Clean Ammonia Opportunities for the Cook Inlet

Alaska Support Industry Alliance – Kenai Chapter
January 13, 2023

ALASKA GASLINE DEVELOPMENT CORP.

Alaska LNG: Gas for Alaskans & Export

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North Slope Gas Supply

- 40 trillion cubic feet (tcf) of discovered, conventional, and developed North Slope associated gas from Prudhoe Bay and Point Thomson
- Gas is currently stranded

Arctic Carbon Capture (ACC) Plant

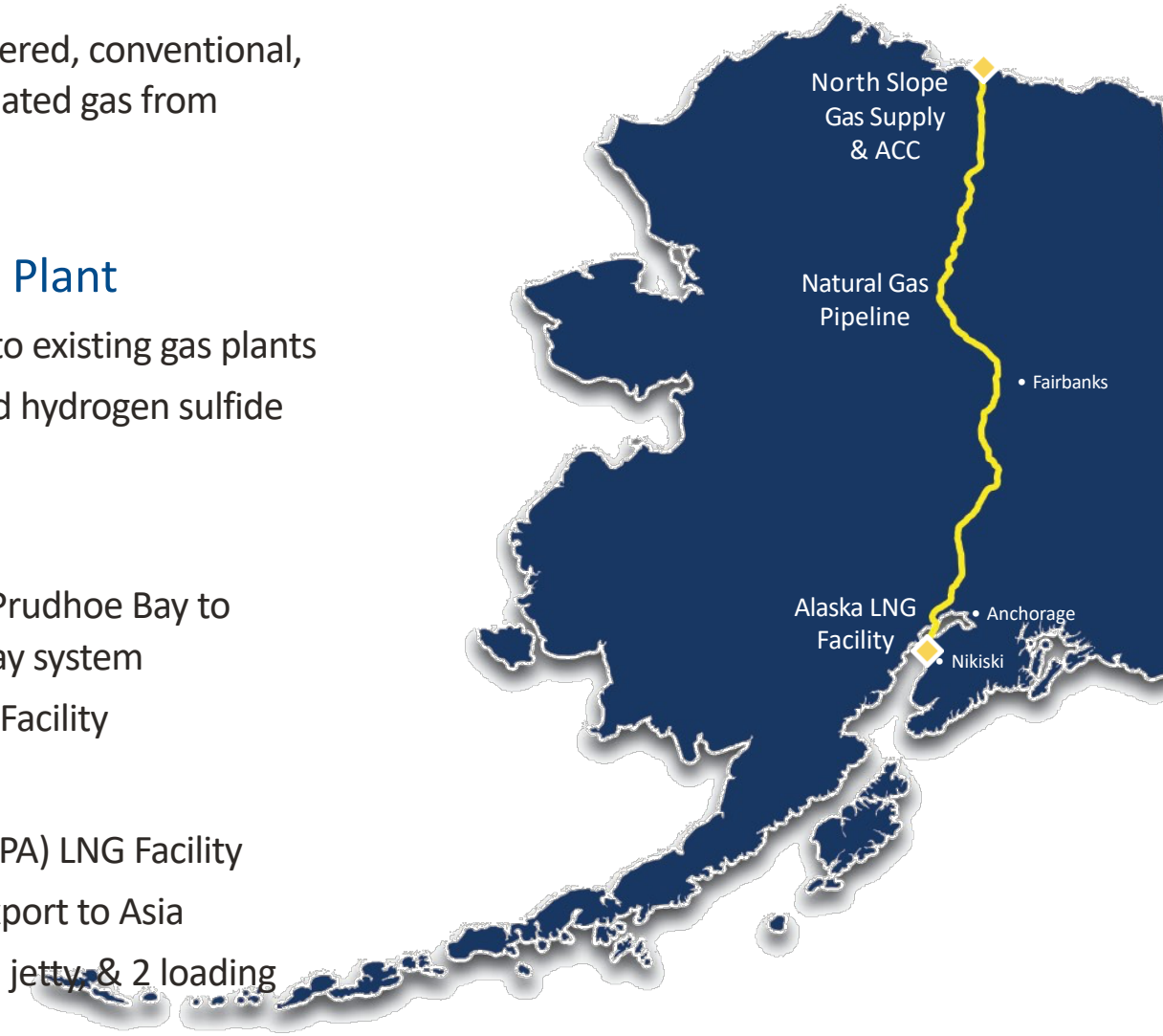
- Located in Prudhoe Bay adjacent to existing gas plants
- Removes carbon dioxide (CO_2) and hydrogen sulfide (H_2S) from raw gas stream

