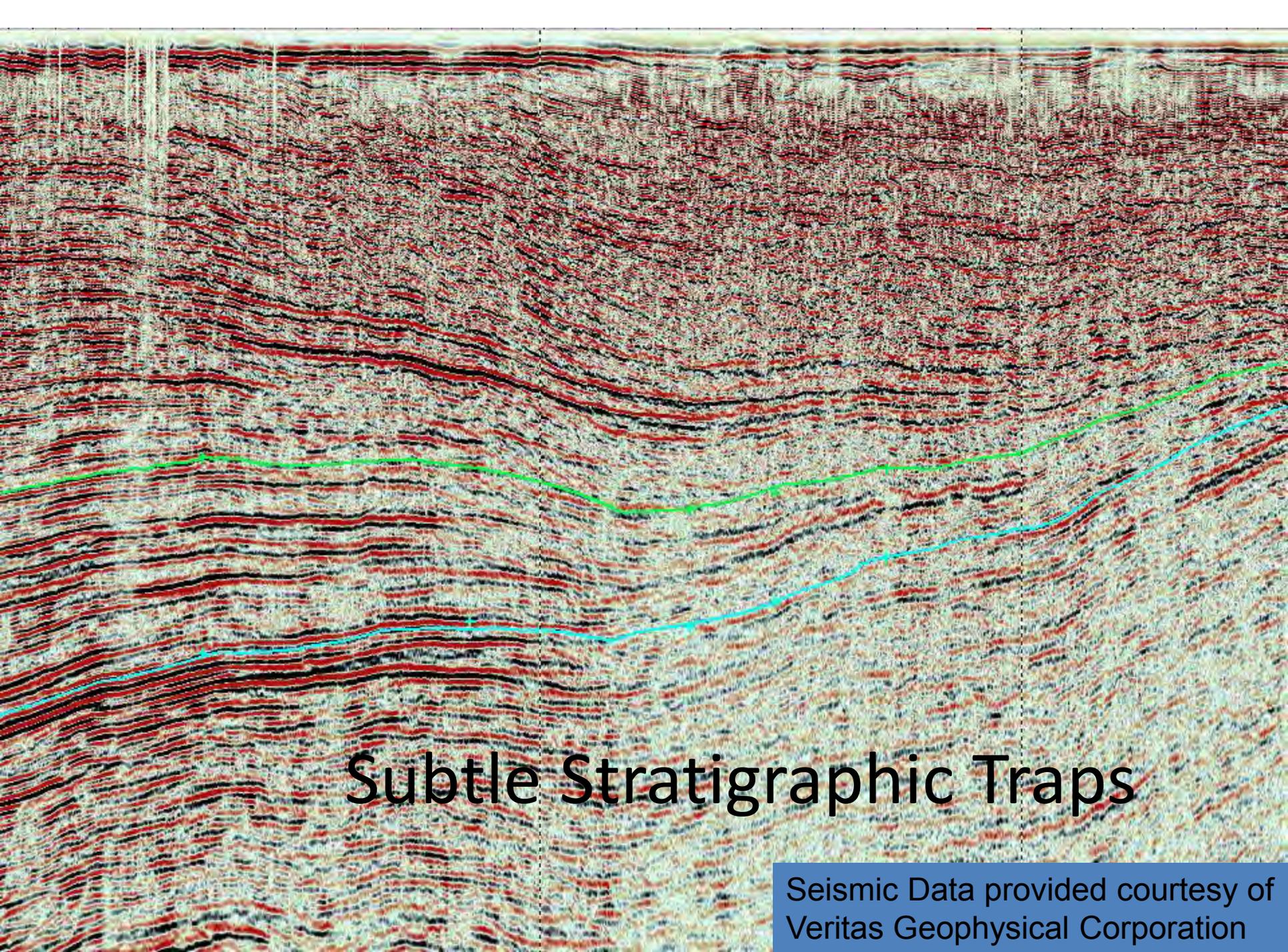




Seismic Data provided courtesy of Veritas Geophysical Corporation

Un-Explored Plays

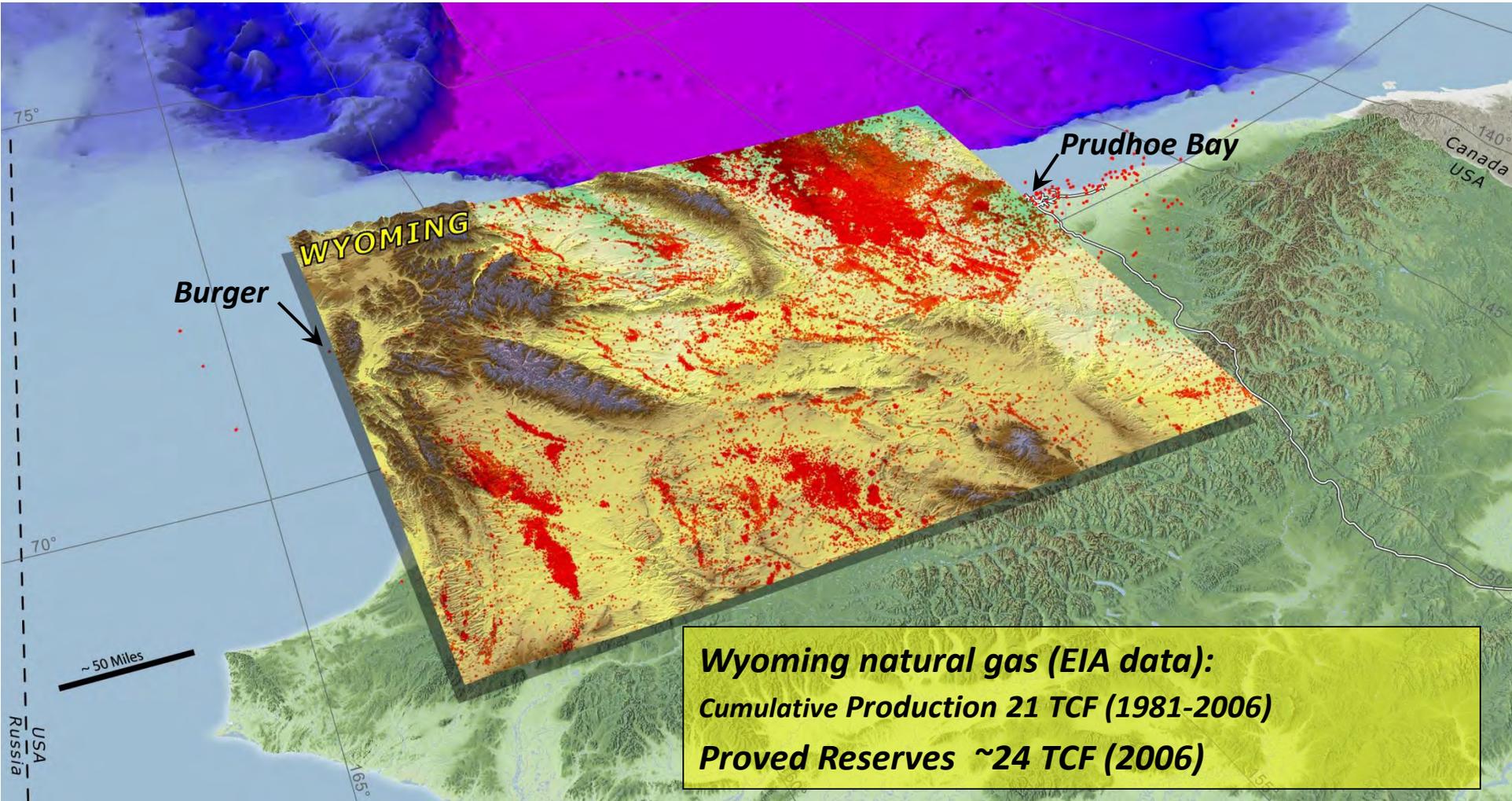




Subtle Stratigraphic Traps

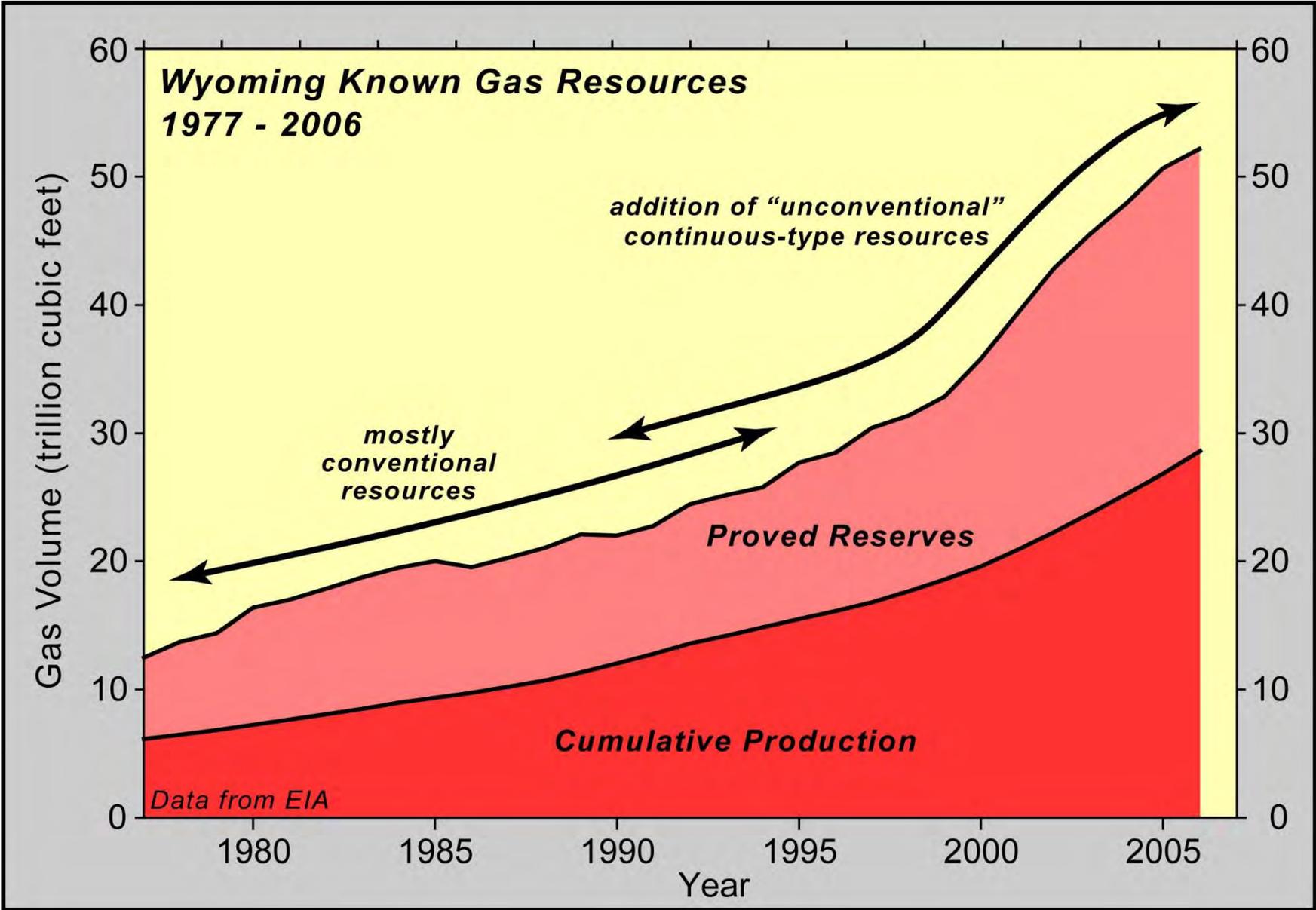
Seismic Data provided courtesy of
Veritas Geophysical Corporation

Exploration Maturity



- **Entire state of Wyoming ~100,000 mi² (~250,000 km²)**
- **Many thousand exploration wells; ~70,000 total wells**

