

ALASKA UTILITIES WORKING GROUP
PHASE I ASSESSMENT: COOK INLET GAS SUPPLY PROJECT

APPENDICES

June 28, 2023

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Appendix A

A1. BRG Practice Qualifications

A.1.1 Our Credentials

In this section, we provide a selection of our most relevant engagements related to gas supply assessment, infrastructure development and investment, market supply, and economic analysis.

- **Natural gas/LNG market study in Asia.** Assessed potential demand for natural gas and LNG for conversion of diesel and/or other liquid fuels, including current and planned diesel and/or liquid fueled power plants that potentially can be converted. Considered proximity to the coast, access to infrastructure, government regulations and policy. Assessed the cost components and economics of small/mid-scale LNG supply to potential customers. Assessed typical cost of conversion from diesel and/or liquid type fuel to gas for different sectors.
- **Gas market study for the Europe, Middle East, and Africa (“EMA”) region.** Prepared a gas market study including gas supply & infrastructure review, energy policy and regulatory overview, gas demand outlook assessment, gas contracts, pricing and market insights, and strategic market assessment.
- **Advisory for mid-scale LNG liquefaction project in Louisiana.** Conducted project feasibility analysis for the Calcasieu River LNG export project in the areas of technology and plant configuration, timeline of regulatory approvals and risks, assessment of the overall natural gas supply and transportation infrastructure, shipping logistics, competitiveness analysis and risk assessment.
- **Market analysis for LNG supplies in Mexico and U.S.** Provided a detailed analysis of NW Mexico and US Southwest markets for new LNG supplies to be delivered into Puerto Libertad, Sonora. Included detailed analysis of future demand, competing LNG and basin gas supply, LNG impacts on liquid trading hub prices, basis differentials, and inter-regional and international gas flows.
- **Colombia gas supply evaluation.** Evaluated gas supply terms and conditions and developed fuel nomination procedures included in the operations manual for a significant gas-fired IPP project jointly owned and operated by an international investor and a local regional utility in Colombia.
- **Commercial feasibility analysis of an LNG floating terminal for a European petroleum company.** Provided market and commercial analysis to assess the economic viability of developing an FSRU import terminal in the eastern Mediterranean. Conducted a techno-commercial evaluation for importing LNG into the Greek market. The work included the development of monthly long-term (20 year) natural gas supply and demand model of gas market fundamentals in the country, accounting for government policies impacting the future primary energy mix, technological evolution in the power and maritime sectors, and carbon regulations. The study included an evaluation of technological parameters including site evaluation, a metocean conditions assessment, and technology selection to evaluate

technical feasibility of a floating LNG terminal. Detailed CAPEX and OPEX analyses were developed and evaluated for LNG import, regasification, and distribution in country. Existing gas pipeline constraints and competition for gas were also evaluated and highlighted.

- **Utility gas supply portfolio study.** Evaluated adequacy and selection of a gas supply portfolio by the utility. Provided expert testimony before the Georgia Public Service Commission.

A2. Cornerstone Energy Services Credentials

A.2.1 Our Credentials

In this section, we provide a selection of our most relevant engagements related to our LNG project management, engineering and design services.

LNG Projects

- **Led the engineering and design effort for this turnkey project.** Complete design, material specification, procurement support, permitting support, and construction support for the installation of a two-bay truck unloading/loading station, with operator kiosk, boil-off handling, control system and integration into the existing LNG facility in Brooklyn, NY.
- **Provided Project Management and lead Engineering in support of New LNG import terminal in New England.** Efforts included designs associated with storage, vaporization, trucking, interconnector pipelines, remote berth with sub-sea LNG transfer lines.
- **Led the engineering and design effort for this turnkey project.** Complete design, material specification, procurement support, and permitting support for upgrading the existing sendout system including LNG pumps, vaporizers, boil-off gas handling, truck unloading, odorize, gas chromatograph as well as a new modern control system for the LNG facility in southern New England.
- **Provided project management and engineering services for a proposed 70,000 gallons per day liquefaction plant in Canada.** The project will support the local township, local mining association, and five surrounding municipalities, as the proposed LNG facility will provide gas to the proposed local gas distribution system within the communities.
- **Project–project and engineering design services associated with proposed LNG import terminal in northern New England.** This project included an approximate 35-mile connector pipeline. Services included routing, field survey, right of way efforts and design associated with FERC filing package.
- **Supported efforts associated with expansion of an existing LNG import terminal in southern New England.** These services included project management for design and construction of 375 MMSCF/d high-pressure send out, new ship berth, new high-volume boil-off compressor system, administration building expansion, electric service

modernization (dual-feed, 34kV).

- **Provided lead engineering in support of New LNG import terminal in Tarbert, Co. Kerry, Ireland.** Efforts included designs associated with storage, vaporization, interconnector pipeline, EU procurement regulations.

Pipeline and Above Ground Facility Efforts

- **Project management, design, permitting, construction/commissioning support as well as as-builts/job books in support of new pipeline company in New England.** This new system consisted of approximately 70-miles of steel transmission pipe, 150-miles of HDPE distribution pipe as well as 2 interconnection facilities, 9 main line valve sites, 6 pressure regulator sites and 1 pig farm.
- **Design and construction support of a power plant addition in NJ.** This project included new interconnection with gas transmission company, new 16" pipeline with three HDD sections, new gas compressors (4), gas blending skid, cooling skid and ADC building. Project also included commissioning, purge support, procurement, and materials tracking.
- **Design of a CNG trailer offloading facility.** Project required decompression of 1100 MSCFH of natural gas from 4,250 psig to 80 psig prior to injection into a local distribution system for use on zero-degree days. Design responsibilities included offload stations from sixteen CNG trailers, gas pre-heat, pressure regulation, fuel gas service, and metering.
- **Conceptual design, CAPEX and OPEX estimates for a new gas transmission and distribution system in the southern Ontario, Canada.** Our Team also developed a GasWorks model of the proposed system and performed the system analysis of the proposed design including developing peak estimates and system performance under various conditions.
- **Provided project management as well as engineering design** on numerous natural gas pipelines being routed, engineered, permitted, and installed in various locations throughout the mid-Atlantic region. To date, Cornerstone's project team has provided right-of-way acquisition, routing, field engineering, field survey, mapping, drafting as well as as-built services on over 200-miles of natural gas midstream pipelines being developed in this area.
- **Field and engineering services** required to identify High Consequence Areas and Class Locations for over 300-miles of pipelines in Texas. Our GIS team incorporated the resulting data into the client's GIS database and developed corresponding alignment sheets for presenting class data.
- **Provided project management as well as engineering design** on numerous natural gas

