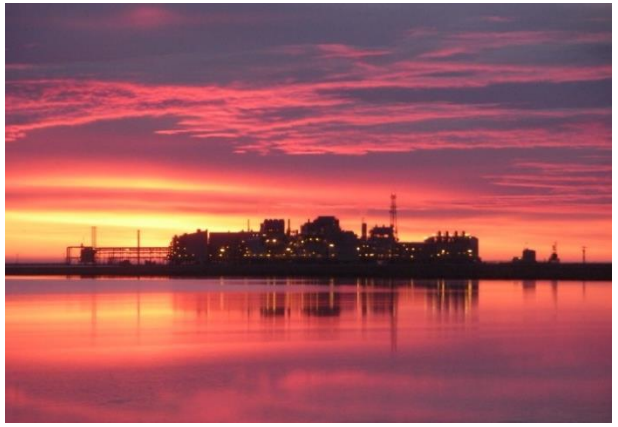
2022 Cook Inlet Gas Forecast

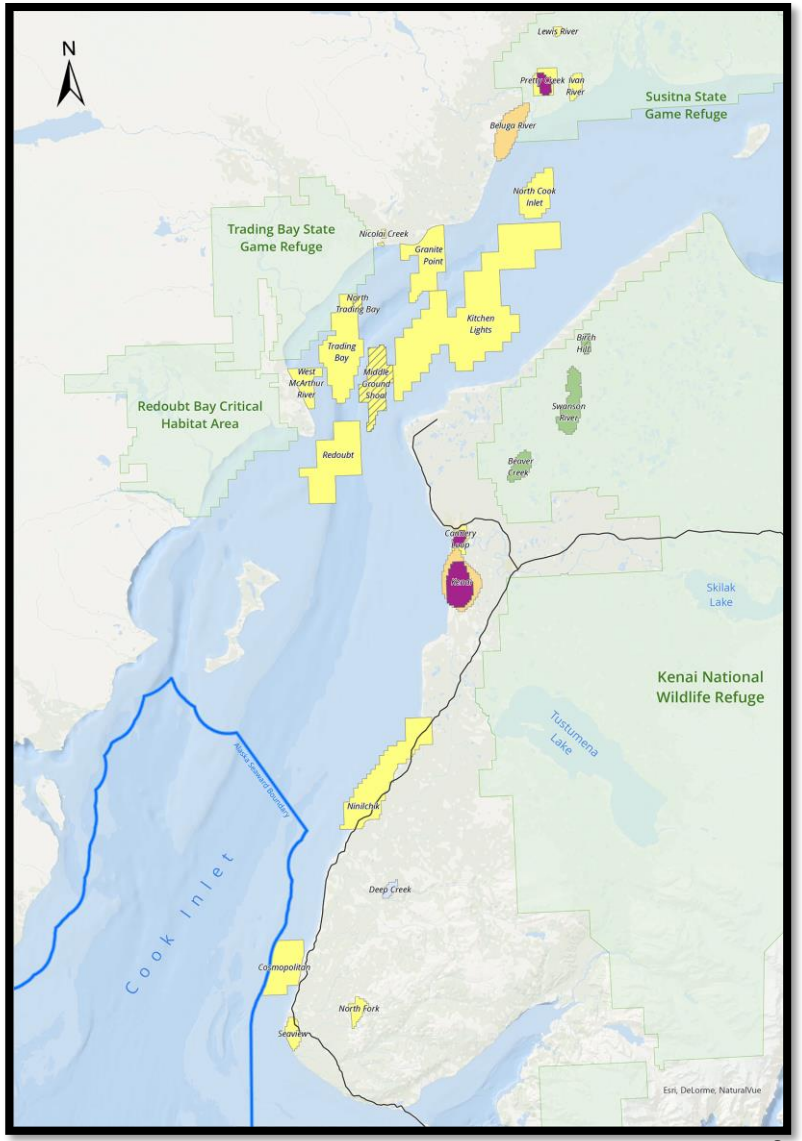
House Resources Committee

Presented by Jhonny Meza & John Burdick
Division of Oil & Gas
Alaska Department of Natural Resources
February 6, 2023

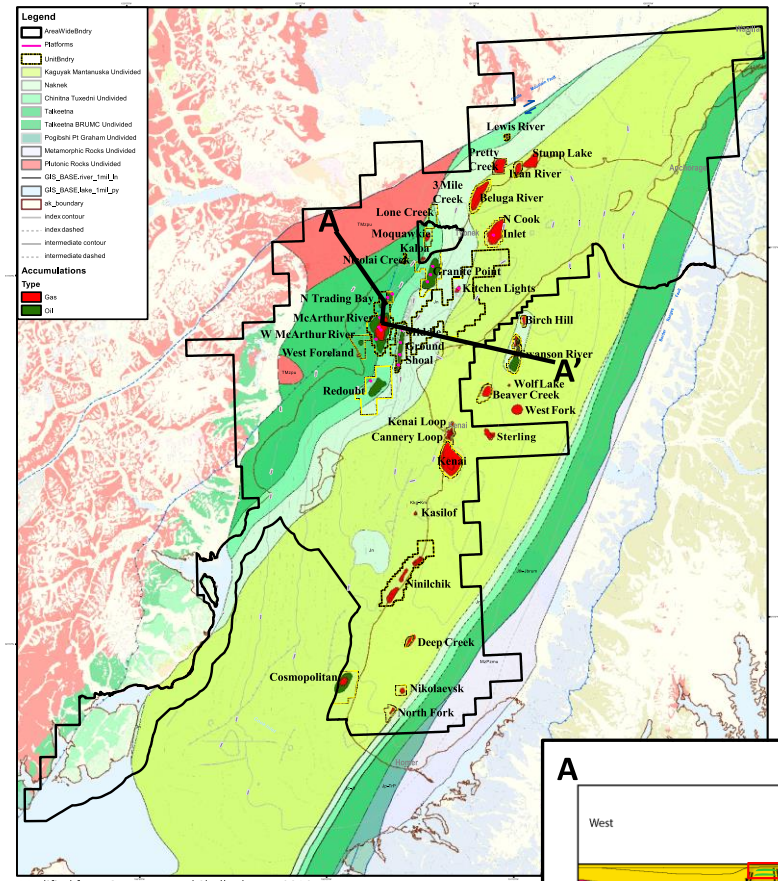



Outline

- **Cook Inlet Geology**
- **Cook Inlet Supply and Demand Evolution**
- **Cook Inlet Recovery Act and Resulting Activity**
- **Overview of Division of Oil and Gas (DOG) Cook Inlet Studies**
- **2022 Cook Inlet Gas Forecast**
  - Methodology
  - Economic constraints
  - Forecast - outcomes
  - Comparison to previous studies



Cook Inlet Geology



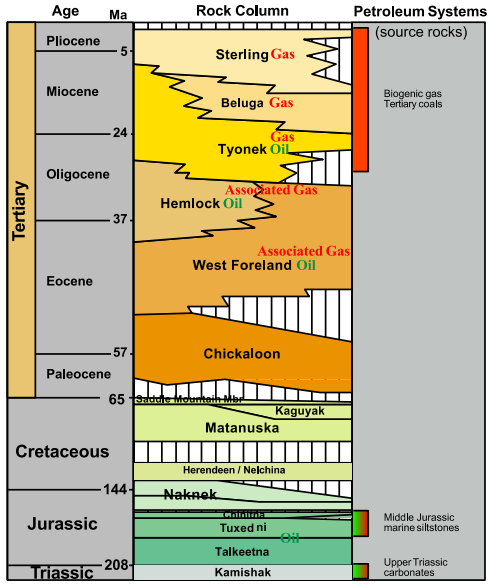
Modified from Gregersen and Shellenbaum, 2016

Top Mesozoic Subcrop Map with Oil and Gas Accumulations, C

Majority of oil and gas production is from Tertiary reservoirs

Oil Seeps; TBU M-28 produced oil

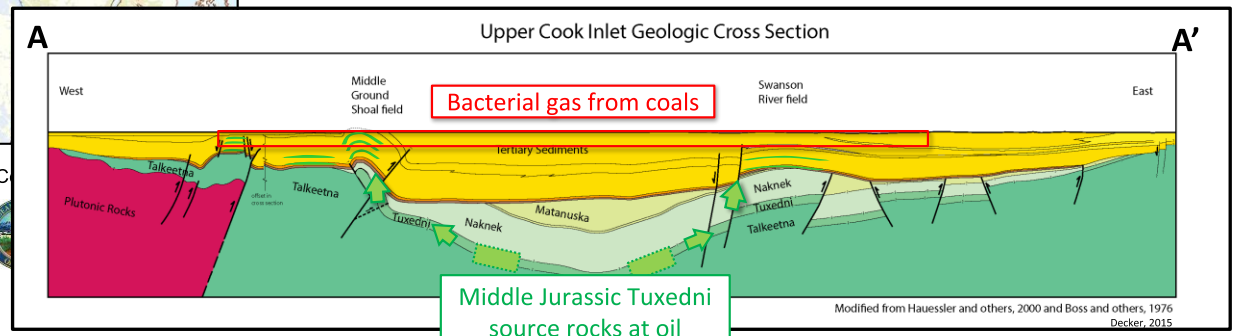
Cook Inlet Stratigraphic Column



Modified by Alaska DOG / DGGS staff from USGS 1995, MMS 1995, Swenson 2003, Curry *et al*, 1993

Two Sources of Gas In Cook Inlet Basin

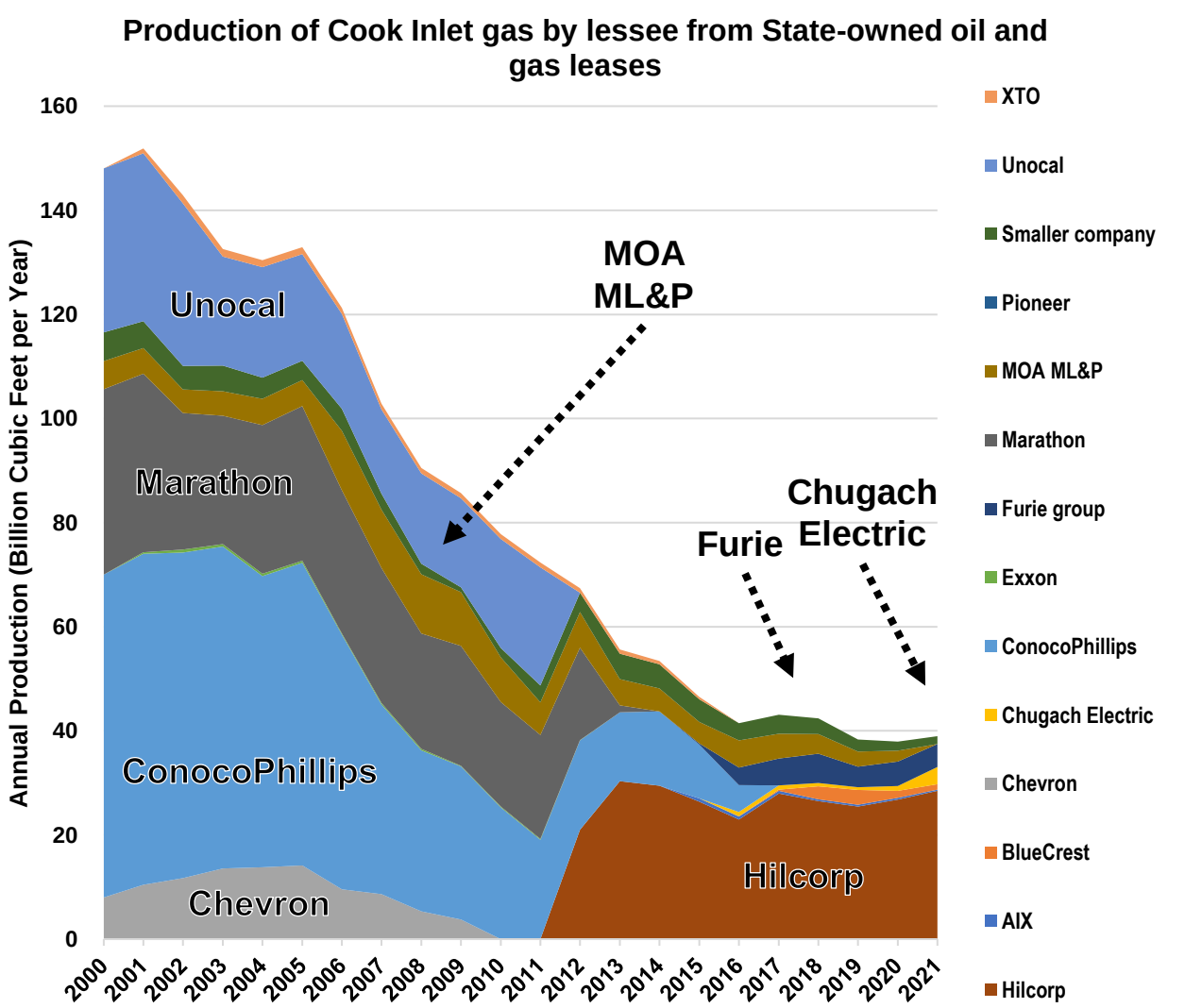
1. Biogenic gas from coals.
2. Oil migrated from source rocks, creating associated gas.