Natural Gas Pipeline

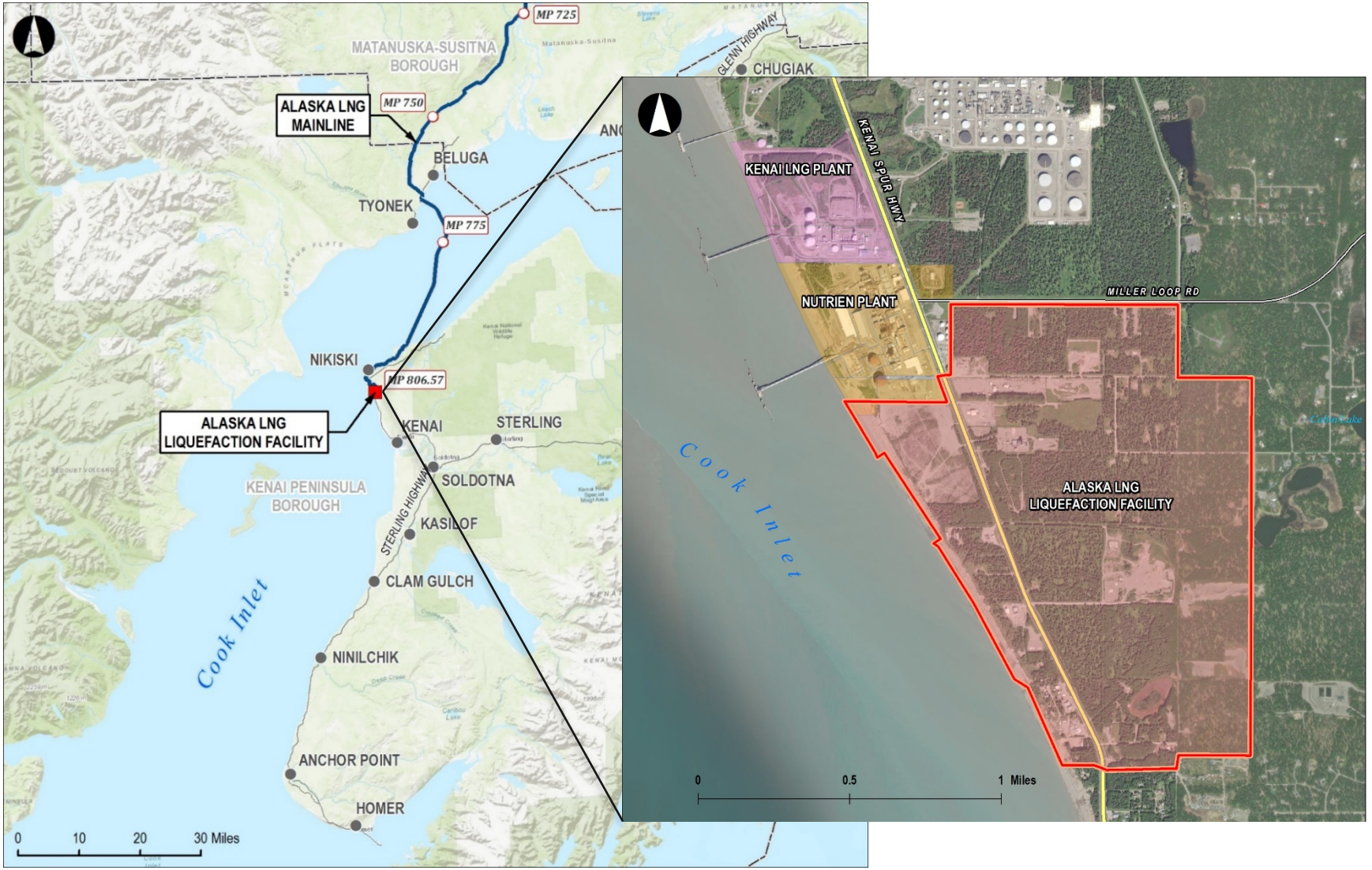
- 807-mile, 42” dia. Mainline from Prudhoe Bay to Nikiski, following TAPS and highway system
- Provides gas to Alaskans and LNG Facility