pipelines being routed, engineered, permitted, and installed in various locations throughout Colorado and Wyoming. To date, Cornerstone's project team has provided right-of-way acquisition, routing, field engineering, field survey, mapping, drafting as well as as-built services on over 150-miles of natural gas midstream pipelines being developed in this area.

- **Provided project management, procurement, design, construction support and as-built services** as part of a major build out of assets in west Texas, of multiple projects totaling over 300-miles of transmission and midstream pipelines and associated above ground facilities. Included all standard and trenchless design as well as interconnect, valve, and meter/regulation sites.
- **Provided project management and associated services** associated with all mapping, field survey, design and drafting associated with approximately 200-miles of new natural gas pipeline facilities in northern New England.
- **Provided project management and associated services** associated with all mapping, field survey, design and drafting associated with approximately 400-miles of new natural gas pipeline facilities. Throughout Tennessee, Virginia, and North Carolina.

Appendix B

B1. List of Documents Cited

No.	Document Title
1.	26 U.S. Code §45V – Credit for production of clean hydrogen. See White House, Building a clean energy economy: A guidebook to the inflation reduction act’s investments in clean energy and climate action, available at https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf .
2.	46 CFR 154.176(b)(1)(iii)(A), Longitudinal contiguous hull structure, up to date as of May 19, 2023;
3.	46 CFR 154.172(c), Contiguous steel hull structure, up to date as of May 19, 2023;
4.	46 CFR 154.32(c), Equivalents, up to date as of May 19, 2023;
5.	Alaska Gasline Development Corporation, public Alaska LNG and ASAP project information, at https://agdc.us/ .
6.	Anchorage Daily News, <i>Hotly debated federal Cook Inlet oil and gas lease sale draws only 1 bid</i> , Dec. 30, 2022, https://www.adn.com/business-economy/energy/2022/12/30/hotly-debated-federal-cook-inlet-oil-and-gas-lease-sale-draws-only-1-bid/ .
7.	Baker, A., <i>Calgary’s Pembina Pipeline Eyeing Cedar LNG FID by Third Quarter</i> , Natural Gas Intelligence, February 28, 2023, https://www.naturalgasintel.com/calgarys-pembina-pipeline-eyeing-cedar-lng-fid-by-third-quarter/ .
8.	Bettina Chastain (CEA Board President) and Arthur Miller (CEA CEO), <i>Opinion: Anchorage’s electric utility is making progress on its clean-energy goals</i> , Anchorage Daily News (April 13, 2023).
9.	Bloomberg, <i>Global LNG market outlook 2022-26</i> , June 29, 2022, https://www.bloomberg.com/professional/blog/global-lng-outlook-overview-tight-supply-expected-until-2026/ .
10.	Bloomberg Tax, <i>The New Clean Hydrogen Production Tax Credit, Explained</i> , November 23, 2022, https://news.bloombergtax.com/daily-tax-report/the-new-clean-hydrogen-production-tax-credit-explained .
11.	BNEF LNG export and import projects – 4Q 2022.
12.	Bradner, Tim. <i>Study says Inlet gas discoveries won’t stop shortage</i> , Alaska Journal of Commerce, March 22, 2012.
13.	Chambers, S., <i>LNG carrier rates on a charge</i> , Splash 247, September 14, 2022, https://splash247.com/lng-carrier-rates-on-a-charge/ .
14.	Chugach Electric, <i>Fire Island Wind- Power Purchase Agreement</i> , https://www.chugachelectric.com/about-us/regulatory-affairs/fire-island-wind .