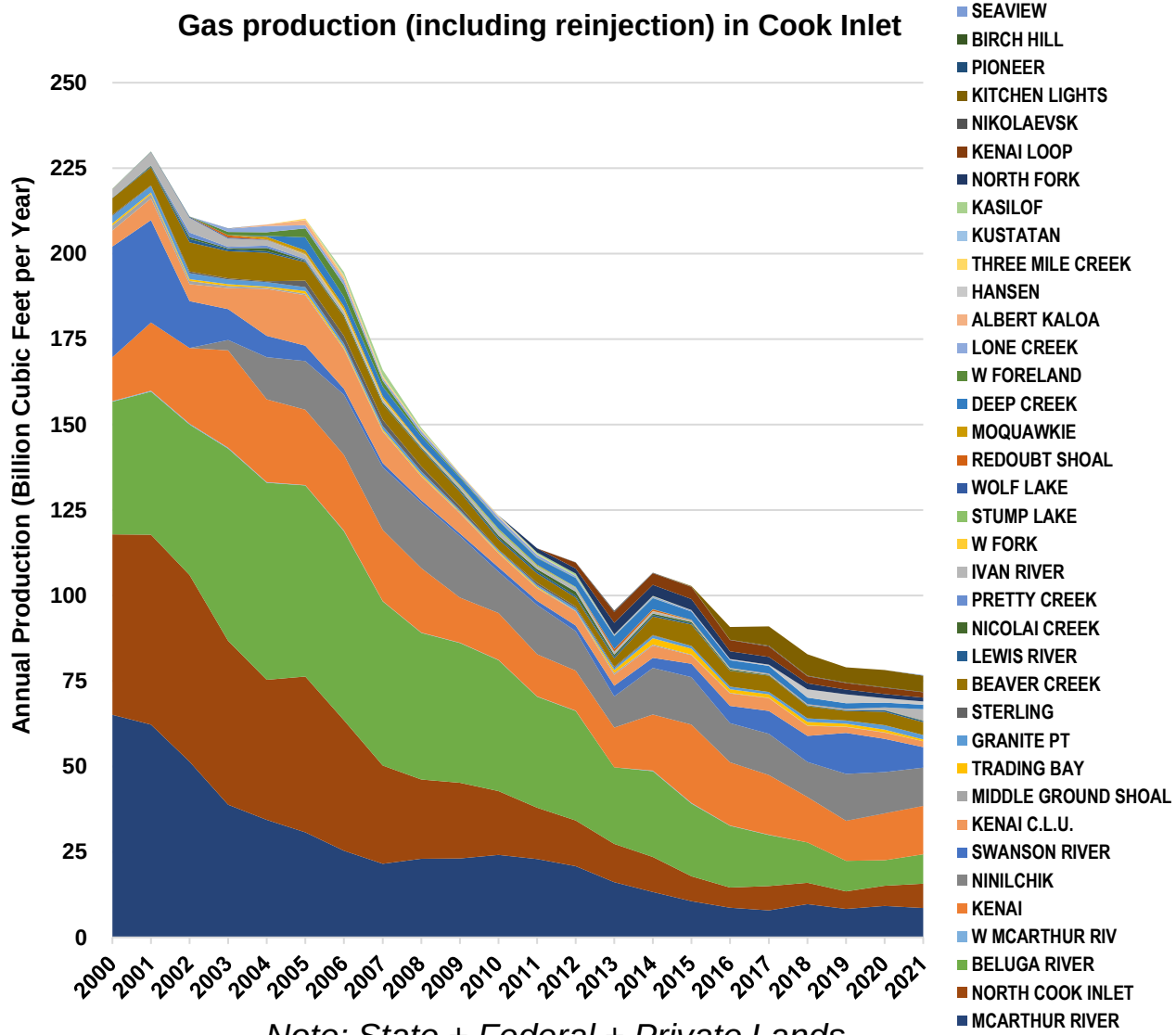
Quick Look Guide to Cook Inlet Oil and Gas

LS Gregersen, 3-13-2020

Cook Inlet Fields Overview: Gas Production History



Note: State Lands Only



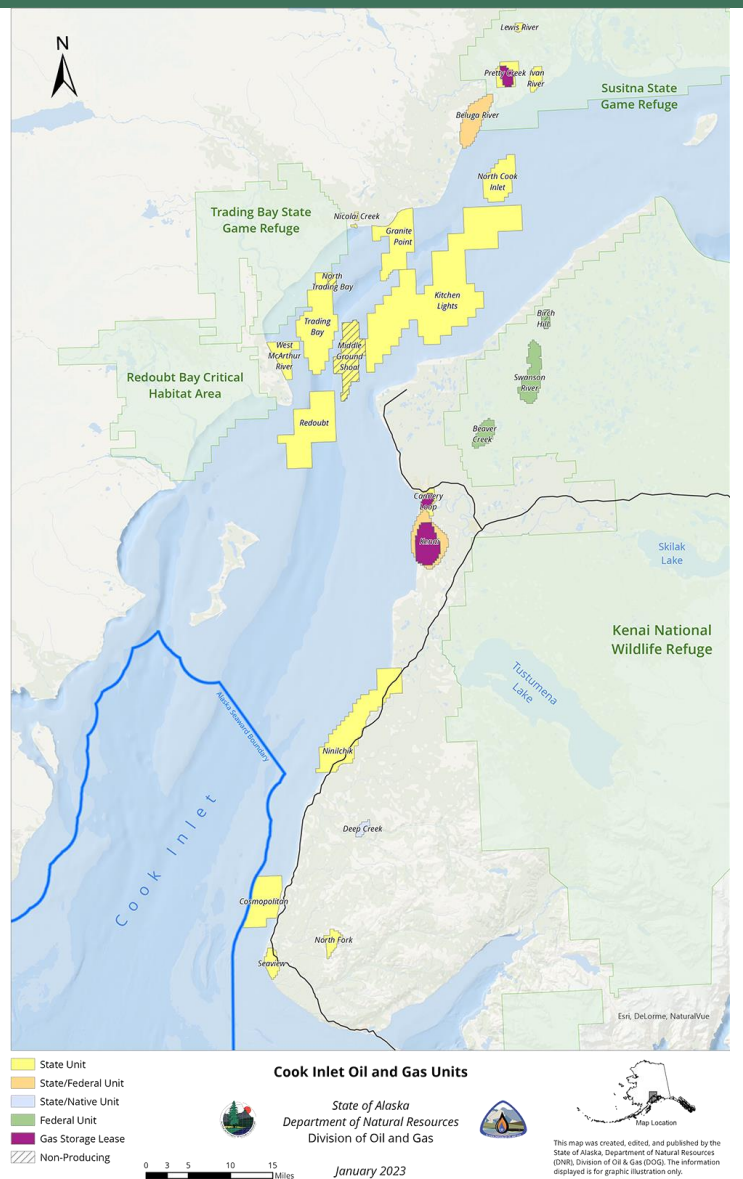
Note: State + Federal + Private Lands

Cook Inlet Fields Overview: Production by Field

Field	Operator and lessees	2022 Gas Production	2022 Oil Production
Kenai Loop	AIX Energy LLC	1.17 bcf	
Nicolai Creek	Amaroq Resources, LLC	0.1 bcf	
Hansen	Bluecrest Alaska Operating LLC	0.58 bcf	770 bopd
Redoubt Shoal	Cook Inlet Energy, LLC.	0.07 bcf	879 bopd
West McArthur River	Cook Inlet Energy, LLC.	0.00 bcf	240 bopd
Kitchen Lights	Furie Operating Alaska, LLC; Cornucopia Oil & Gas Company; A. L. Berry; Danny Davis; Taylor Minerals, LLC; Corsair Oil & Gas	4.02 bcf	
Beaver Creek	Hilcorp Alaska, LLC	3.72 bcf	629 bopd
Beluga River	Hilcorp Alaska, LLC; Chugach Electric Association	11.07 bcf	
Deep Creek	Hilcorp Alaska, LLC	1.17 bcf	
Granite Pt	Hilcorp Alaska, LLC	1.16 bcf	2,199 bopd
Ivan River	Hilcorp Alaska, LLC	3.37 bcf	
Kenai	Hilcorp Alaska, LLC	5.53 bcf	
Kenai C.L.U.	Hilcorp Alaska, LLC	0.68 bcf	
Lewis River	Hilcorp Alaska, LLC	0.24 bcf	
McArthur River	Hilcorp Alaska, LLC	6.08 bcf	2,631 bopd
Middle Ground Shoal	Hilcorp Alaska, LLC	0 bcf	0 bopd
Nikolaevsk	Hilcorp Alaska, LLC	0.08 bcf	
Ninilchik	Hilcorp Alaska, LLC	11.52 bcf	
North Cook Inlet	Hilcorp Alaska, LLC	10.93 bcf	
Seaview	Hilcorp Alaska, LLC	0.06 bcf	
Swanson River	Hilcorp Alaska, LLC	3.65 bcf	705 bopd
Trading Bay	Hilcorp Alaska, LLC	0.4 bcf	794 bopd
North Fork	Vision Operating, LLC	1.13 bcf	

bcf = billion cubic feet

bopd = barrels of oil per day



https://dog.dnr.alaska.gov/Information/MapsAndGis

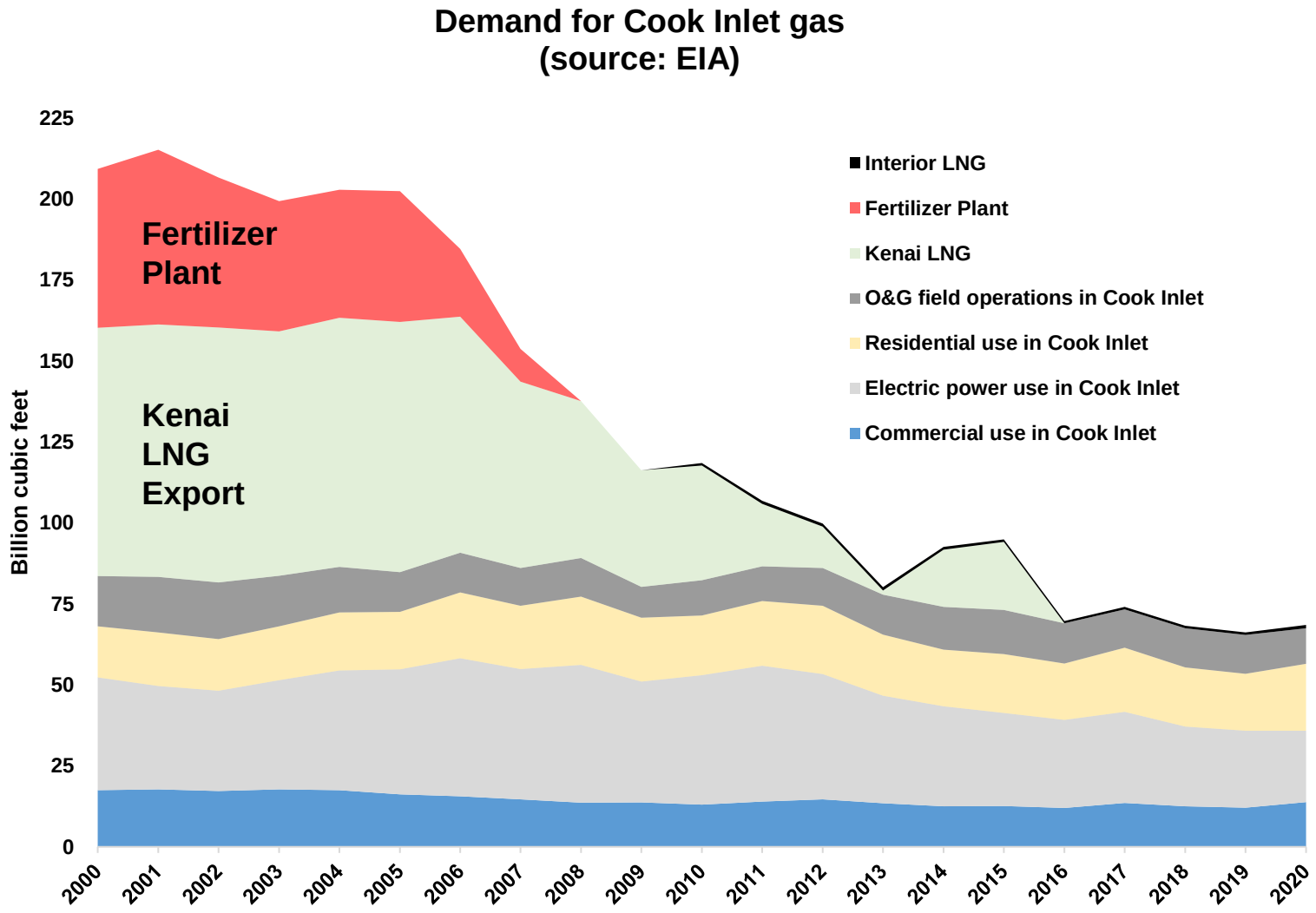
Southcentral Gas Demand: Demand by User Type