Alaska LNG Facility

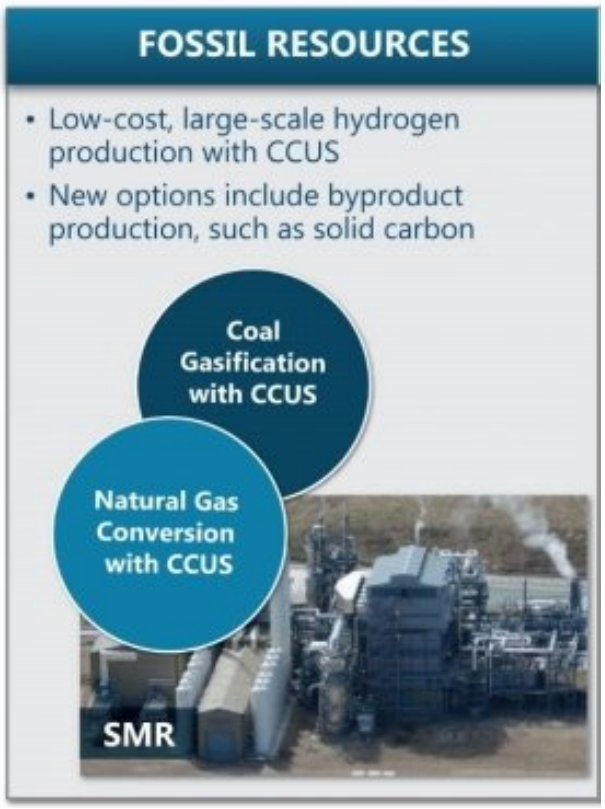
- 20-million tonnes per annum (MTPA) LNG Facility
- Converts natural gas to LNG for export to Asia
- 3 liquefaction trains, 2 LNG tanks, jetty, & 2 loading berths