15.	Chugach Electric, <i>South District Rate Information</i> , April 1, 2023, https://www.chugachelectric.com/member-services/billing-payments/rate-information-south-district .
16.	ConocoPhillips, <i>The History of Cook Inlet</i> , https://www.conocophillipsalaska.com/ea/cookinlettimeline/ .
17.	Corri A. Feige (ADNR Commissioner) and Lucinda Mahoney (Alaska Department of Revenue Commissioner), <i>Investing in Alaska Beyond ESG</i> , January 2022, available at https://dog.dnr.alaska.gov/Documents/ResourceEvaluation/Alaska_ESG_Jan_2022.pdf .
18.	Davis, Carolyn, Natural Gas Intel, <i>Alaska Gasline Secures Final EIS for Pipeline Project</i> , June 22, 2018, https://www.naturalgasintel.com/alaska-gasline-secures-final-eis-for-pipeline-project/ .
19.	DeMarban, Alex, <i>Hilcorp Warms Alaska utilities about uncertain Cook Inlet natural gas supplies</i> , Anchorage Daily News, May 17, 2022.
20.	Dempsey, H., <i>Europe battles to secure specialized ships to boost LNG imports</i> , Financial Times, March 27, 2022, https://www.ft.com/content/bc5f79a6-729e-47ff-bf46-cb23c460fa6f .
21.	EIA, <i>Natural Gas Weekly Update, Alaska is a major natural gas producer, but little of the natural gas reaches market</i> , May 27, 2021, https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2021/05_27/ .
22.	IEA, <i>Gas Market Report Q1 2023</i> , https://iea.blob.core.windows.net/assets/c6ca64dc-240d-4a7c-b327-e1799201b98f/GasMarketReportQ12023.pdf .
23.	IRENA, <i>Renewable Power Generation Costs in 2021</i> , p. 15, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jul/IRENA_Power_Generation_Costs_2021.pdf?rev=34c22a4b244d434da0accde7de7c73d8
24.	Kirong, N., <i>Alaska utilities plan \$200M Railbelt transmission system upgrades</i> , S&P Global, May 30, 2022.
25.	Lacey, Pamela A., <i>Developments in Renewable Natural Gas: The Promise of RNG</i> , American Gas Association, October 26, 2017, p. 8, available at https://www.epa.gov/sites/default/files/2017-11/documents/27.lacey_2017aiw.pdf .
26.	LNG Prime, <i>LNG Canada pipeline more than 85 percent complete</i> , March 31, 2023, https://lngprime.com/americas/lng-canada-pipeline-more-than-85-percent-complete/77690/ .
27.	Matanuska Electric Association, <i>Schedule of Rates for Q2 2023</i> , https://www.mea.coop/co-op-benefits/current-rates .
28.	Miller, G., <i>Price of LNG goes stratospheric. Will LNG shipping rates follow?</i> , Freight Waves, August 24, 2022, https://www.freightwaves.com/news/price-of-natural-gas-goes-stratospheric-will-lng-shipping-rates-be-next .
29.	Municipality of Anchorage, <i>Anchorage Landfill Gas to Energy Project Details</i> , https://www.muni.org/departments/sws/pages/anchlandfillgastoenergypri.aspx
30.	Offshore Technology, <i>Pembina Pipeline's \$2.4bn Cedar LNG project secures environmental approval</i> , March 15, 2023, https://www.offshore-technology.com/news/pembina-cedar-environmental-nod/ .

31.	Oracle, <i>Crystal Ball</i> , https://www.oracle.com/applications/crystalball/ .
32.	Palisade, <i>@Risk Probabilistic Risk Analysis in Excel</i> , https://www.palisade.com/risk/?gclid=Cj0KCQjwxYOiBhC9ARIsANiElfbQoh42P7VupRbwECl9ONAdSoR5is5PmHL08PQFvztrsfDdzod7fAaAuKVEALw_wcB .
33.	Poten & Partners, <i>Chinese Buyers Line Up Deals</i> , LNG In World Markets, August 2021.
34.	Poten & Partners, <i>Portfolio Players Underpin Sole 2020 FID</i> , LNG In World Markets, November 2020.
35.	Poten & Partners, <i>US Export Projects in Pole Position for FIDs</i> , LNG In World Markets, January 2023.
36.	Poten & Partners, <i>US Projects Rank High on FID List</i> , LNG In World Markets, January 2022.
37.	Regulatory Commission of Alaska, <i>Affidavit of John D. Sims</i> , p. 3, November 9, 2022, Docket U-22-090.
38.	Reuters, <i>Agrium closes Alaska plant, blames gas shortage</i> , September 26, 2007, https://www.reuters.com/article/agrium-alaska-idUSWEN126820070925 .
39.	Roser, M., <i>Why did renewables become so cheap so fast?</i> , Our World in Data, December 1, 2020, https://ourworldindata.org/cheap-renewables-growth .
40.	Roszkowska, Ewa, <i>Rank Ordering Criteria Weighting Methods – A Comparative Overview</i> , Optimum Studia Ekonomiczne, Issue 65, No. 5, 2013.
41.	Saugier, Luke, <i>Presentation to Alaska State Legislature</i> , House Energy Committee, p. 5, January 2023.
42.	Seapeak, <i>Our fleet</i> , https://www.seapeak.com/our-capabilities/our-fleet/ .
43.	Sempra, <i>Sempra Infrastructure Receives Export Licenses for Two LNG Projects</i> , December 22, 2022, https://www.sempra.com/sempra-infrastructure-receives-export-licenses-two-lng-projects .
44.	S&P Global, <i>Platts JKM (Japan Korea Marker) LNG Price Assessment</i> , https://www.spglobal.com/commodityinsights/en/our-methodology/price-assessments/lng/jkm-japan-korea-marker-gas-price-assessments .
45.	State of Alaska Department of Natural Resources, Division of Oil & Gas, <i>Cook Inlet Natural Gas Availability</i> , March 2018, available at https://dog.dnr.alaska.gov/Documents/ResourceEvaluation/CI_Natural_Gas_Availability_Study_2018.pdf .
46.	State of Alaska Department of Natural Resources, Division of Oil and Gas, <i>2022 Cook Inlet Gas Forecast</i> , January 2023, available at https://dog.dnr.alaska.gov/Documents/ResourceEvaluation/Cook_Inlet_Gas_Forecast_Report_2022.pdf .
47.	TradeWinds, <i>Thirty-year-old Seapeak LNG carrier offered for demolition sale</i> , January 11, 2023, https://www.tradewindsnews.com/gas/thirty-year-old-seapeak-lng-carrier-offered-for-demolition-sale/2-1-1385599 .

48.	US Department of Energy, HydroGen, <i>High Efficiency PEM Water Electrolysis Enabled by Advanced Catalysts, Membranes and Processes</i> , p. 3, April 30, 2019, https://www.hydrogen.energy.gov/pdfs/review19/p155_ayers_2019_o.pdf .
49.	US Department of Energy, <i>LNG Annual Report 2014</i> , Office of Fossil Energy.
50.	US Department of Energy, <i>LNG Annual Report 2015</i> , Office of Fossil Energy.
51.	US EPA, <i>Project and Landfill Data by State- Alaska (March 2023)</i> , https://www.epa.gov/lmop/project-and-landfill-data-state .
52.	World Resources Institute, <i>Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers</i> , December 17, 2020, https://www.wri.org/research/renewable-natural-gas-climate-strategy-guidance-state-policymakers .