Kenai LNG Plant

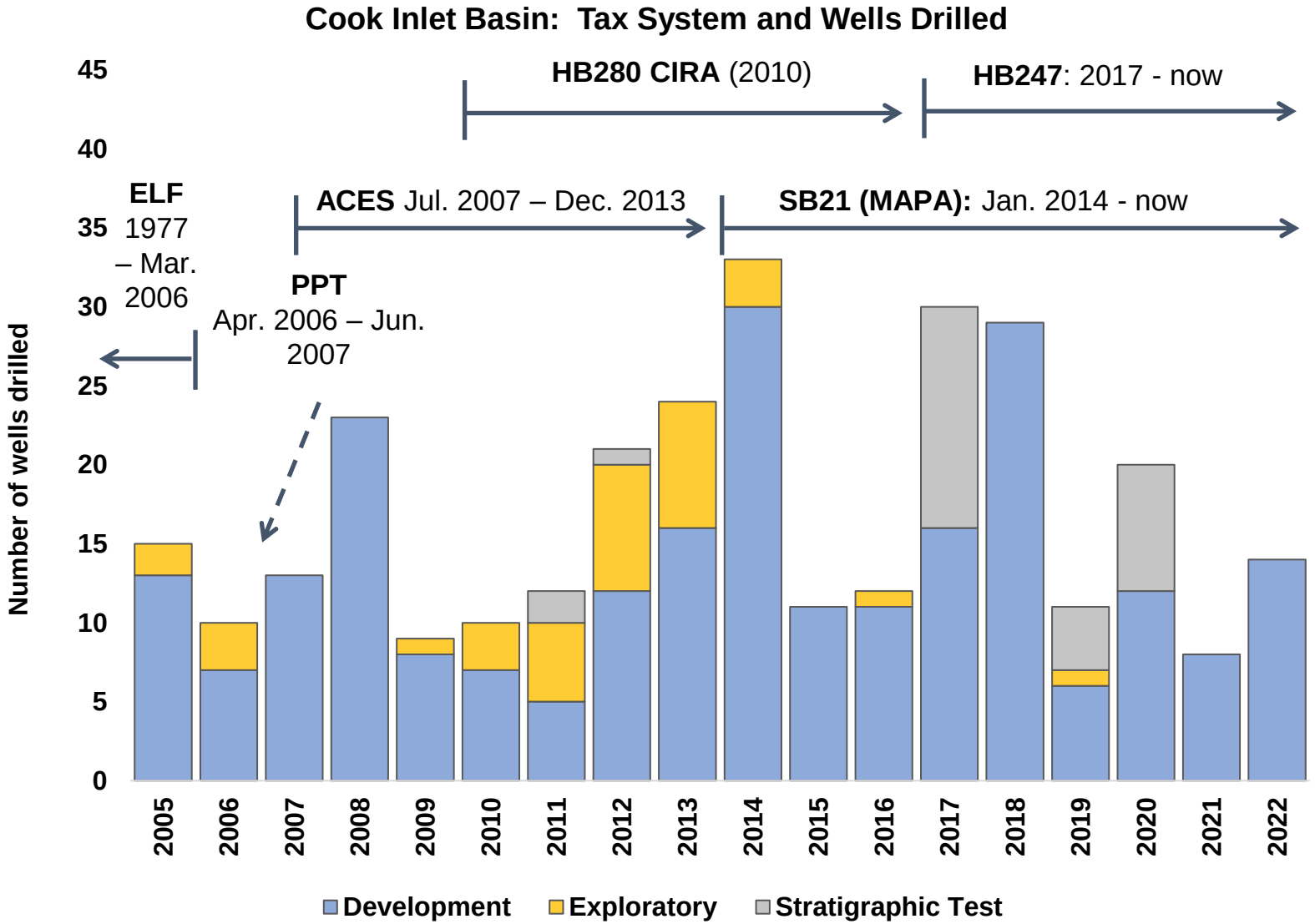
- Nikiski liquified natural gas (LNG) facility is operated by Trans-Foreland Pipeline Co. LLC – which is a sub of Marathon Oil.
- Last exported LNG was 2015.
- Department of Energy (DOE) authorization for exporting LNG expired in 2018.
- Dec. 2020 Federal Energy Regulatory Commission (FERC) approved LNG Imports to this facility an annual capacity up to 1.8 billion cubic feet (bcf) per year.

Nutrien Fertilizer Plant

- Second largest ammonia/urea plant in U.S.
- Shut down and mothballed in 2007, however Nutrien maintains permits and remains interested in reopening the plant.
- Gas prices relative to Lower 48 makes economics difficult.
- Potential source for blue hydrogen/blue ammonia.



Cook Inlet Recovery Act and Resulting Activity



- **Active:**
  - Discovery royalty AS 38.05.180(f)(4)
- **Expired or repealed in 2016 or with HB 247:**

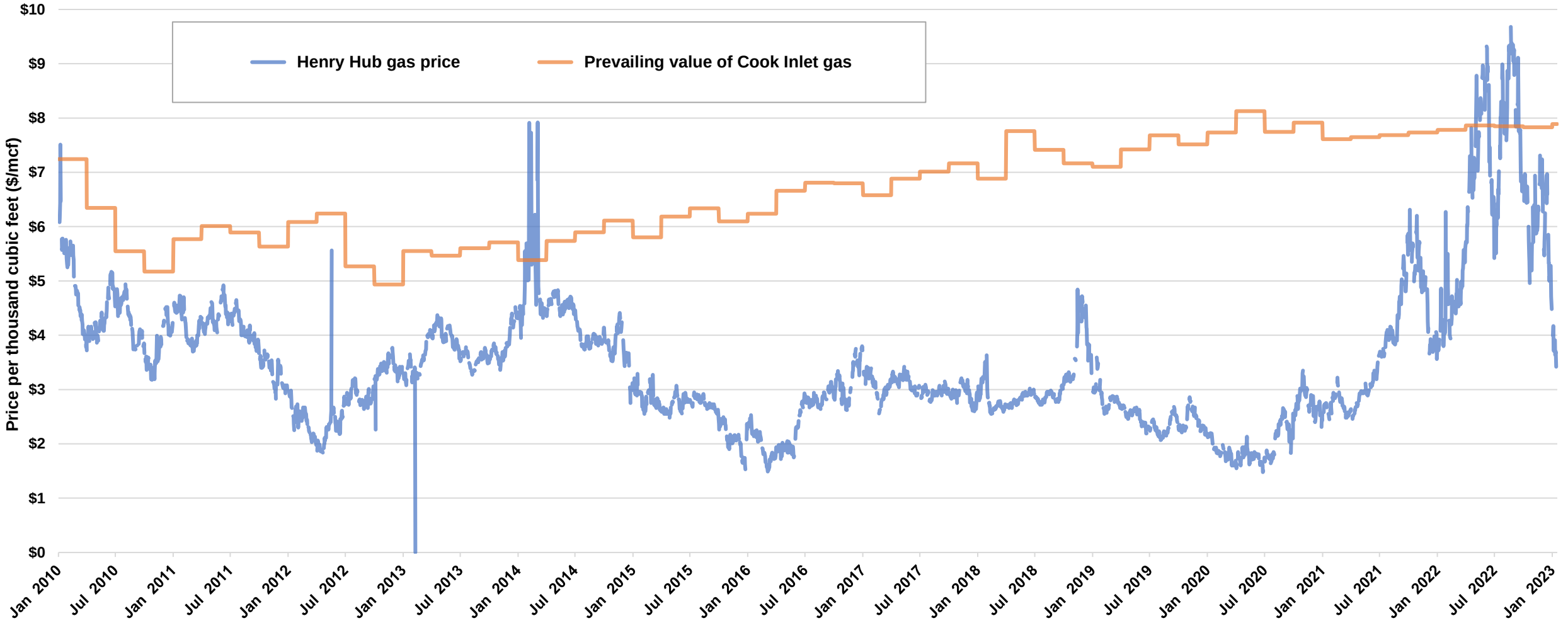
Before CIRA

- Exploration Incentive credit: AS 38.05.180(i)
- Alternative Credit for Exploration: AS 43.55.025(a)
- Gas Exploration and Development credit: AS 43.20.043
- Qualified Capital Expenditure credit: AS 43.55.023(a)
- Small Producer Credit AS 43.55.024: Qualification deadline May 2016
- Carried Forward Annual Loss Credit: Expired with HB 247

CIRA

- Well Lease Expenditure Credit AS 43.55.023(l)
- Gas Storage Facility Credit AS 43.20.046
- Cook Inlet Jack-Up Rig Credit AS 43.55.025(a)(5) and (l)

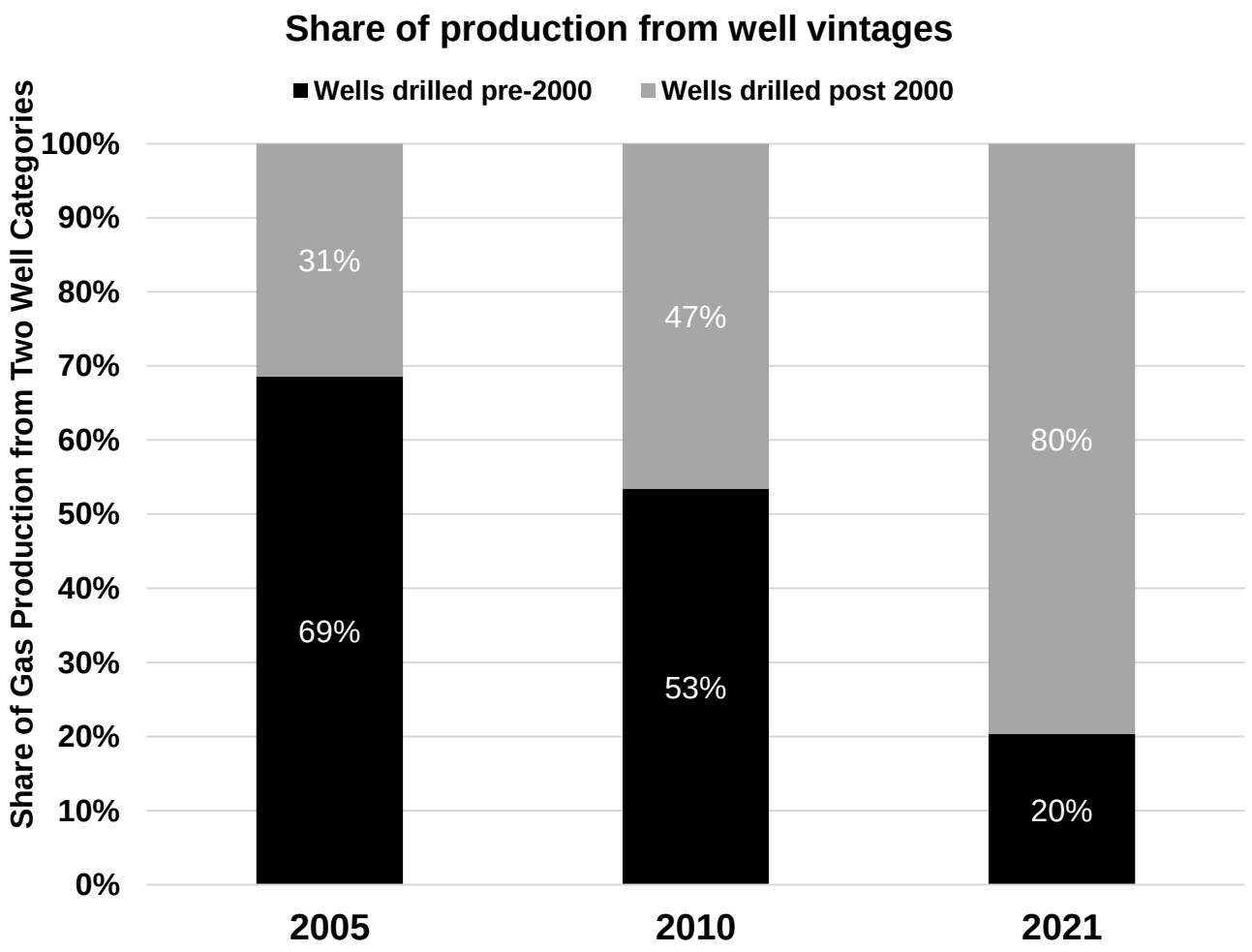
Cook Inlet Natural Gas: Local Prevailing Value vs Henry Hub



Exploration & Development in Cook Inlet: Cook Inlet Future Production

The CI Basin depends on successful exploration.