Wyoming Gas Reserves & Production History



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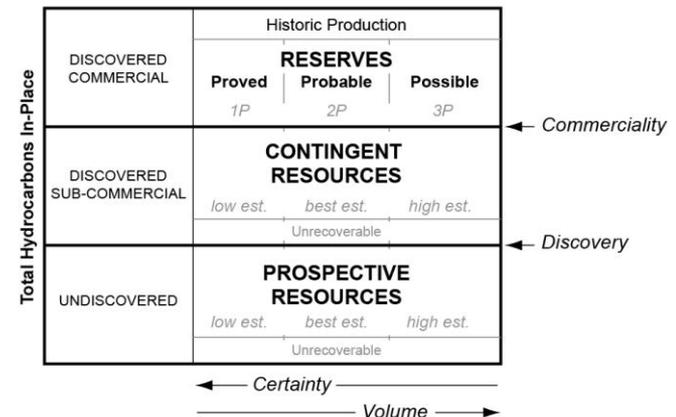
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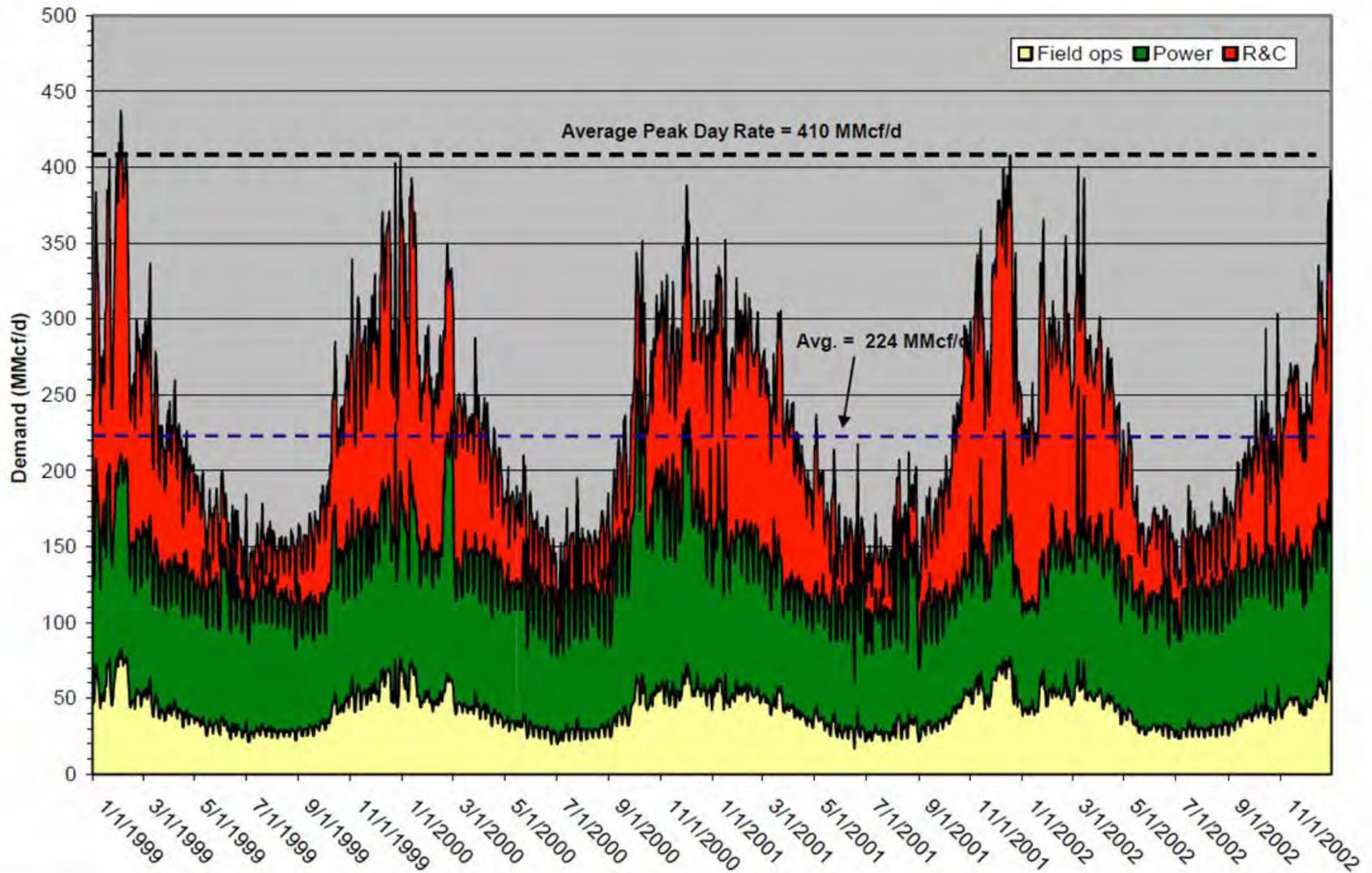