B2. Cook Inlet Incremental Development Assumptions

Incremental Cook Inlet Supply was calculated using 50th percentile. This supply curve was calculated using a 15% real hurdle rate in the March 2018 ADNR Study.¹

Figure 1: Augmented Cumulative Supply from ADNR Natural Gas Availability Study, March 2018

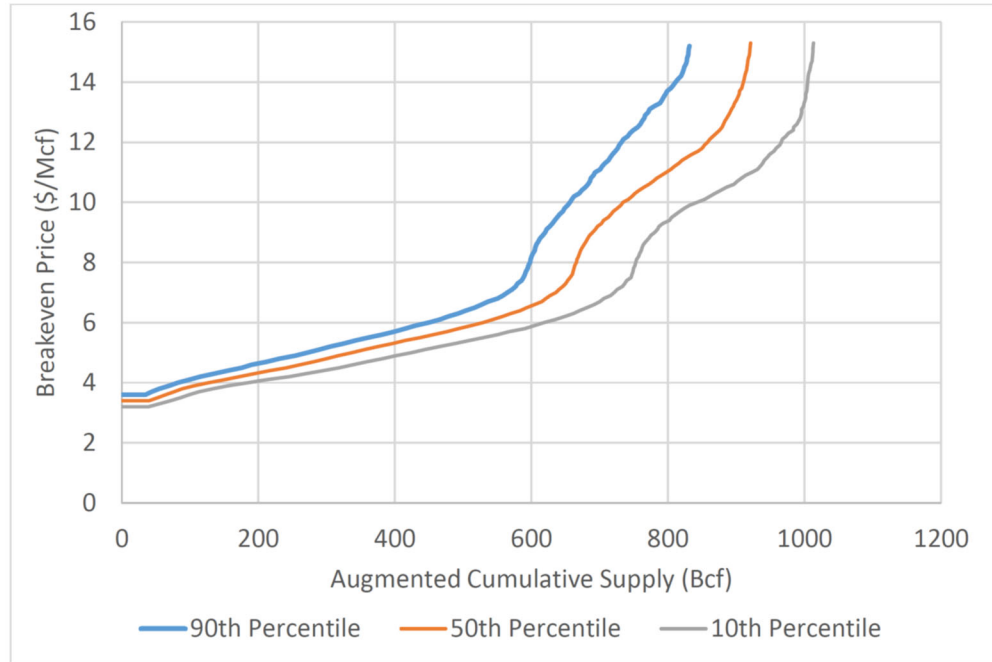


Figure A-1. Cumulative supply from augmented production sources (15% real hurdle rate)

The augmented cumulative supply in Figure 1 includes volumes of gas that would have been economic to produce in the range of prevailing Cook Inlet gas prices over the past 5 years. Resources developed in the past 5 years would be included in the proved developed production forecast provided by DNR in 2022. Various economic and technical factors likely impact the expected resource size and expected recovery in this period. Furthermore, the 2018 ADNR Study assessed reserves and resources based on probability of recovery, expressed in the form of percentiles, and hurdle rate scenarios resulting in significant variability in the estimated amounts of expected recovery.

To estimate the remaining incremental supply, we limited incremental volumes to those in excess of 700 BCF. The augmented cumulative supply curve indicates that incremental gas volumes in the amount of 100 BCF could be recovered in the price range from approximately \$9.3/mcf to \$11/mcf in (\$2016). An additional 120 BCF could be recovered in the range from \$9.3/mcf to \$15.1/mcf. To arrive at the upper end of the range of \$25.5 we adjusted \$15.1/mcf using PPI inflation between 2016 and December 2022 (factor of 1.69). Incremental volumes were applied to meet the unmet demand while retaining decline profiles that would ensure expected ultimate recovery less than 100 BCF and 120 BCF for the two supply tranches.

¹ 2018 ADNR Study, p. 34.

Appendix C

C1. Options Inventory

Options - Private or Utility Consortium					BRG	BV
Remaining Cook Inlet Natural Gas (beyond current contract volumes)	A	Proved	1	Onshore Conventional Developed and Undeveloped		
		Probable	2	Offshore Conventional Undeveloped		
			3	Onshore Conventional Undeveloped		
		Prospective	4	Onshore and Offshore Conventional Undeveloped		
		Other	5	Coalbed Methane		
Other Thermal Fuels	B	Gas	6	Blue Hydrogen (natural gas feed stock)		
			7	Green Hydrogen (clean energy electrolysis)		
			8	Compressed Natural Gas (CNG)		
			9	Renewable Natural Gas (RNG Biogas)		
		Liquid	10	Blue Ammonia (natural gas feed stock)		
			11	Diesel		
		Solid	12	Coal		
North Slope Gas	C	AK LNG Project	13	42' North Slope to Nikiski		
			14	Pipeline Acceleration Variant		
			15	LNG Terminal Acceleration Variant		
		In-State Pipeline	16	36" Size variant		
			17	24" Size variant		
		Other	18	Arctic Fox 12" pipeline to Fairbanks		
			19	Arctic LNG (Qilak)		
		20	LNG Trucking or Truck/Rail			
Cook Inlet LNG Imports	D	Land Based LNG Facilities	21	Greenfield Terminal, Storage, and Regas		
			22	Retrofit existing Nikiski facilities for Import		
		Floating Storage and Regas Units (FSRU)	23	Chartered FSRU		
			24	Retrofit FRSU		
			25	New Build FSRU		

Options - State participation					BRG	BV
24" In-State Pipeline	E	80% subsidy	26	Sized for in-state demand with expansion opportunity; 80% of capital contributed by government entity.		