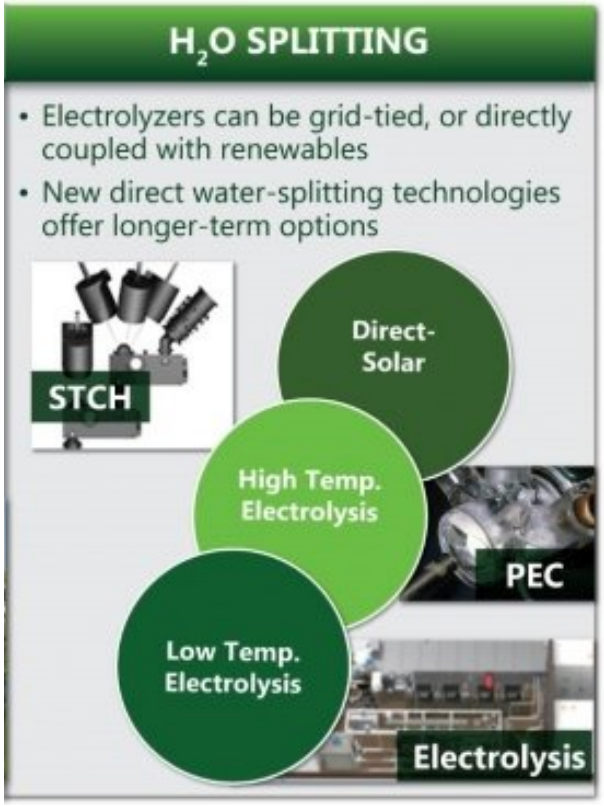


Cook Inlet Vicinity Map



Hydrogen Production

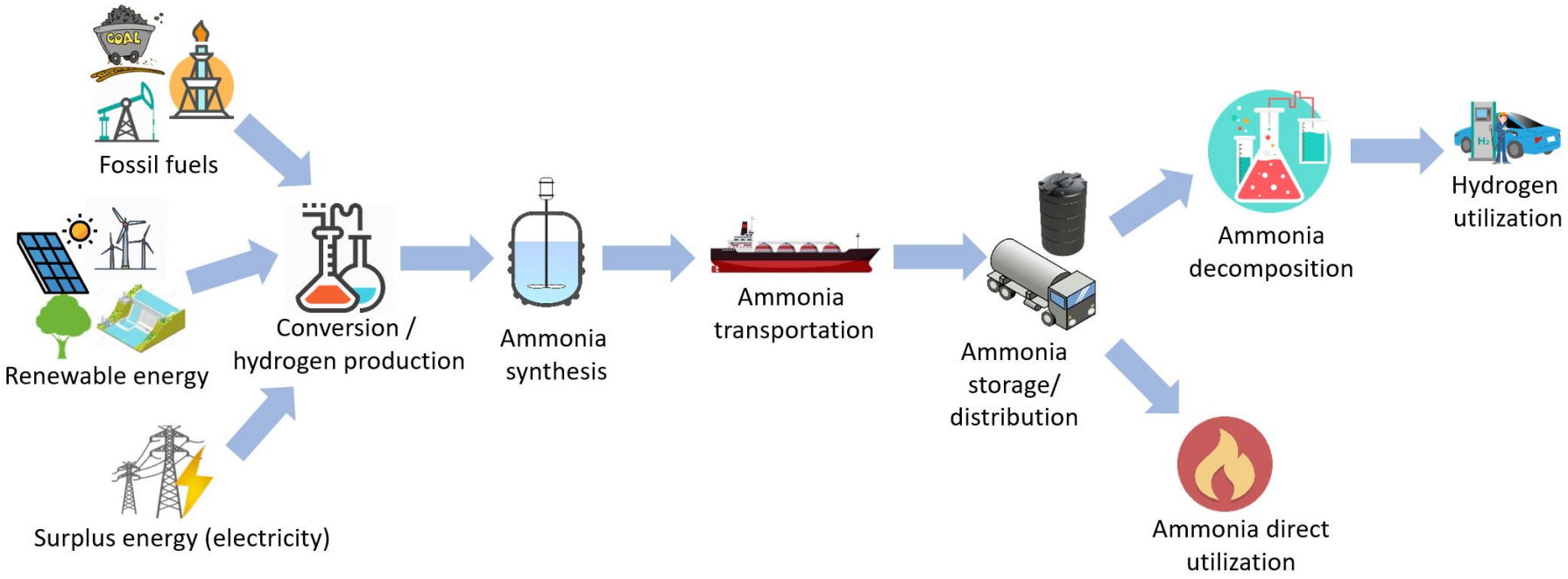




CCUS: carbon capture, utilization, and storage; SMR: steam methane reforming; STCH: solar thermochemical hydrogen; PEC: photoelectrochemical.

Source: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Hydrogen Production Pathways
Hydrogen Production Pathways | Department of Energy

Ammonia as a Hydrogen Carrier



Source: Encyclopedia.pub Ammonia as a Hydrogen Carrier

Alaska LNG & Hydrogen

ALASKA GASLINE DEVELOPMENT CORP.