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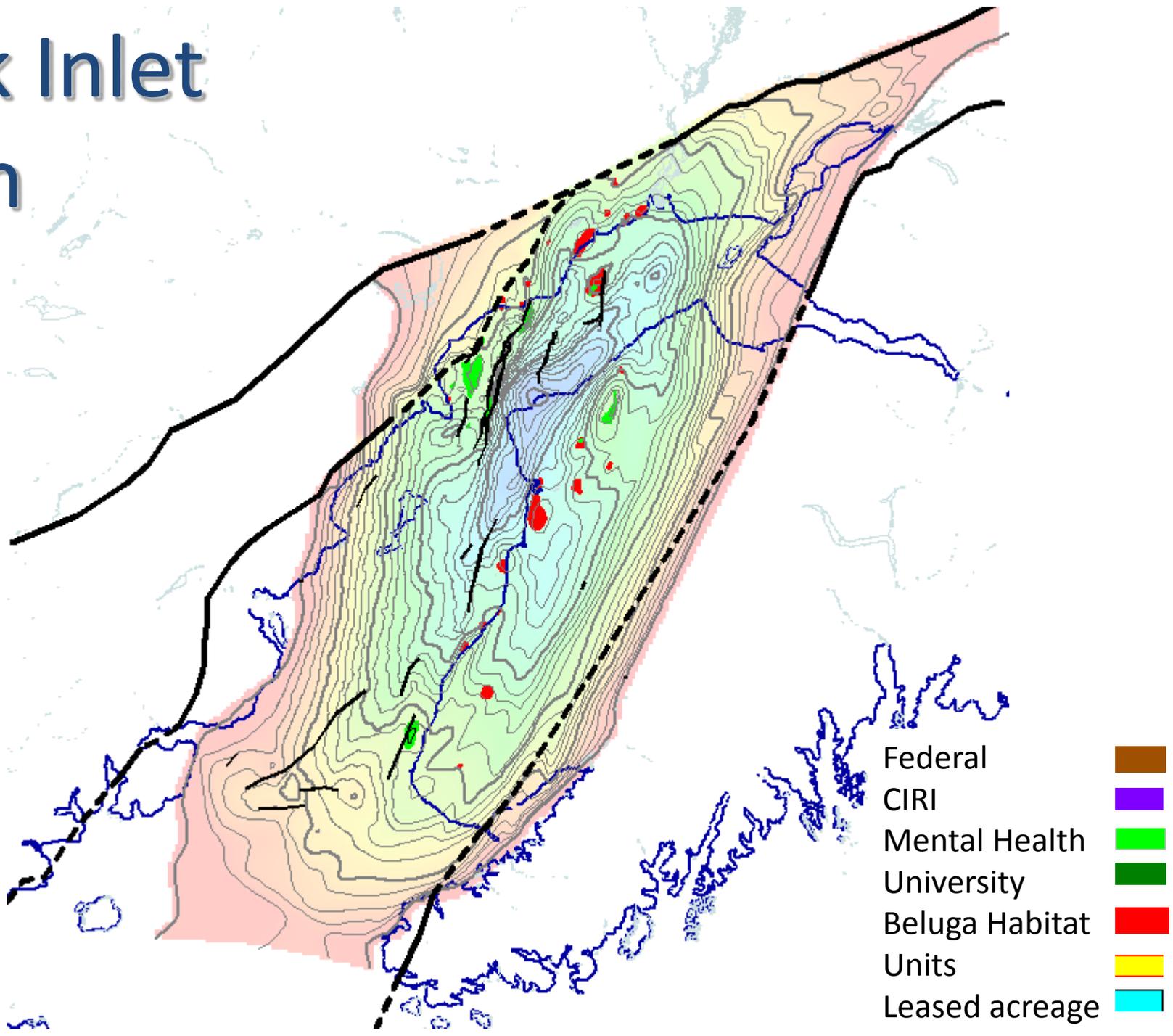
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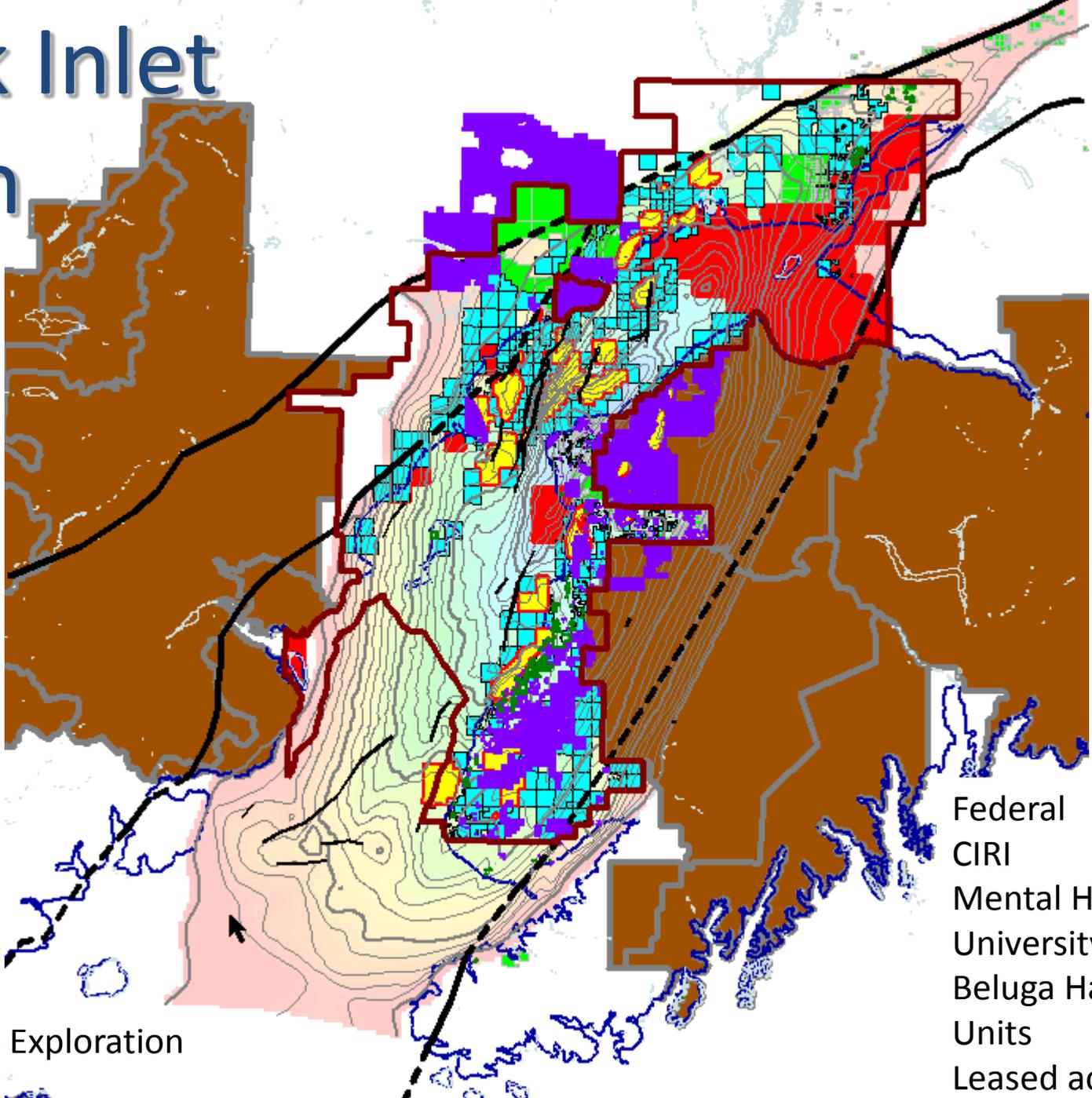
Illustrative South-Central Alaska Daily Demand