		100% State Owned	27	Sized for in-state demand with expansion opportunity; state-owned with 2% annual return on investment.	
LNG Import to Land Based Grass Roots Terminal, Storage, and Regas Facilities	F	80% subsidy	28	Land based LNG facilities; 80% of capital contributed by government entity.	
		100% State Owned	29	Land based LNG facilities, state-owned with 2% annual return on investment.	

- options independently investigated by both consultants with similar results (cost, schedule, risks)
- options independently investigated by Black & Veatch ("BV")
- options independently investigated by BRG

C2. Options Evaluated by B&V

#	Options		Project Cost	Cost of Supply	Schedule to Place into Service	Risks	Status
i.	Additional Regional Natural Gas Supply	Cook Inlet Onshore Conv Gas	\$10's million	Cook Inlet parity	1 to 5 years	Resource constraint; Outside of utility control	Active
		Cook Inlet Offshore Conv Gas	\$10's million	Cook Inlet parity	1 to 5 years		
		Lower Cook Inlet Offshore Conv Gas	\$100's million	Not specified	3 to 10 years	Lack of investors; offshore permitting issue	Seeking investors
		Coal Bed Methane	\$10's million	Diesel parity ²	5 to 10 years	No proven economic production in Alaska	Inactive
ii.	Other Alternatives	Blue Hydrogen ³	\$1,150 million	\$39 to \$62/Mcf	5 to 7 years	High initial investment; Requires pipeline transportation	Limited commercial deployment; Research undergoing on

² Anchorage Daily News, interview with Bob Fowler, CEO Fowler Oil and Gas concerning Susitna Gas exploration area license applications, February 20, 2022.

³ Project cost is based on assumed project size to meet annual demand of 15.3 Bcf/year.

#	Options	Project Cost	Cost of Supply	Schedule to Place into Service	Risks	Status	
						project economics	
iii.	Compressed Natural Gas (CNG)	\$150 to \$200 million	\$7/Mcf +	18 to 24 months	Difficult to scale	Commercially available	
iv.	Blue Ammonia ⁴	\$1,400 million	\$26/Mcf	5 to 7 years	High initial investment; Relatively high cost for production and transportation	Limited commercial deployment; Research undergoing on project economics	
v.	Diesel ⁵	Not applicable	\$17 to \$20/Mcf	Not applicable	For peaking only; environmental risk	Commercially available	
vi.	North Slope Natural Gas	Alaska LNG Project (42" pipeline from North Slope to Nikiski)	\$39 billion ⁶	\$6.7/Mcf	8 to 10 years	Uncertainties in project development; Outside of Chugach control; additional processing required from higher BTU content	Seeking anchor customers
		Alaska LNG Project (Terminal Accelerated)	\$1.5 to \$2.0 billion ⁷	Not specified	5 to 6 years	Outside of Chugach control	Seeking investors
		Alaska in-state Pipeline (Bullet line, 24' to 36' pipeline)	\$13 billion ⁸	\$11.5 to \$14.5/Mcf	8 years	Outside of Chugach control	Inactive

⁴ Project cost is based on assumed project size to meet annual demand of 15.3 Bcf/year.

⁵ Assuming shipping from Lower 48.

⁶ Alaska Gasline Development Corp, Alaska LNG Project Update, October 27, 2022. Assuming project developed by third parties. Costs represent total project costs \$2012.

⁷ Assuming project developed by third parties. Costs represent total project costs \$2012.

⁸ Assuming project developed by third parties. Costs represent total project costs \$2012.

#	Options	Project Cost	Cost of Supply	Schedule to Place into Service	Risks	Status
	Arctic Fox Pipeline, 12" pipeline from North Slope to Fairbanks	\$716 to \$1,002 million ⁹	\$9.7/Mcf	2 to 3 years	Insufficient market	Inactive
	LNG Trucking or Truck/Rail/Pipe	\$55 million	\$25 to \$30/Mcf	2 to 5 years	Transportation logistics	Inactive