- The CI Basin has been producing for over 60 years.
- Continuous exploration has led to 13 new oil and gas units coming online, and over 450 wellbores drilled **since year 2000.**
- Of the ~200 million cubic feet per day (mmcfd) of produced gas in 2021, ~80% came from wells drilled less than 20 years ago.
- Exploration/delineation within and outside the units is crucial to continued security of gas supply for the basin.



Overview of Division of Oil & Gas Cook Inlet Studies

2009 - Preliminary Engineering and Geological Evaluation of Remaining Cook Inlet Gas Reserves

- Consisted of engineering and geologic evaluations of 28 currently producing Cook Inlet gas fields to derive estimates of remaining Proved and Probable reserves.
- Applied single deterministic Decline Curve Analysis (DCA) and Material Balance (MBAL) engineering methods to publicly available production and pressure data obtained from Alaska Oil and Gas Conservation Commission (AOGCC).
- Did not address economics of drilling additional wells, recompleting existing wells, optimizing infrastructure, and the ability to sell the gas into the Cook Inlet market.
- Proved + Probable reserves estimated at 1.14 trillion cubic feet (tcf).

2011 - Cook Inlet Natural Gas Production Cost Study

- Investigated investment requirements around various targeted reserves.
- Addressed commercial viability of remaining gas by postulating conceptual plans to produce natural gas from the Cook Inlet Basin to meet a demand of 90 billion cubic feet (bcf) per year.

Overview of Division of Oil & Gas Cook Inlet Studies (Continued)

2015 - Updated Engineering Evaluation of Remaining Cook Inlet Gas Reserves

- An update to 2009's study of 34 currently or historically producing Cook Inlet gas fields to derive estimates of remaining Proved and Probable reserves.
- Applied single deterministic DCA and MBAL engineering methods to publicly available production and pressure data obtained from AOGCC.
- Did not address prospective (undiscovered), contingent (discovered, non-producing), and 3P (Proved + Probable + Possible) reserves.
- Proved + Probable reserves estimated at 1.18 trillion cubic feet (tcf).

2018 - Cook Inlet Natural Gas Availability

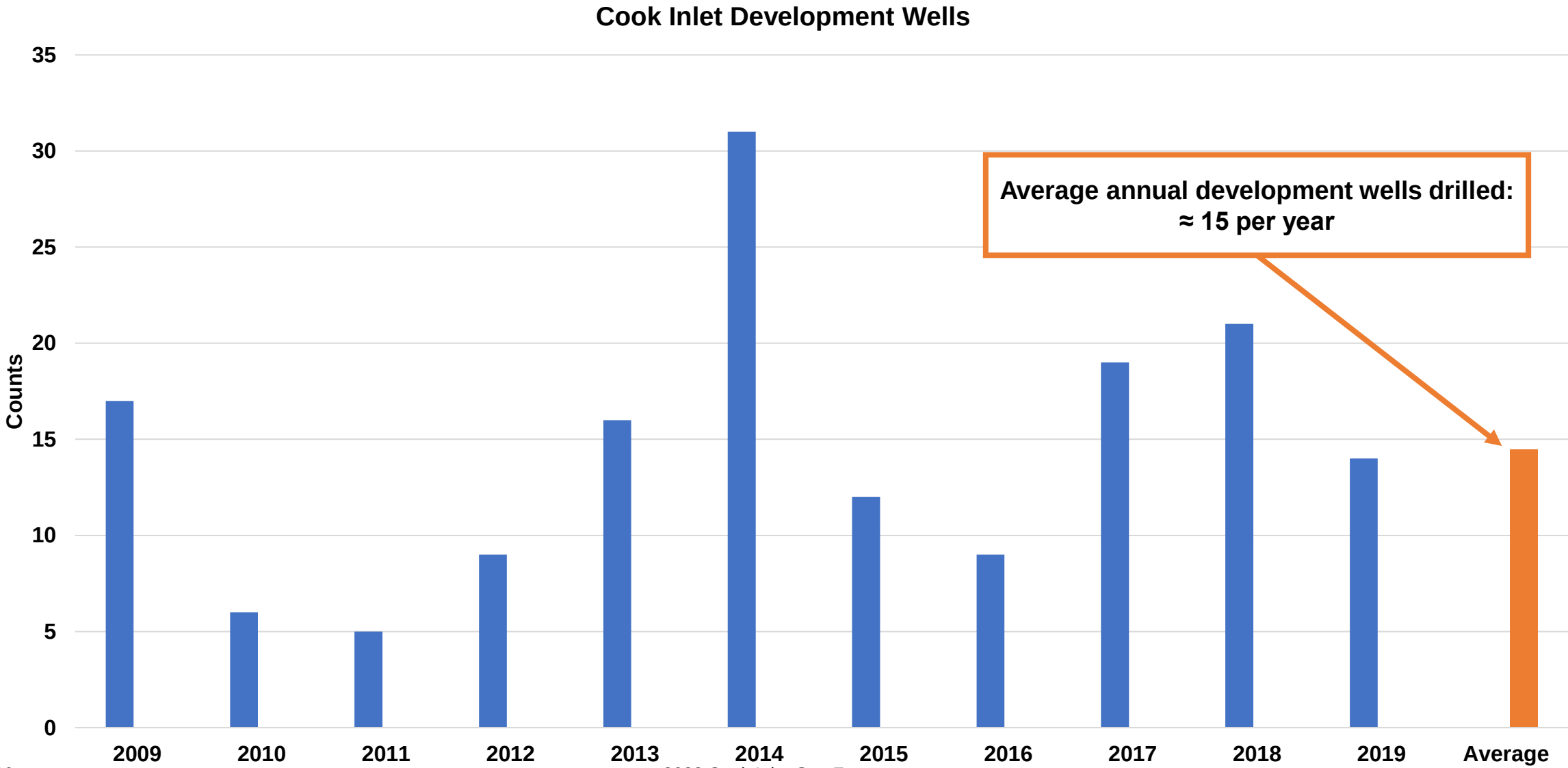
- Built on three previous DOG Cook Inlet gas studies, while incorporating future supplies by formulating hypothetical development projects required to produce undeveloped volumes and estimate each project's economic viability.
  - 500–800 bcf of additional gas is economic to develop at a price range around $6-8/thousand cubic feet (real 2016 dollars).
- P50 reserves estimate of 700 bcf when price is $8 per thousand cubic feet (mcf).

Current Study

2022 - Cook Inlet Gas Forecast

- A technical reserves assessment of 90 different gas & oil pools in the Cook Inlet Basin using publicly available production data obtained from AOGCC.
- Decline Curve Analysis (DCA) used to estimate volumes from currently producing well set. Type Curve(s) were developed to estimate volumes from future development wells.
- Discovered resources contingent upon more favorable commercial conditions and undiscovered (prospective) resources were not included in the forecast.
- Estimated field level economic limits were used in the “truncated” forecast cases.
- Forecasted volumes do not account for gas produced from gas storage to avoid duplicative gas volumes produced.
- Flat gas demand of 70 billion cubic feet per year does not assume future additional requirements nor does it assume possible substitutes or increasing efficiency in consumption both for energy producers and commercial or domestic consumers.

Cook Inlet Development Well History (Pre-Pandemic, 2009-2019)



Modeling the Economic Limit for each Field: Structure of the model

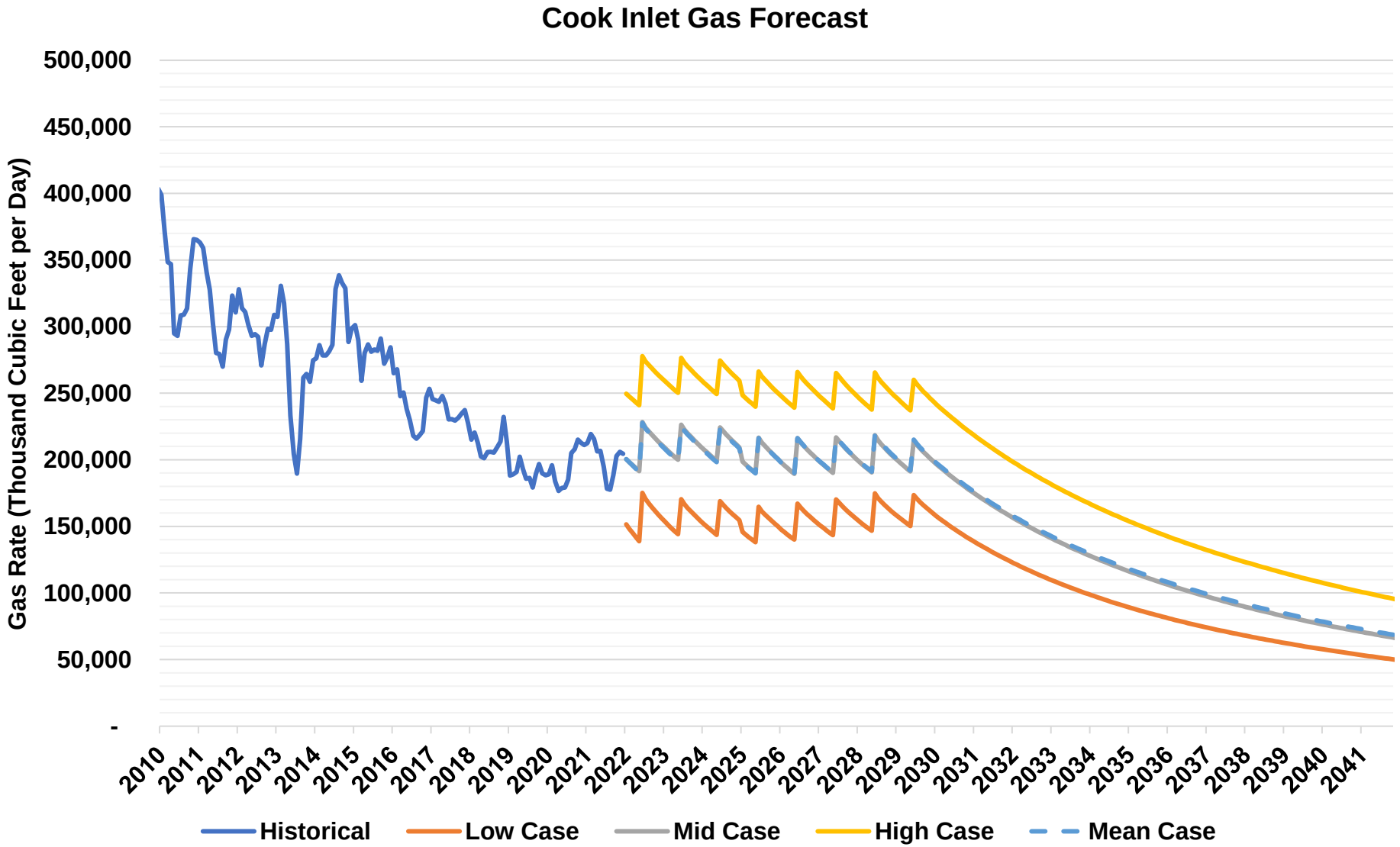
1. **The technical forecast of oil and gas is run through an economic model.**
   - Upstream companies unlikely to operate their fields at a sustained loss (i.e., negative cash flows).
   - If marginal revenue associated with production of oil and gas in a field is not large enough to cover marginal expenditure, then the operator will likely stop production.
   - Marginal expenditure includes costs, royalty and overriding royalty payments, and taxes.
   - Remaining technically recoverable gas production beyond the economic limit point will not be available to the market.