Cook Inlet Basin



Cook Inlet Basin

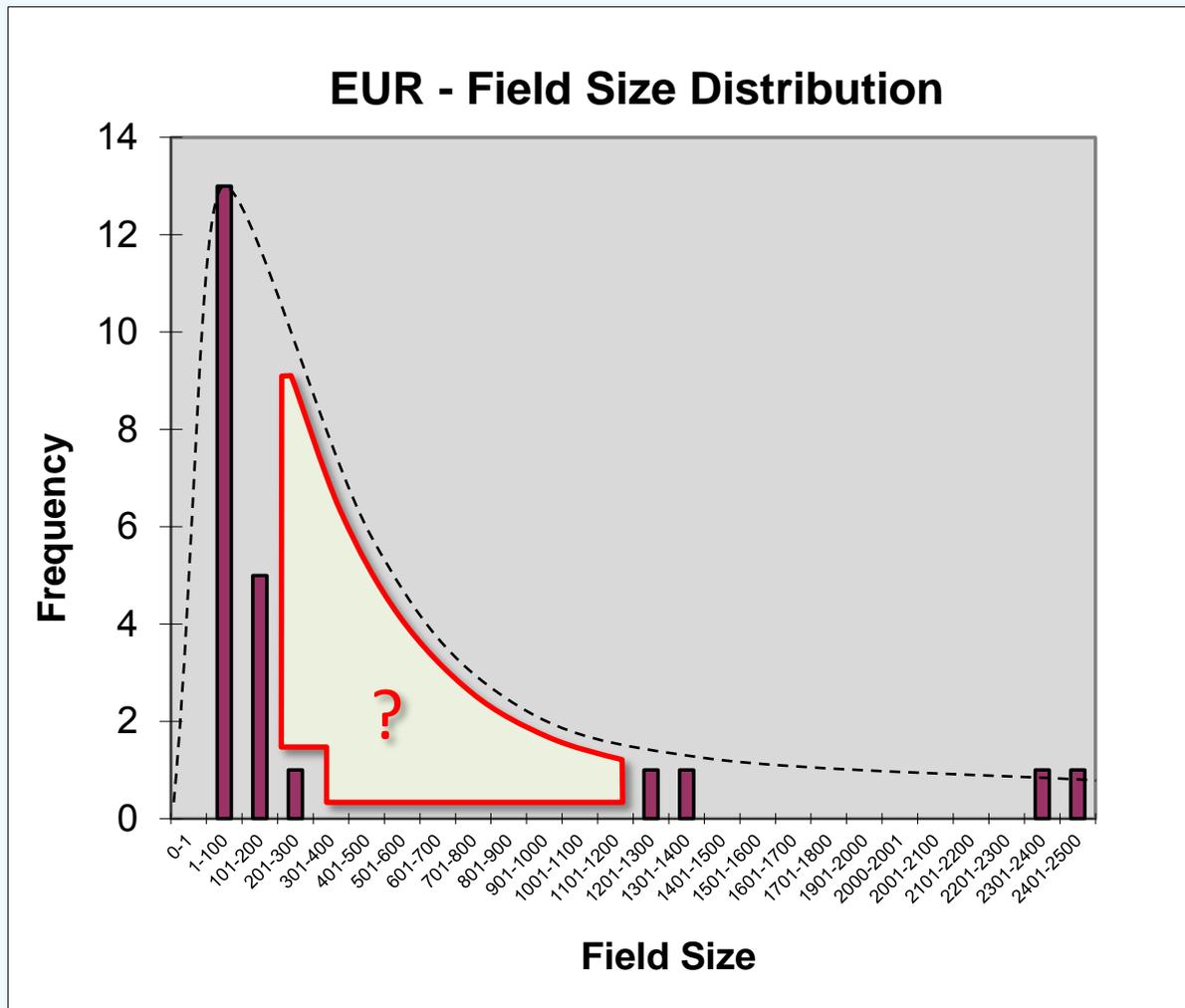


- Federal
- CIRI
- Mental Health University
- Beluga Habitat
- Units
- Leased acreage