C.2.1 B&V Assumptions

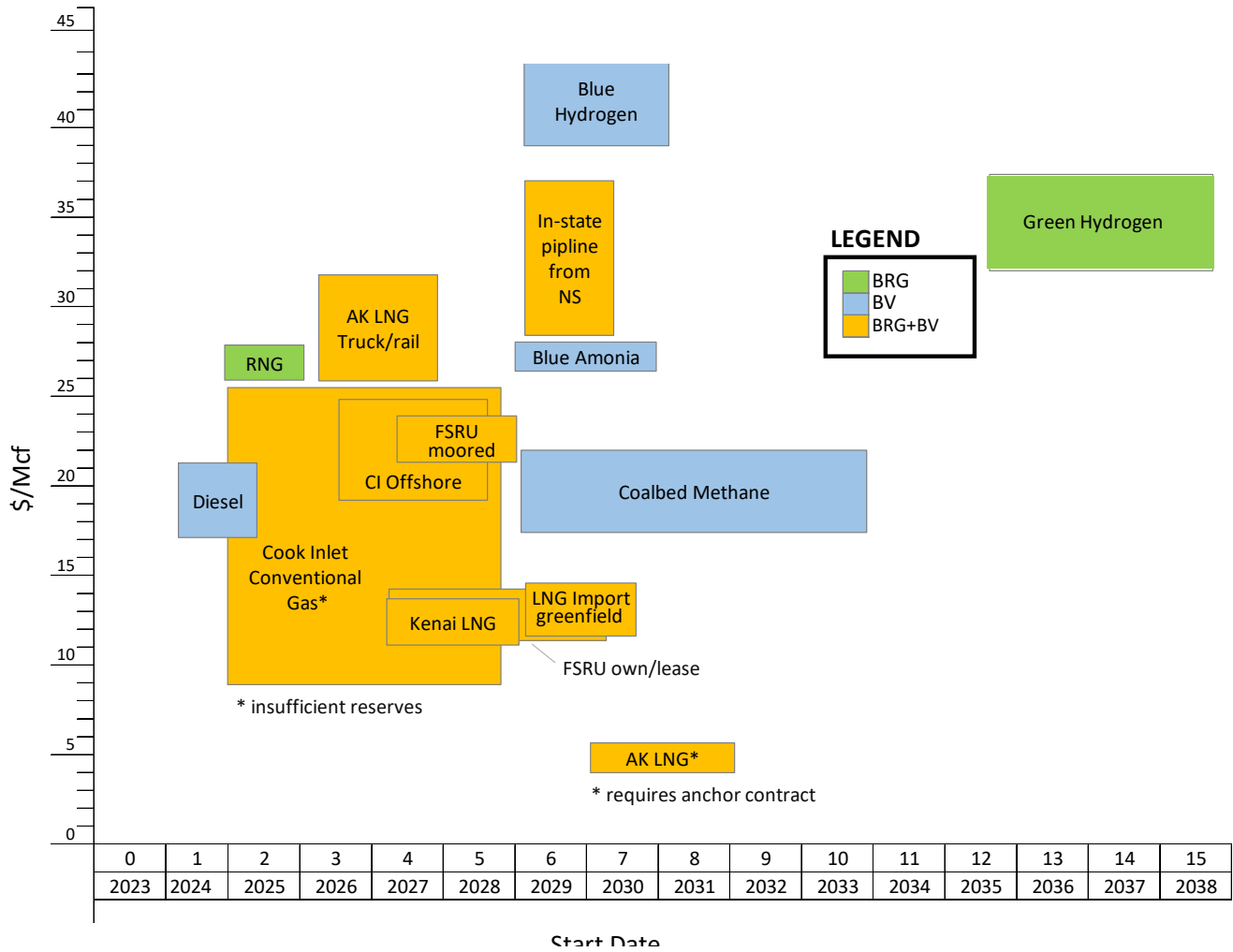
#	Options	Assumptions
ii.	Blue Hydrogen	<ul style="list-style-type: none"> ○ North Slope conversion Steam methane reforming (SMR) technology + carbon capture utilization and storage (CCSU) Export via pipeline for blue hydrogen: 800 miles from North Slope <ul style="list-style-type: none"> ○ Facility technical characteristics H2 production capacity: ~460 tonnes/day (for demand of 15.3 Bcf/year at 70% capacity factor) Capacity factor: 70% for H2 production SMR on-line: 2031 <ul style="list-style-type: none"> ○ Fuel cost: \$3.0/mmbtu ○ Alaska cost adder: 25% for project capital cost ○ Levelized hydrogen pipeline cost: assuming 18" pipeline, \$3.5 to \$6.0/kg of H2
iv.	Blue Ammonia	<ul style="list-style-type: none"> ○ North Slope conversion SMR technology + CCSU Export via railway/trucking for blue ammonia: 800 miles from North Slope <ul style="list-style-type: none"> ○ Facility technical characteristics Ammonia production capacity: 2,857 tonnes per day (for demand of 15.3 Bcf/year at 70% capacity factor for H2 production and 97% for ammonia facility) SMR on-line: 2031

⁹ Assuming project developed by third parties. Costs represent total project costs \$2012.