2. **Structure of the economic model:**

Production of gas for sale	Not all gas produced is available to the market: Small share used for in-field operations and enhanced oil recovery.
Revenue	Proxy for gas prices between some Cook Inlet producers and local utilities.
Costs	One-size-fits-all approach for costs allowing for differences based on proximity to infrastructure (offshore vs. onshore, West vs. East).
Royalty	Share of gross revenues: 12.5%.
Overriding royalty interest	Another claim on gross revenues: percentage varies.
Taxes	O&G production tax ($1/bbl and $0.177/mcf ceilings) and O&G property tax.

mcf = thousand cubic feet
bbl = barrel

Forecast Untruncated High-Mid-Low-Mean Streams



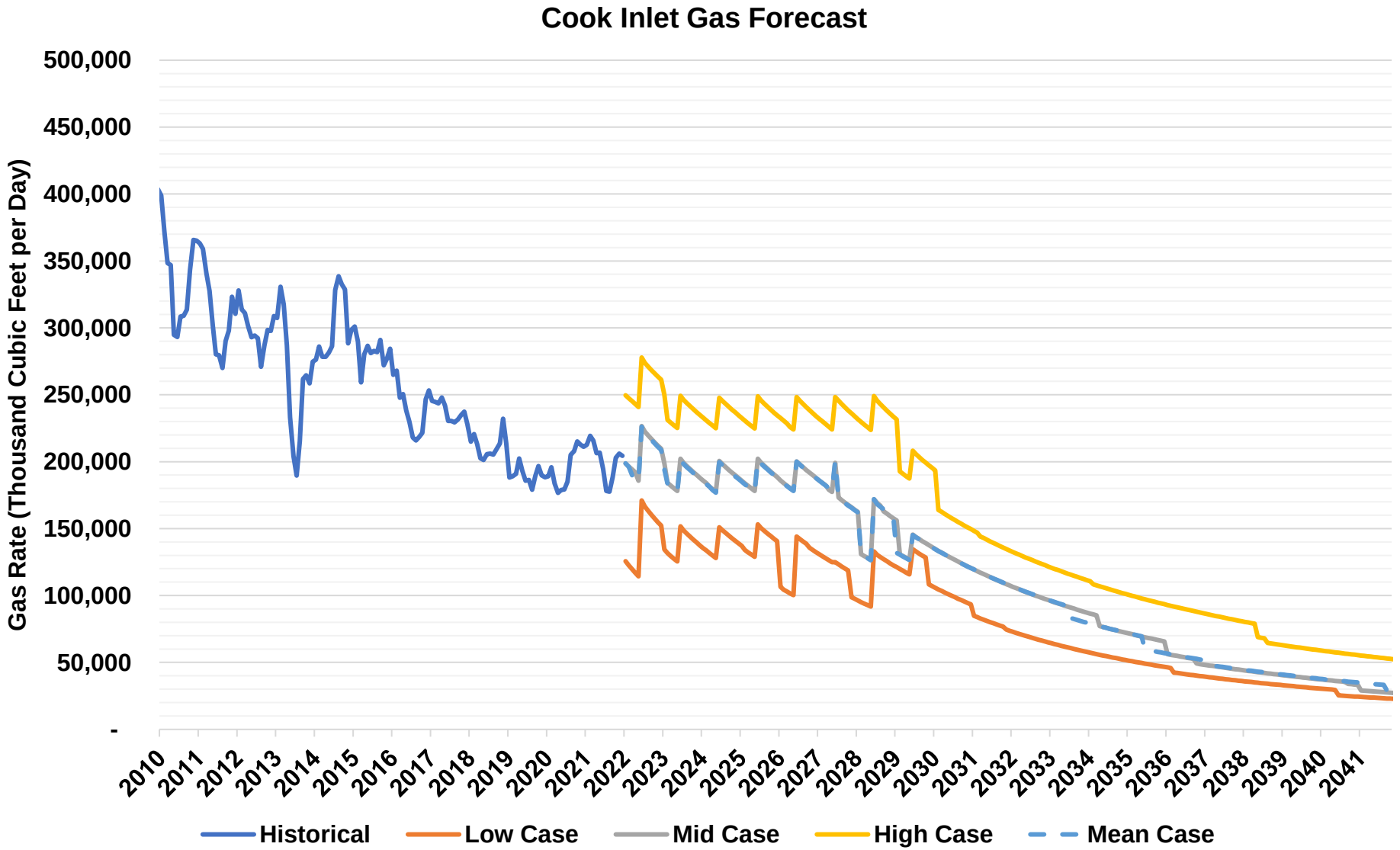
High Case (P1)	
Total Gas Reserves (bcf)	1,404.0
Gas (bcf)	1,361.7
Associated Gas (bcf)	42.3

Mid Case (P1)	
Total Gas Reserves (bcf)	1,101.4
Gas (bcf)	1,079.3
Associated Gas (bcf)	22.1

Low Case (P1)	
Total Gas Reserves (bcf)	843.2
Gas (bcf)	832.4
Associated Gas (bcf)	10.8

Mean Case (P1)	
Total Gas Reserves (bcf)	1,108.8
Gas (bcf)	1,085.2
Associated Gas (bcf)	23.6

Forecast
Truncated High-Mid-Low-Mean Streams



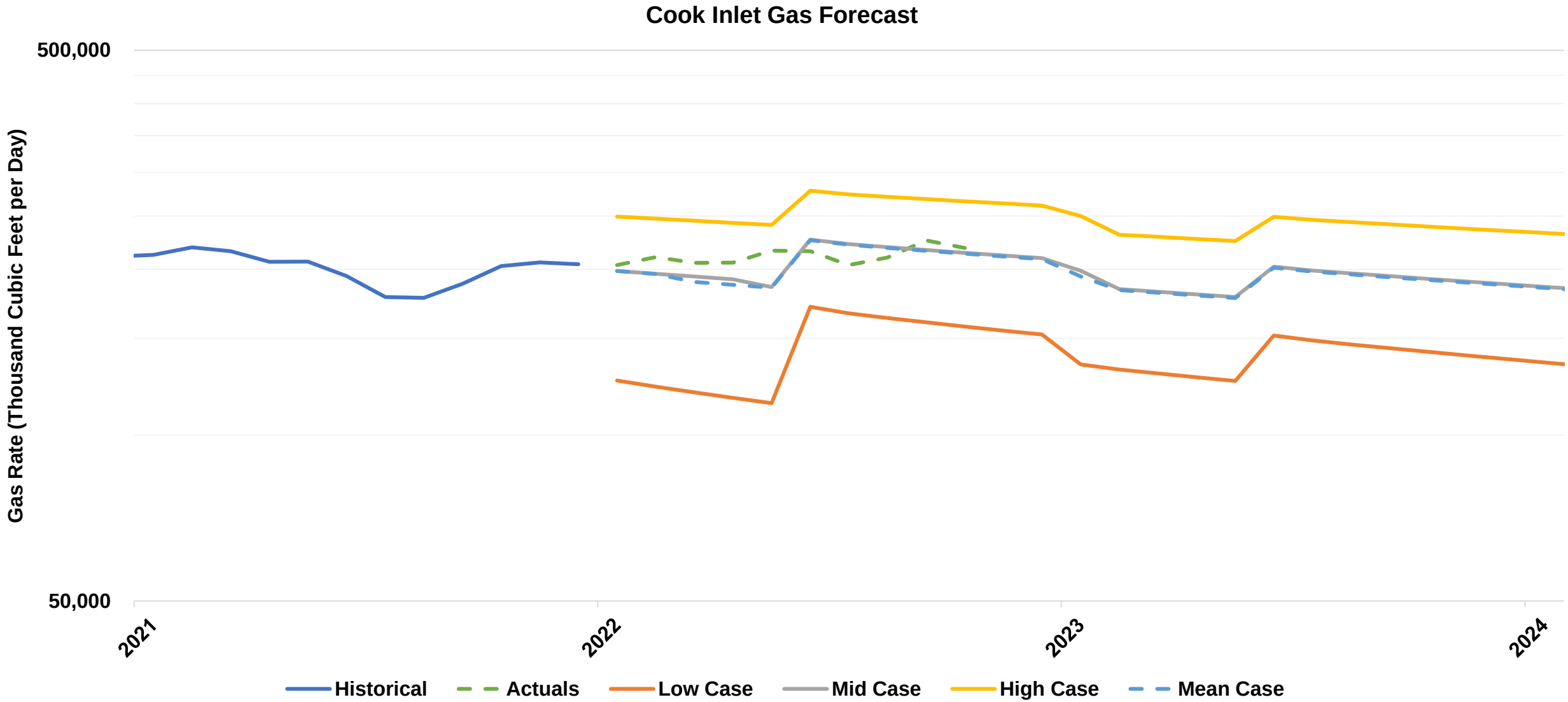
High Case (P1)	
Total Gas Reserves (bcf)	1,108.9
Gas (bcf)	1,066.6
Associated Gas (bcf)	42.3

Mid Case (P1)	
Total Gas Reserves (bcf)	823.9
Gas (bcf)	807.9
Associated Gas (bcf)	16.0

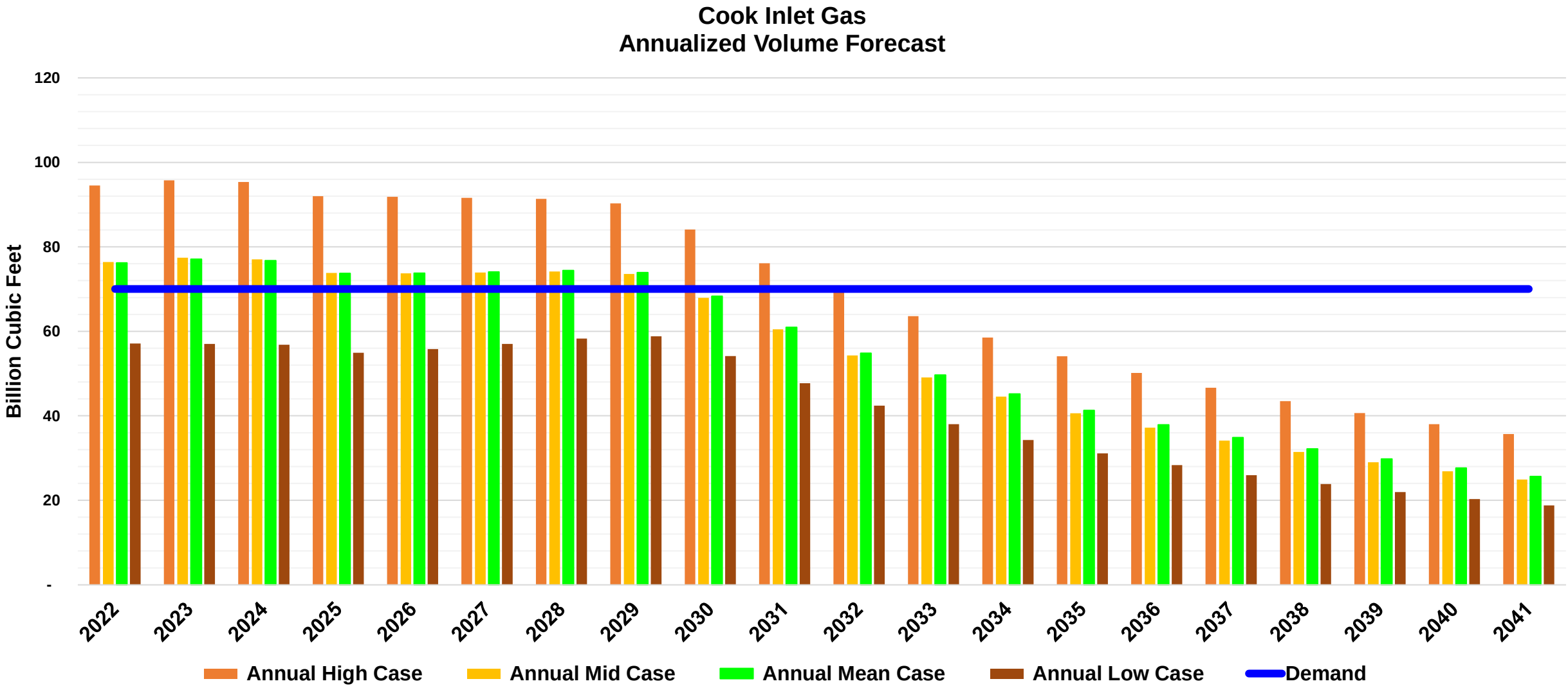
Low Case (P1)	
Total Gas Reserves (bcf)	602.5
Gas (bcf)	597.2
Associated Gas (bcf)	5.3