Hurdles to Exploration

Gas Field Size Distribution - EUR

Gaps in lognormal distribution suggest undiscovered fields



Dashed curve is schematic, for illustrative purposes only

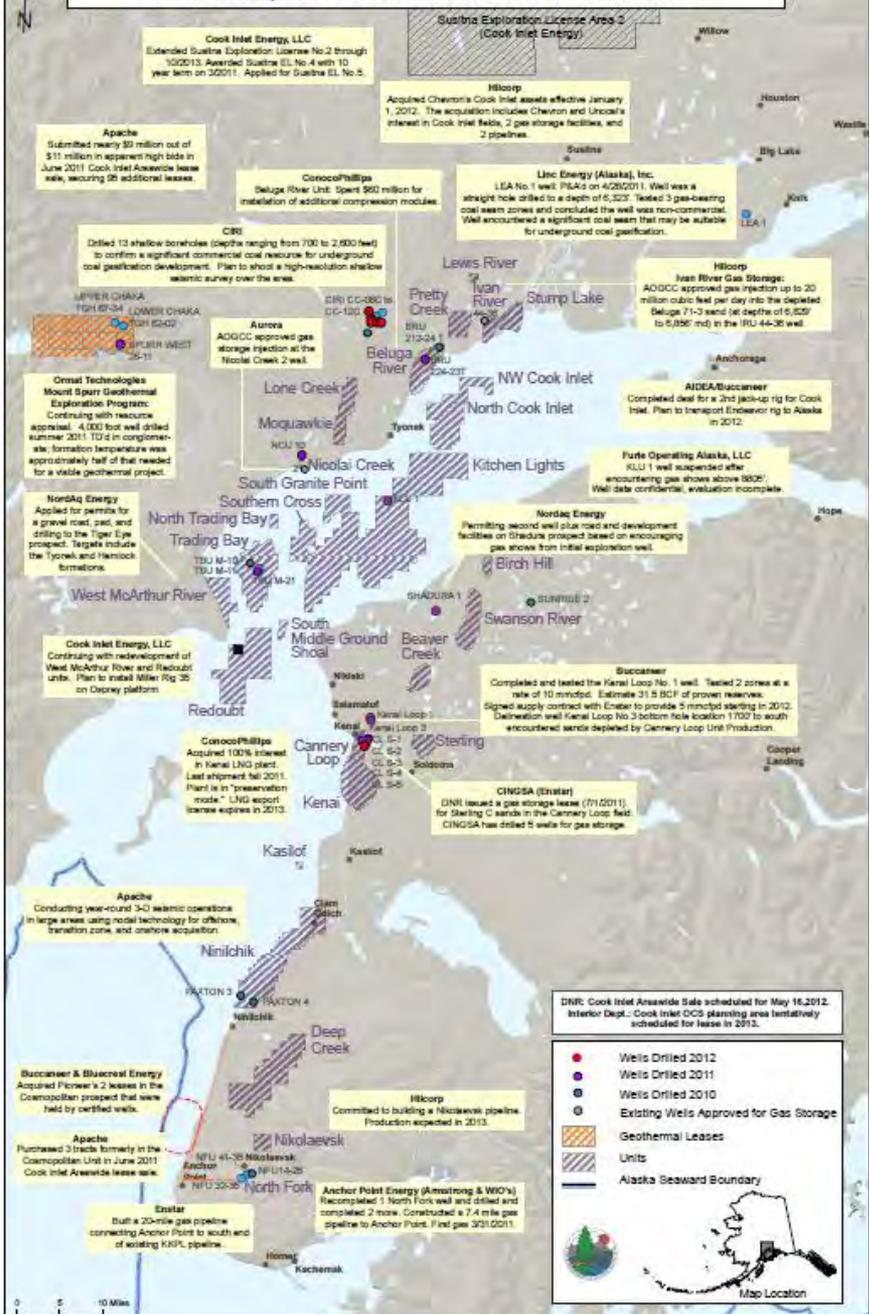
Stump Lake	6
Pretty Creek	6
West Fork	7
Lewis River	9
North Fork	12
Falls Creek	13
Birch Hill	22
Sterling	26
N Trading Bay Unit	30
Moquakie	43
Wolf Lake	50
Trading Bay	90
Ivan River	104
M G S	112
Cannery Loop	116
Granite Point	137
Swanson River	145
Beaver Creek	242
BRU	1266
McAurther River	1384
NCI	2328
Kenai	2425