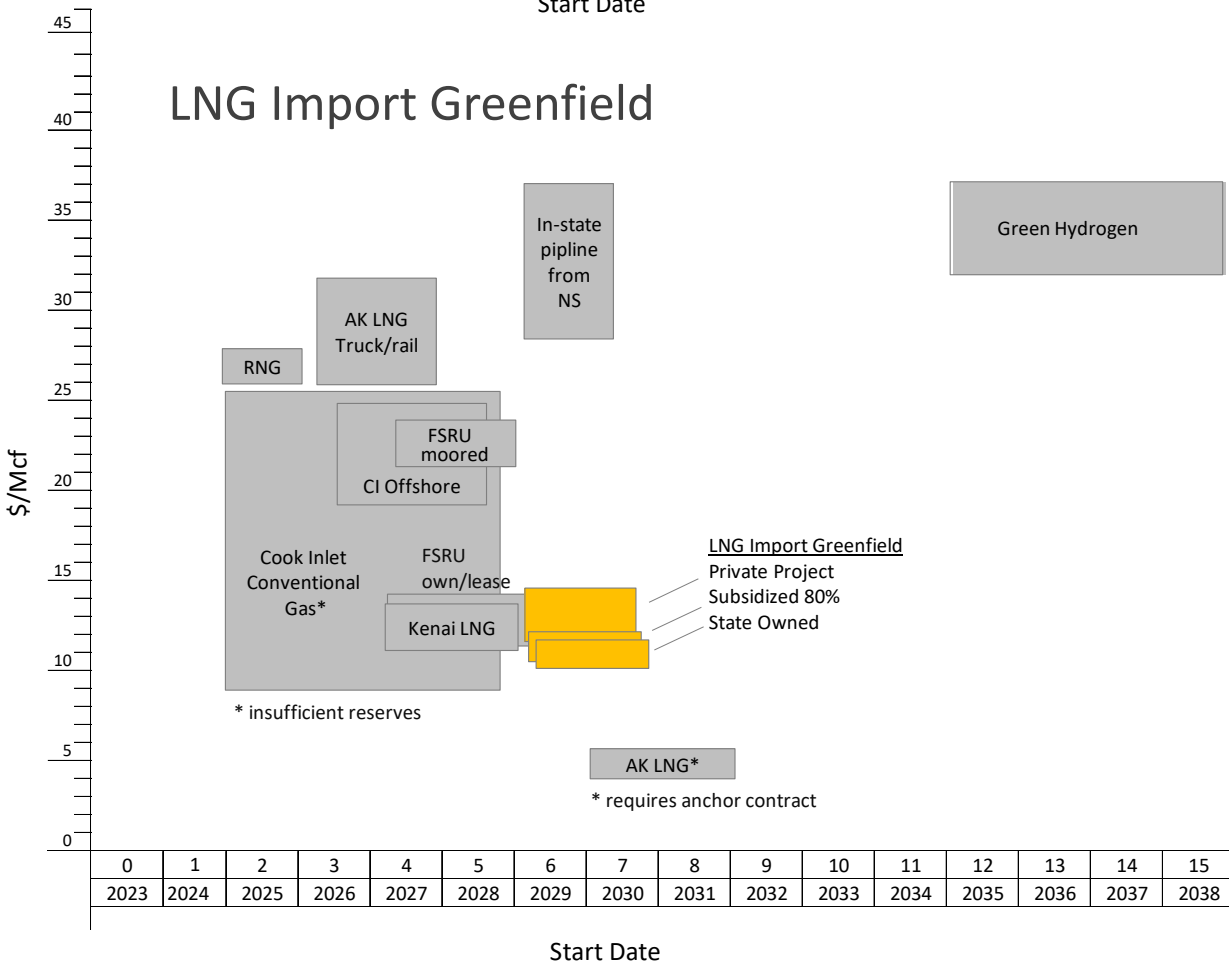
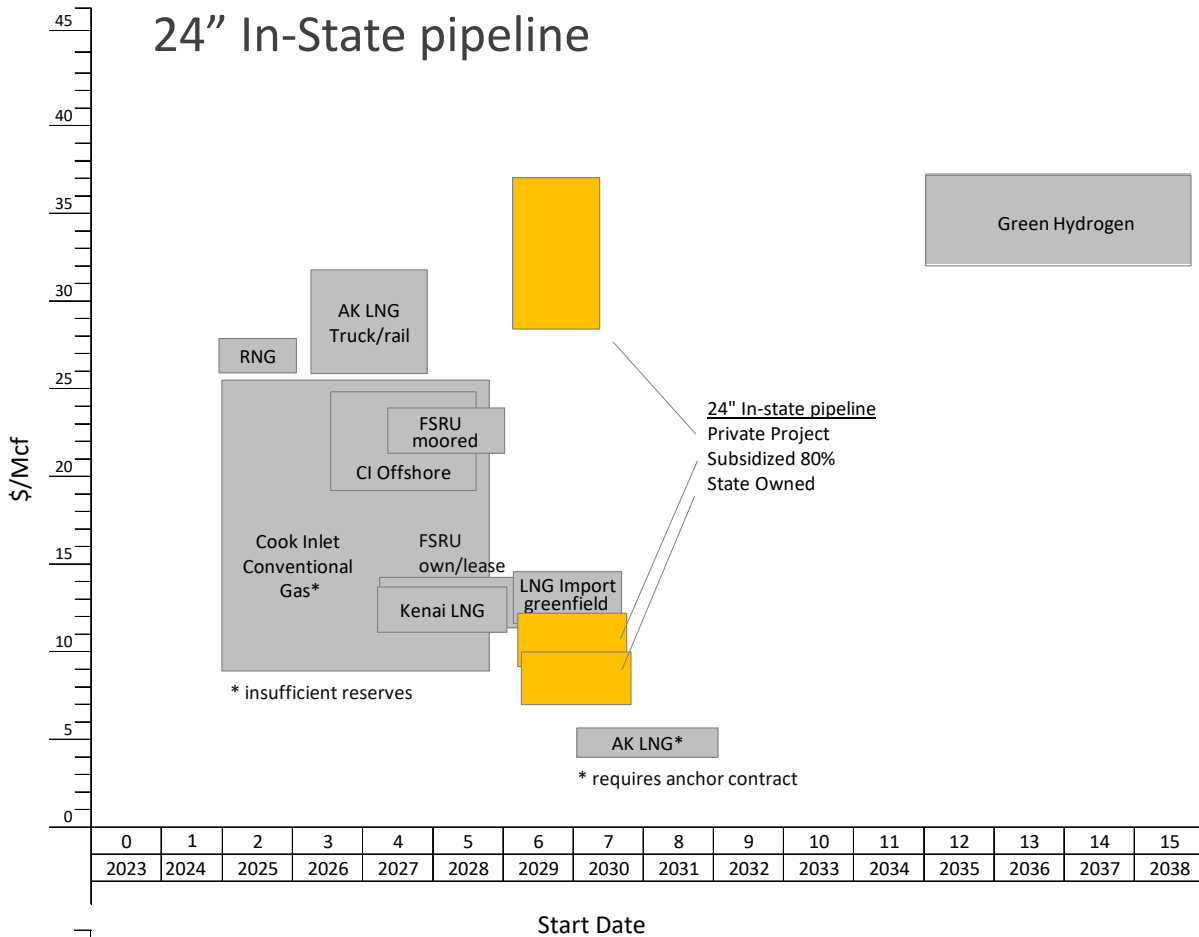
#	Options	Assumptions
		<ul style="list-style-type: none"> ○ Fuel cost: \$3.0/mmbtu ○ Alaska cost adder: 25% for project capital cost ○ Transportation: Trucking miles: \$0.5/mile-short ton Rail miles: \$0.2/mile-short ton
vi.	Coal	<ul style="list-style-type: none"> ○ Remaining coal fired power plants in Alaska are interior based locations served by a single coal producer and are either scheduled to retired or being investigated to be retired and replaced with natural gas and/or imported electricity from the Railbelt grid. ○ Permitting for new coal fired power plants and regulations for siting, emissions, and ash disposal has become more time consuming and uncertain. ○ Clean Coal (emissions scrubbing and carbon sequestration) has proven technically difficult and expensive. ○ There is currently only one major producer of coal in Alaska so little competition on fuel price, permitting and funding for new Alaskan coal mines would be time consuming and uncertain. ○ As of September 2021, developers have not reported plans to install any new utility-scale coal-fired power plants in the United States. Source: U.S. Energy Information Administration December 15, 2021 ○ Not competitive with other energy options for Cook Inlet.
vii.	Arctic LNG (Qilak)	<ul style="list-style-type: none"> ○ Arctic offshore liquified natural gas export terminal with ice breaking LNG tankers ○ To compete with PAO Novatek Yamal facility in Russia for Asian demand ○ Developer is Dubai based Lloyds Energy ○ Heads of Agreement signed 2019 with ExxonMobil affiliate for Pt. Thomson supply ○ 250 Bcf/yr project capacity increments ○ \$25/mscf capital expenditures ○ \$5Bn (2023) CAPEX phase 1 ○ Source: NaturalGasIntel March 22, 2023 ○ Cook Inlet not targeted market, not competitive with other global sources of LNG available to Cook Inlet.