Mean Case (P1)	
Total Gas Reserves (bcf)	820.2
Gas (bcf)	803.2
Associated Gas (bcf)	17.0

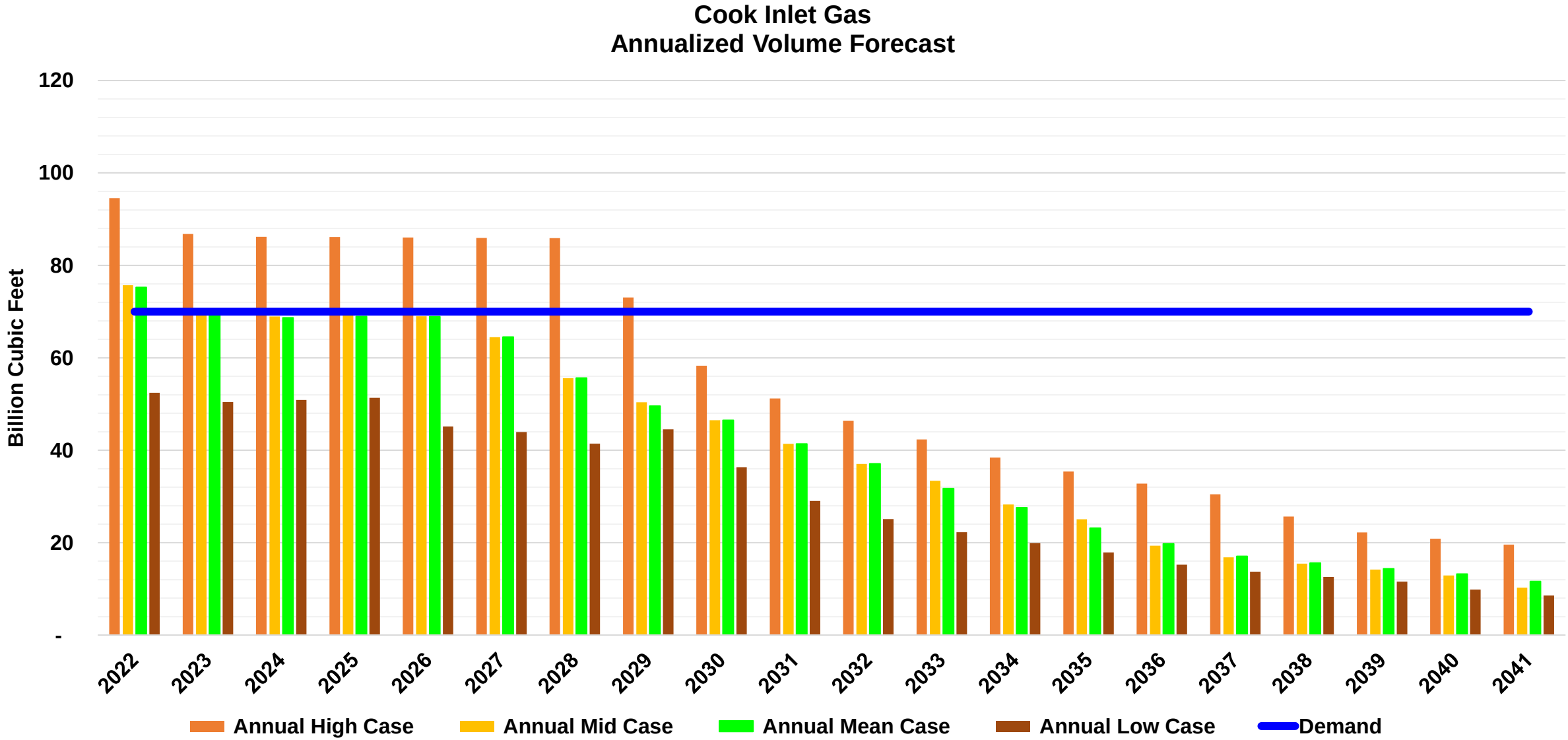
Forecast vs Actuals (Through October 2022)



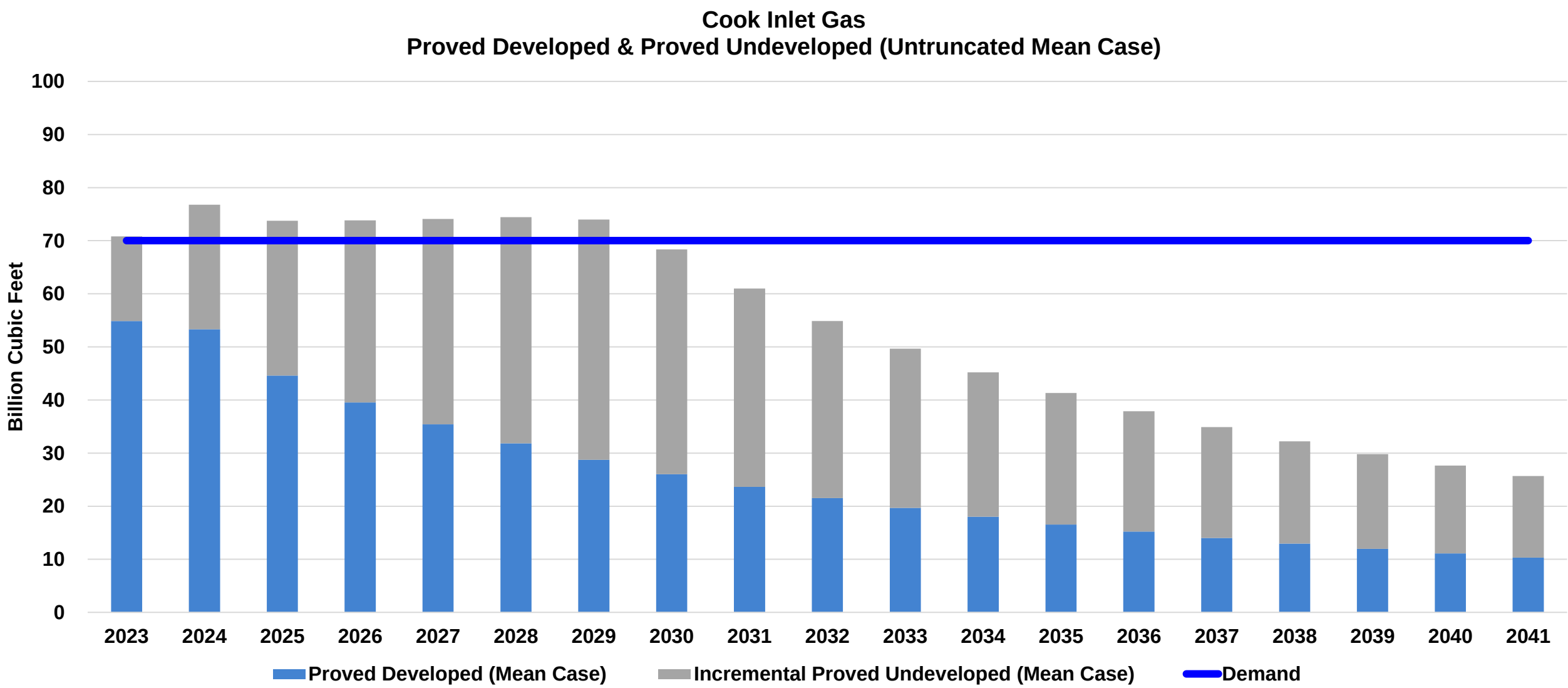
Forecast
Annualized Gas Volume (Untruncated)



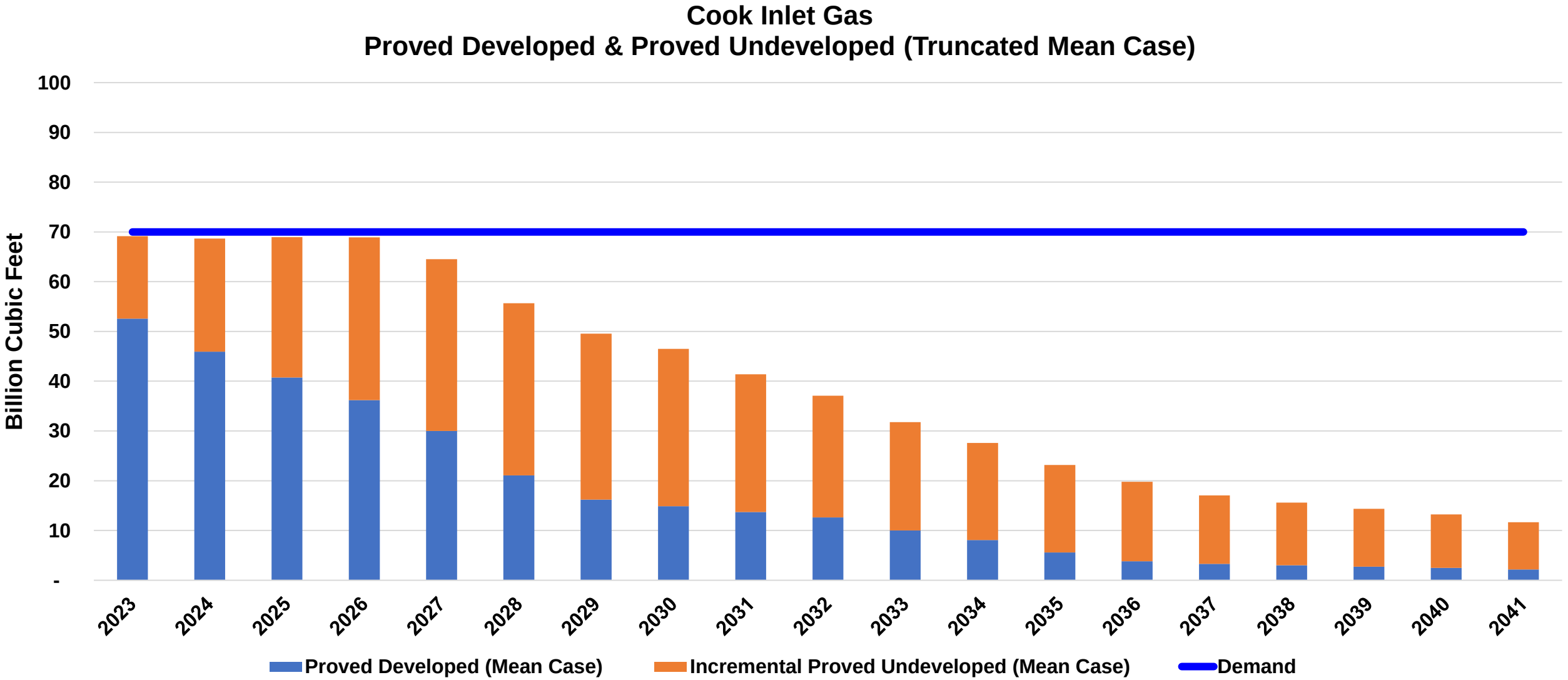
Forecast Annualized Gas Volume (Truncated)