TOTAL = 8576 Bcf

Mean = 373 Bcf

Cook Inlet Oil and Gas Activity 2012

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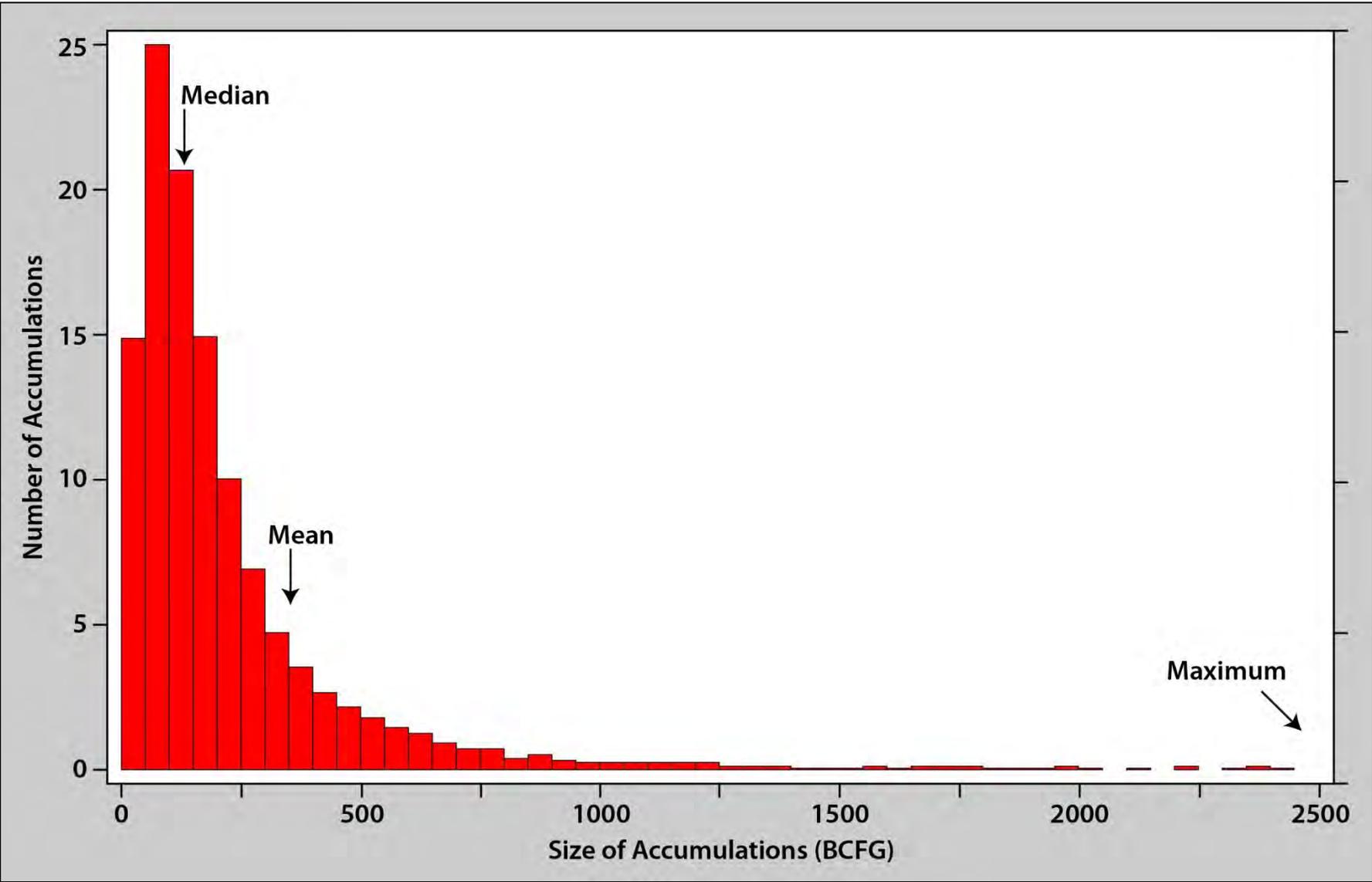
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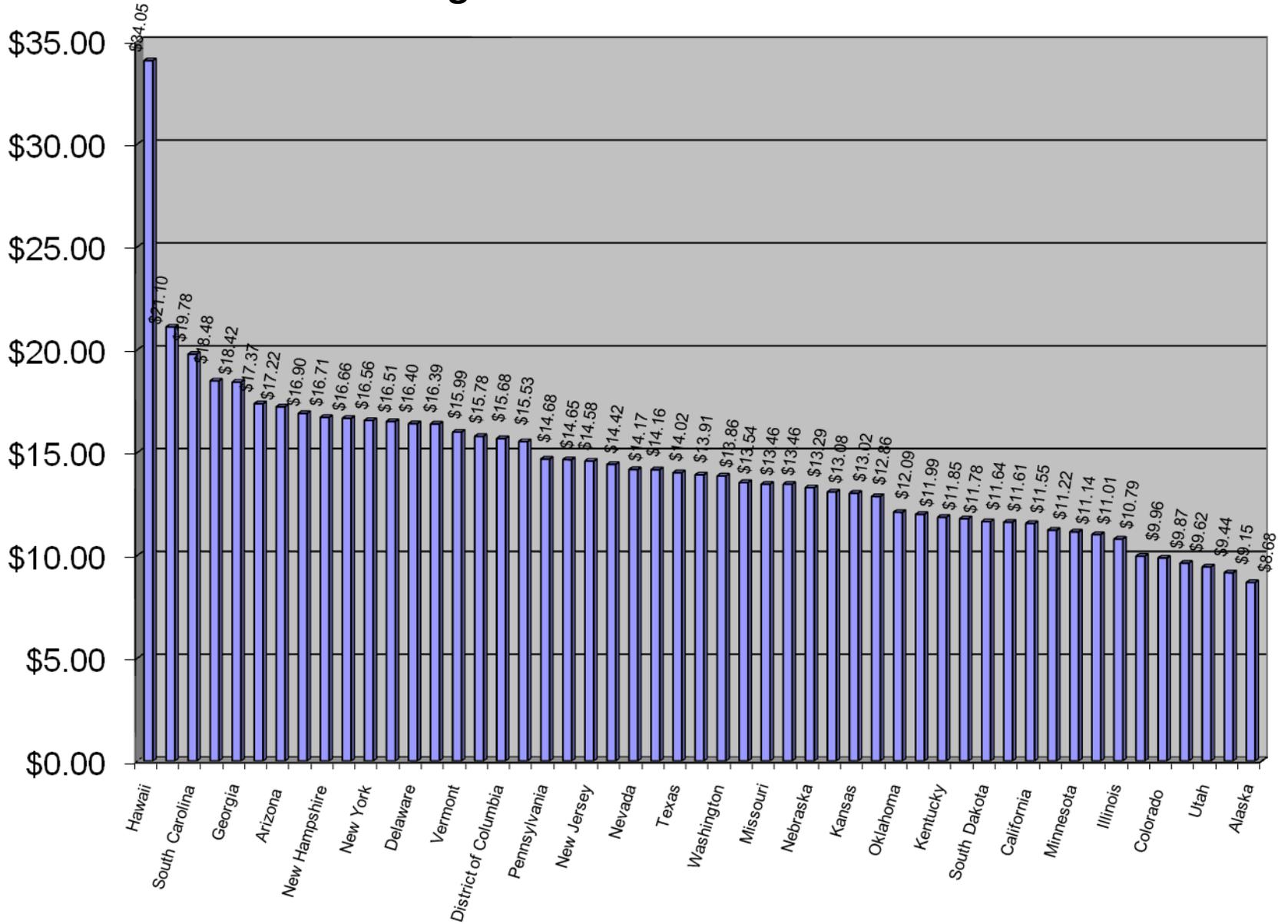
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Log Normal Distribution of Gas Accumulation Size