BRG and B&V Consensus Options Dashboard

Cost of Supply vs. Start Date Analysis



Impact of State Participation on Key Options



Cook Inlet LNG Import Options

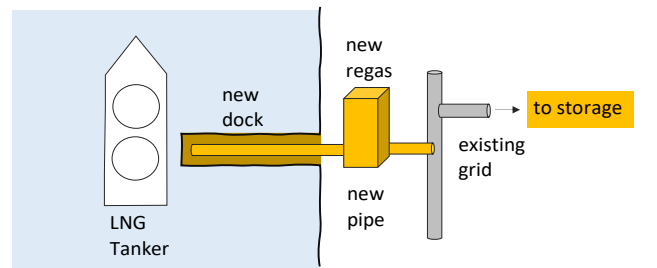
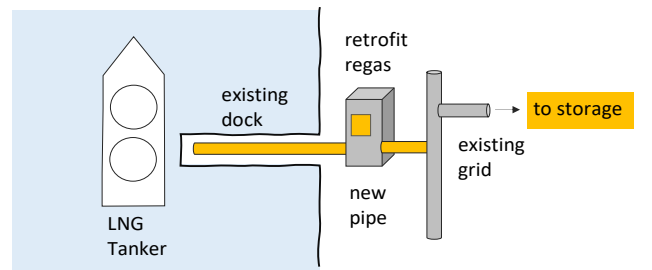
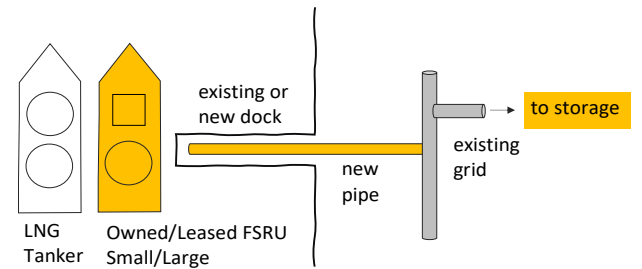
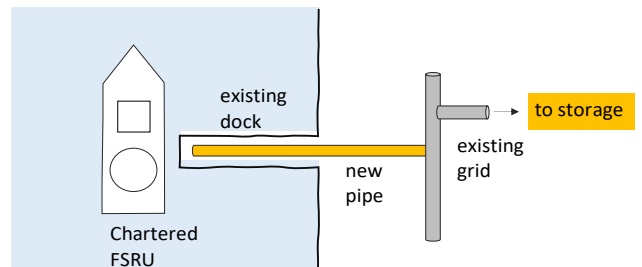
Configurations and indicative metrics

BRG size 55 Bcf/y (top row of each option table)

BV size 15.3 Bcf/y (bottom row of each option table)

	Size Bcf/y	Capital \$MM	Years	Cost of Gas \$/mcf		
				Feedstock	Midstream	Total
Chartered FSRU	55	201	4 - 6	8.6 - 8.9	3.6 - 5.0	12.2 - 13.9
	15.3	60 - 80	3 - 5	8.0	4.6 - 4.7	12.6 - 12.7
Owned FSRU	55	607	4 - 6	8.6 - 8.9	3.6 - 5.0	12.2 - 13.9
	15.3	345 - 365	4 - 6	8.0	4.0	12.0
Kenai Retrofit	55	768	4 - 5	8.6 - 8.9	3.4 - 4.7	12.0 - 13.6
	15.3	150	4 - 6	8.0	4.0	12.0
Kenai Grassroots	55	876	6 - 7	8.6 - 8.9	4.0 - 5.3	12.6 - 14.2
	15.3	350 - 450	5 - 7	8.0	4.0 - 5.0	12.0 - 13.0

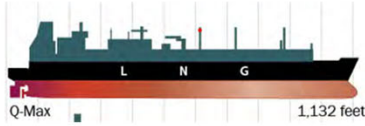
 New kit required



LNG Shipping Options

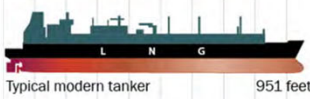
LNG Liquid Tankers

Conventional LNG Tankers



Ship Capacity

5.5 bcf



3.5 bcf



Cook Inlet Class

(ice passport)

2.5 bcf



0.4 bcf



LNG Bunker Barge up to 416 feet
smaller vessels are barges towed by tugs

0.2 bcf

FSRU Options

Large FSRU-LNG



Ship Capacity

Regas Rate

3.4 bcf

max 400 mmsfd

small scale FSRU



0.1-1.0 bcf

min 50 mmcfd

Floating storage plus onboard regasification
smaller vessels are barges towed by tugs