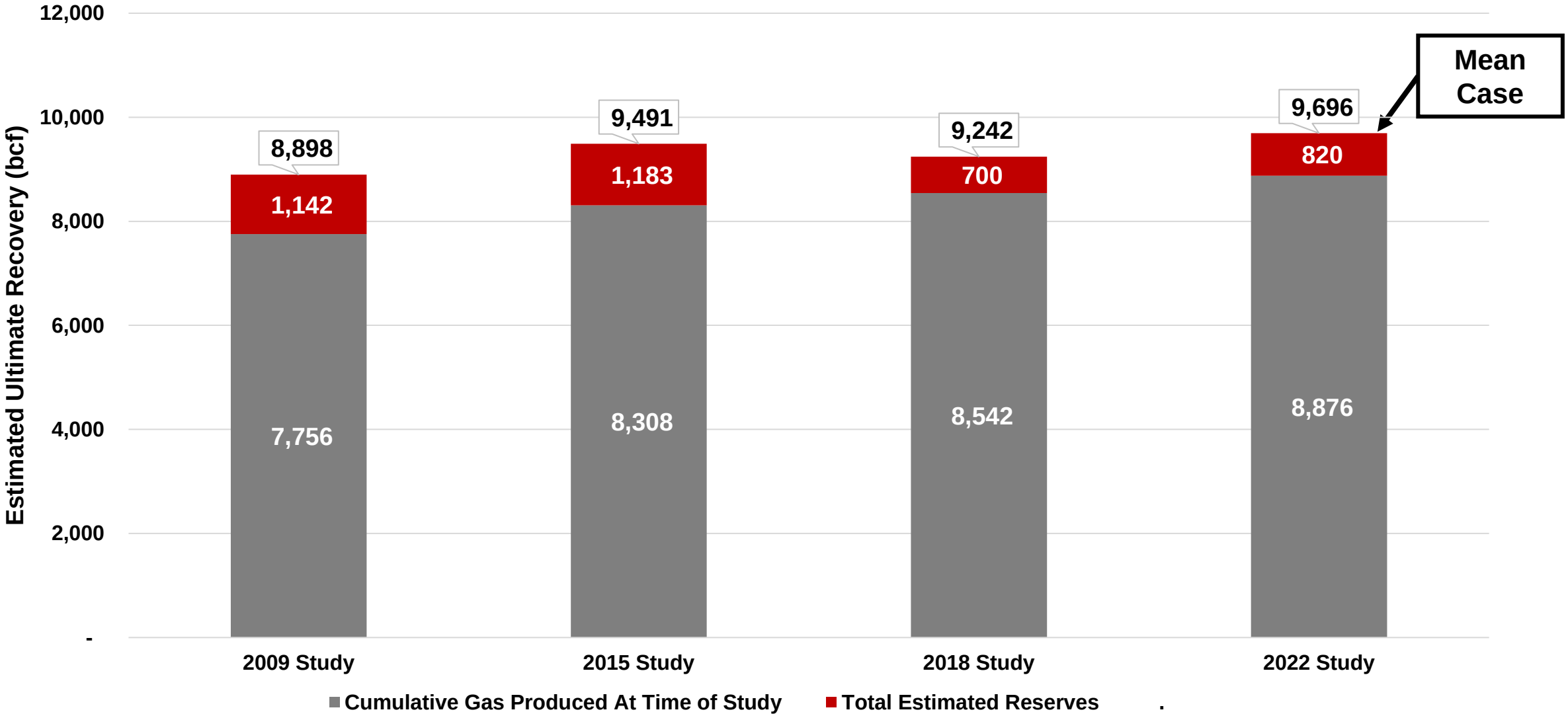
Forecast Proved Developed & Proved Undeveloped



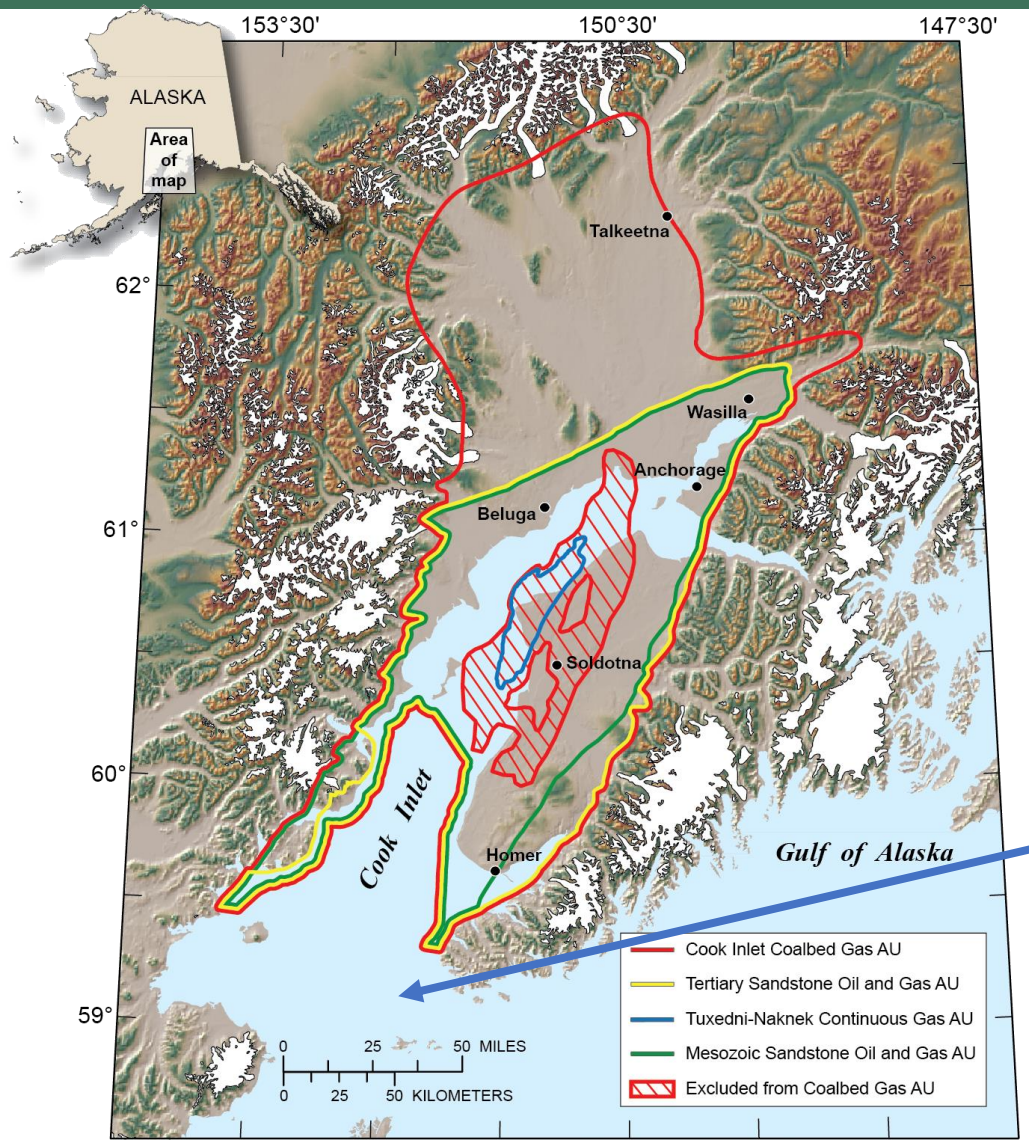
Forecast Proved Developed & Proved Undeveloped



Division of Oil & Gas Studies Compared



Exploration & Development in Cook Inlet: Cook inlet Undiscovered Resource



- **Undiscovered, Technically Recoverable Oil & Gas (USGS 2011):**
  - mean conventional oil 599 million barrels of oil
  - mean conventional gas 13.7 trillion cubic feet
  - mean unconventional gas 5.3 trillion cubic feet
- **Undiscovered, Technically Recoverable Gas:**
  - 1.2 trillion cubic feet additional mean resource assessed in Southern Cook Inlet OCS (BOEM 2011) *South of the USGS study area.*
- In general, access to additional area provides opportunities for locating and commercializing currently undiscovered resources.

Questions?

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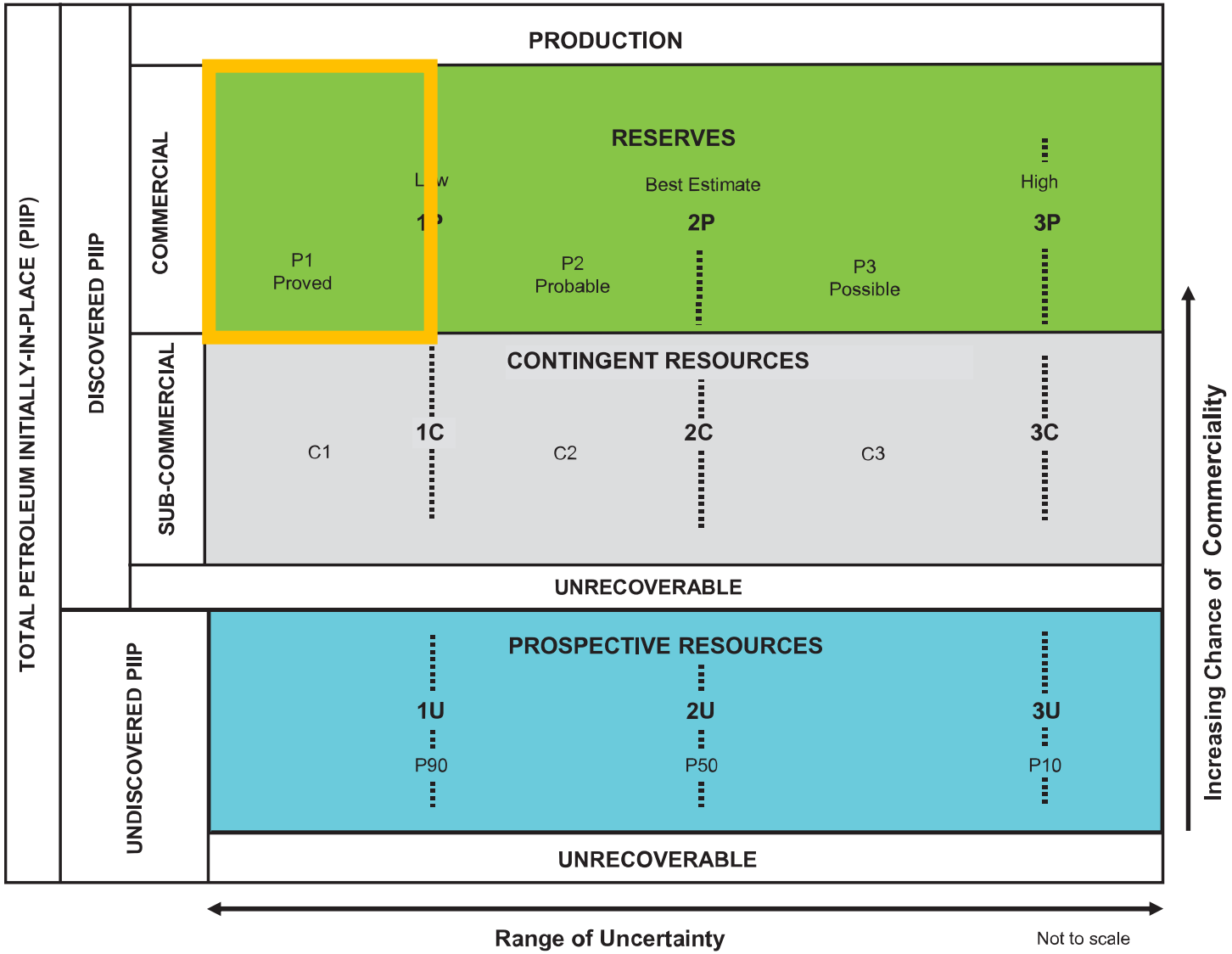
Petroleum Resource Management System



Proved Reserves (P1)

=

Proved Developed Gas Pool-Level Decline Curve Analysis

+

Proved Developed Associated Gas Pool-Level Decline Curve Analysis

+

Proved Undeveloped Type Curve Analysis

Scope & Application

- **Evaluated 90 different gas & oil pools in the Cook Inlet Basin as defined by AOGCC.**
  - Historical production considered through year-end 2021.
- **Probabilistic High-Mid-Low DCA forecasts performed at Pool-level for gas and associated gas.**
  - Pool forecasts begin January 2022.
  - Length of *untruncated* forecast projections mostly held to 20 years, depending on reservoir performance.
  - Field-level oil forecasts were generated to determine economic field oil rate that directly impact produced associated gas forecasts.
- **Type Curves used for future development assumed a steady drilling pace of 15 development wells per year based on historical development wells drilled between 2009 and 2019.**
- **DCA & Type Curve forecasts are run through economic model to derive economic limits for each field by using revenue, fiscal, and cost factors to estimate remaining Proved & Proved Undeveloped reserves.**
- **DCA & Type Curve forecasts are then combined and aggregated to produce a basin-wide forecast.**

Technical Methodology

Decline Curve Analysis

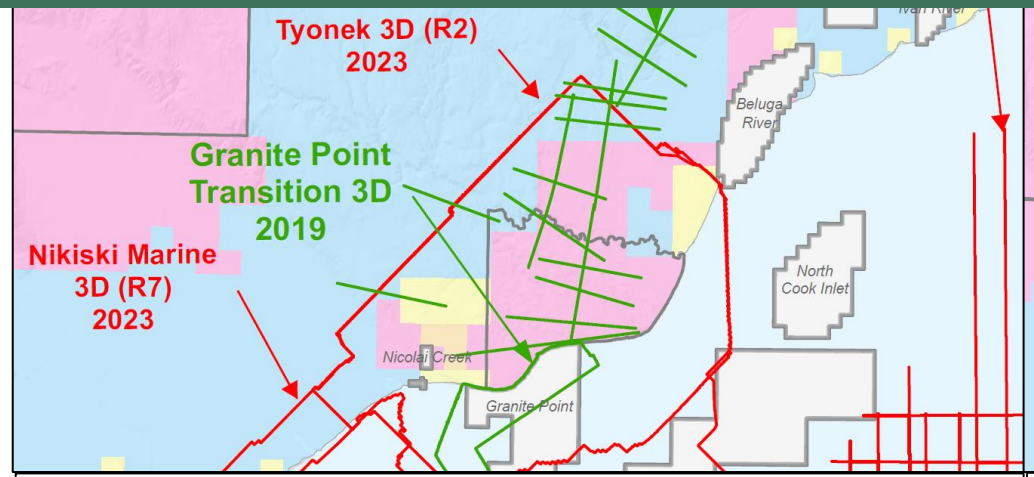
- Extrapolates recent trends of production decline into the future.
- Probabilistic forecasts were generated for currently producing pools to show a range of possible production into the future.
  - Uses statistical bootstrapping method in addition to traditional DCA to derive a quantifiable probabilistic range of outcomes, including High (P10), Mid (P50), and Low (P90) cases.
- Weighted toward recent production history.
- Engineering judgement applied to honor field development and reservoir constraints.