2007 Average Gas Price to American Consumer

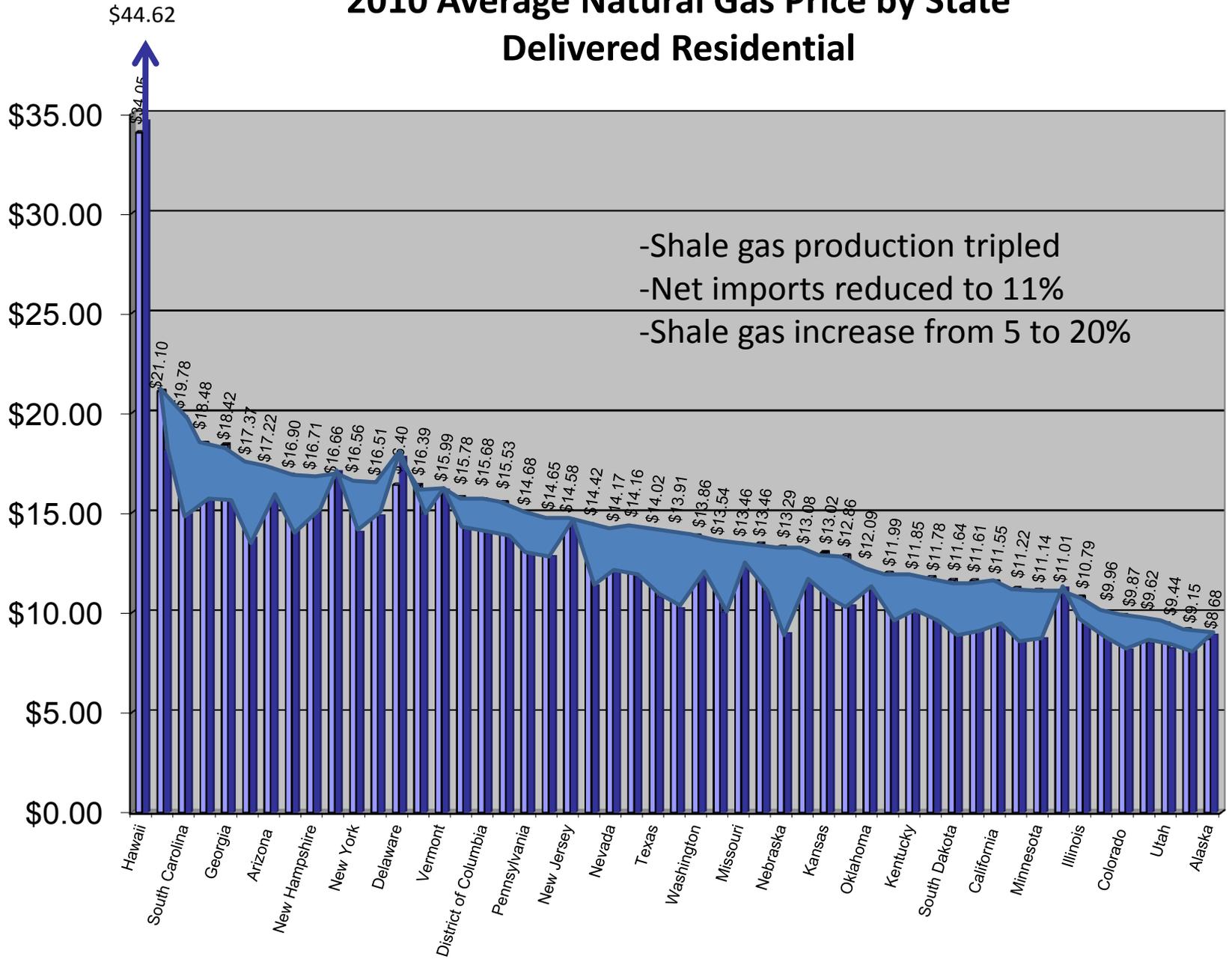
Average Price of N G in 2007



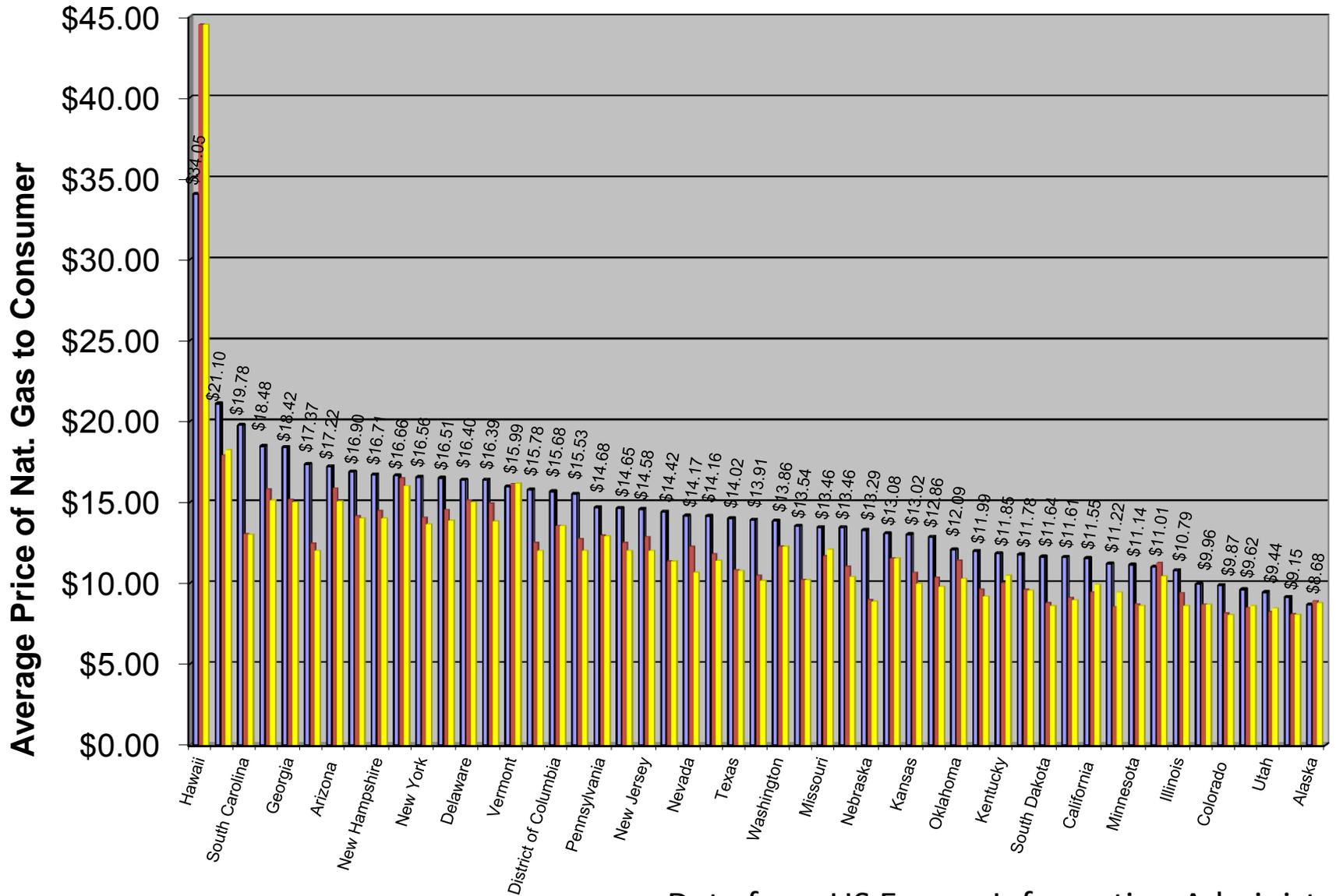
Data from US Energy Information Administration

2010 Average Natural Gas Price by State Delivered Residential

Average Price of N G in 2007



2007 vs. 2010 vs. 2011 Average Gas Price to American Consumer



Data from US Energy Information Administration