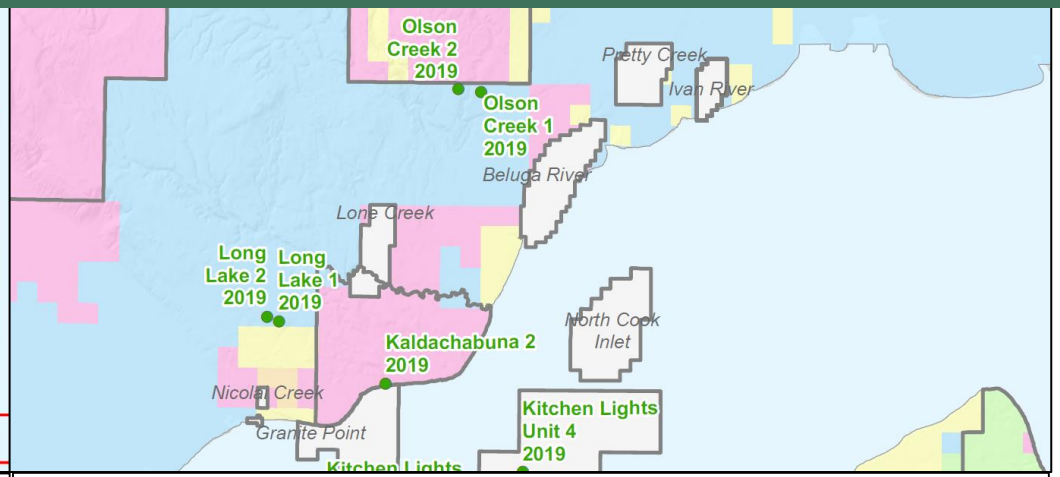
Type Curve Analysis

- Generated from a population of representative wells in respective pools, intended to characterize behavior of future wells drilled in pools.
  - Accounts for both geological parameters and reservoir conditions.
- Grounded in decline curve & statistical analysis using historical production data.
- Based on both historical development wells drilled between 2009 and 2019 and confidential information received from operators for specific fields that remain active and continue to develop in the Cook Inlet basin.

DCA & Type Curve forecasts are then combined and aggregated to produce a basin-wide forecast.

Data Release through the Tax Credits Program





Seismic Data Release Status

Seismic survey, showing data coverage:

2D survey	3D survey	Release Status
		Survey released and available at Geological Materials Center
		Statutory confidentiality period expired; survey eligible for and in preparation for release *(see notes 2, 3, and 4)*
		Other survey with tax credit certificate, statutory confidentiality period still in effect; survey not yet eligible for and prepared for release *(see notes 2, 3, 4, and 5)*

Notes:
1. This map is intended as a current snapshot of information that can be disclosed publicly regarding tax credit seismic surveys.
2. Representation on this map does not guarantee public release and is subject to statutory requirements in effect at the time of acquisition and application for tax credit.
3. Release is subject to public notice and permission of private oil and gas mineral estate owner where applicable. Some surveys require clipping to mineral ownership boundaries; actual map extents of released datasets may differ from those shown here.
4. Year label on "Released" surveys denote actual release year. Year label on "Eligible" and "Issued" denote the year in which the data is eligible for release and distribution under AS 43.55.025(f)(2)(c), most tax credit seismic projects are held confidential for 10 years from completion of initial seismic processing.
5. Map does not include surveys whose initial seismic processing was completed less than 10 years ago but prior to legislative adoption of the disclosure clause of AS 43.55.025(f)(5). Seismic surveys acquired with credits under AS 43.55.023 are not subject to disclosure under AS 43.55.025(f)(5), and cannot be represented here until their confidentiality period has expired.
6. Additional qualifying surveys will be added to this map as new tax credit certificates are issued or as changes in confidentiality status allows.

Source: DNR/DOG Tax Credit Seismic Surveys for Public Release Map updated: March 2022

Well Data Release Status

Well bottom hole location

Well	Has VSP Checkshot	Release Status
		Well released and available at Geological Materials Center
		Statutory confidentiality period expired; well data eligible for and in preparation for release *(see notes 2, 3, and 4)*
		Wells with issued tax credit certificate, statutory confidentiality period still in effect; well not yet eligible for and prepared for release *(see notes 2, 3, 4, and 5)*

Notes:
1. This map is intended as a snapshot of information that can be disclosed publicly regarding tax credit well data.
2. Representation on this map does not guarantee public release and is subject to statutory requirements in effect at the time of acquisition and application for tax credit.
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4. Year label on "Released" wells denote actual release year. Year label on "Eligible" and "Issued" denote the year in which the data is eligible for release and distribution under AS 43.55.025(f)(2)(c), most tax credit wells are held confidential for 2 - 10 years from the completion, suspension, or abandonment.
5. Map does not include wells completed, suspected, or abandoned less than 10 years ago but prior to legislative adoption of the disclosure clause of AS 43.55.025(f)(5). Wells acquired with credits under AS 43.55.023 are not subject to disclosure under .025(f)(5), and cannot be represented here until their confidentiality period has expired.
6. Additional qualifying wells will be added to this map as new tax credit certificates are issued or as changes in confidentiality status allows.

Source: DNR/DOG Tax Credit Well Data for Public Release Map updated: December 2020

DNR releases well & seismic data collected under the tax credit program (past the statutory holding period) for a nominal charge.

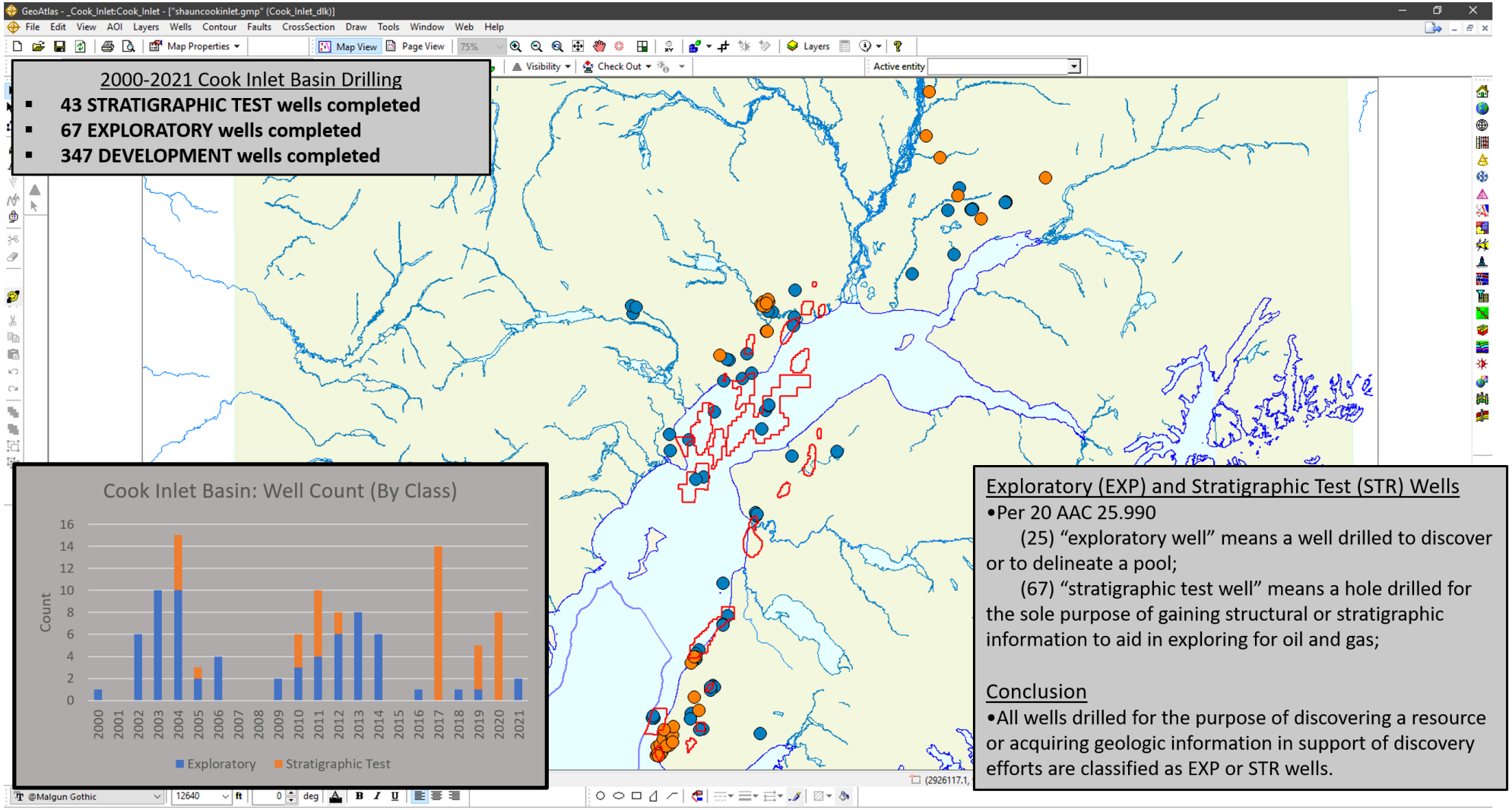
For the State:

- Increases subsurface resource knowledge
- Utility in managing State lands
- Purposed to incentivize new and additional investment

For Industry/Research:

- Lower barrier to entry
- Further published research/training
- Development of new technologies

Exploration & Development in Cook Inlet: 2000 through 2021



Recent Cook Inlet exploration activity comprises seismic, aerial surveys, and drilling of exploratory and stratigraphic test wells.

History of Cook Inlet Tax Credit Program: Design and purpose

The purpose of the Cook Inlet Tax credits is to "entice companies 'to invest more money in Alaska and drill more wells' so that the possibility of both discovery and production could be 'substantially' increased."

Minutes, Senate Finance Committee, May 13, 2003, summarizing comments from Sen. Wagoner regarding AS 43.55.025(a) tax credits contained in SB 185

Primary Cook Inlet Credits

AS 43.55.023(l) *

Well Lease Expenditure Credit

- In effect from 2010 – 2017 for Cook Inlet
- Credit equal to 40% of well or seismic cost (decreased to 20% in 2017)
- Not available for North Slope

AS 43.55.025(a) *

Alternative credit for exploration

- In effect from 2003 – 2016 for Cook Inlet (2010 for Jack-Up Rig Credit)
- Credit equal to 30% or 40% of well or seismic cost (increased from 20% in 2008)
- Distance restrictions from existing wells or units to qualify

Other Major Tax Credits

AS 43.55.023(a)

Qualified Capital Expenditure Credit

- In effect from 2006 – 2017 for Cook Inlet
- Credit equal to 10% - 20% of capital expenditures

AS 43.55.023(b)

Carried Forward Annual Loss Credit

- In effect from 2006 – 2017 for Cook Inlet
- Credit equal to 25% of annual loss (increased in 2007)

Additional Considerations

- Credits could be certificated, and either traded or repurchased by the State
- * These credits have DNR data submittal requirements