Japanese-Led Work Team

Mitsubishi Corporation

TOYO ENGINEERING

AGDC-led Alaska H2Hub

Nutrien Santos STOREGGA

ACEP Alaska Center for Energy and Power

SALAMATOF INC

ONE CREW ONE JOURNEY

U.S. DOE Hydrogen Hub Program

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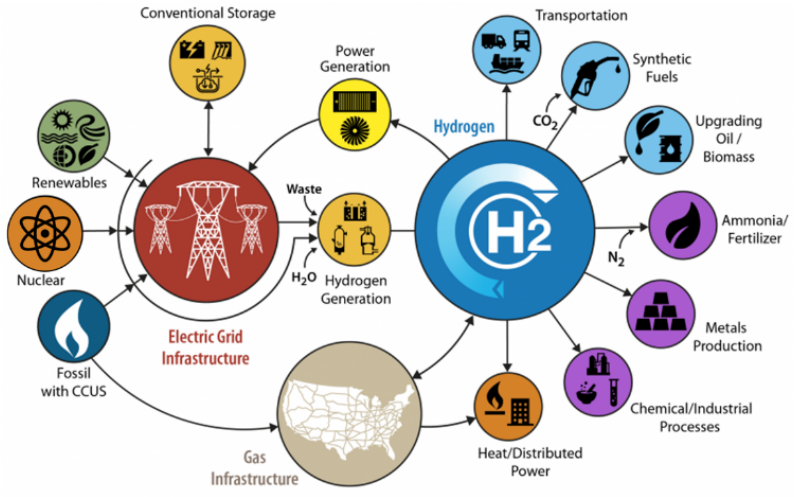
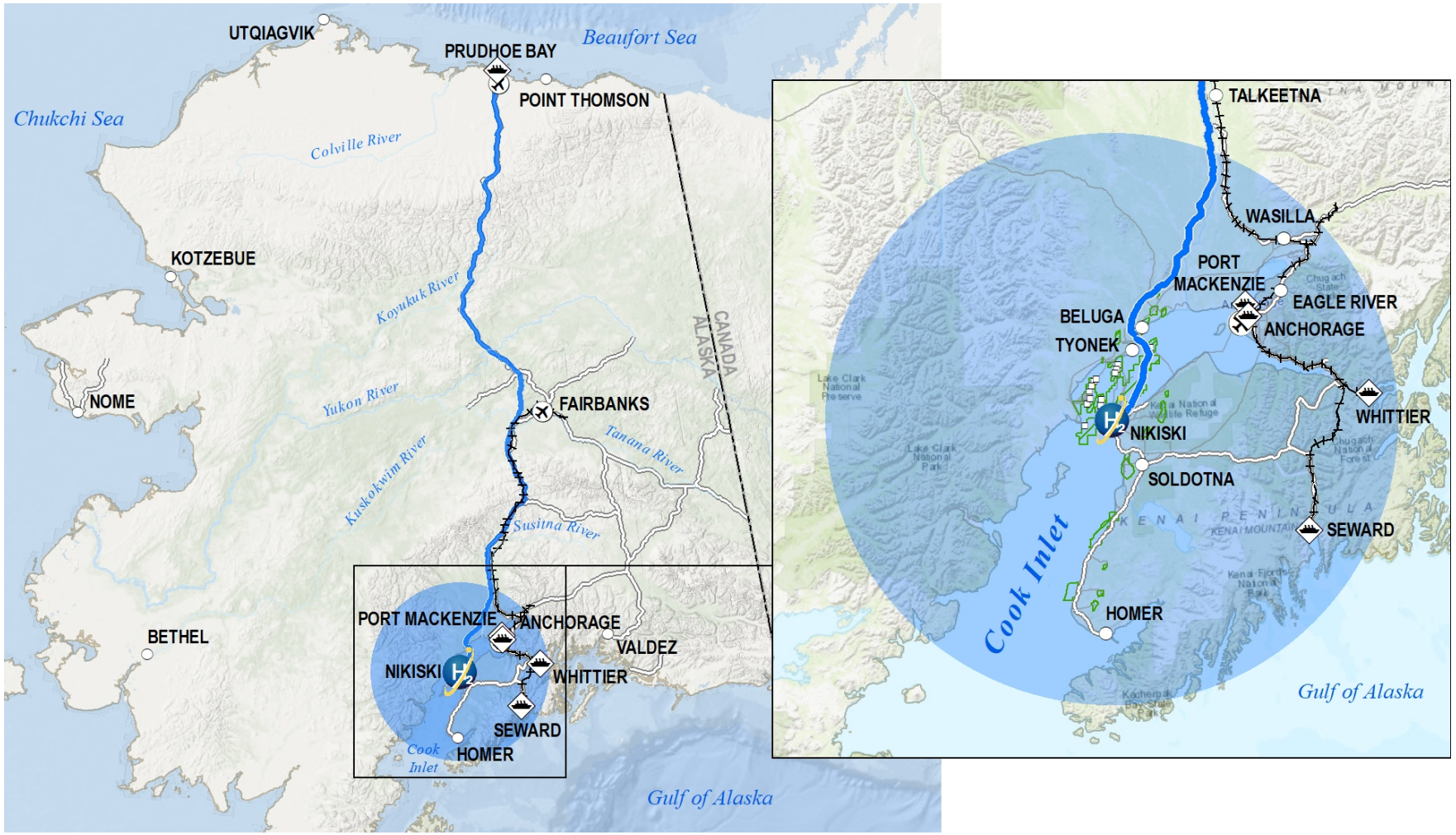
- Bipartisan Infrastructure Law (BIL) of 2021
  - Funding of 6 to 10 regional clean hydrogen hubs (H2Hubs)
  - $8 billion over 5 years.
- Intended to spur development of regional infrastructure leading to production, processing, delivery, storage, and end-use of clean hydrogen
- Criteria for producing impactful, commercial-scale quantities of clean hydrogen is at least 50 – 100 tons per day
- A single DOE H2Hub award could be up to $1 billion in direct matching grants
- AGDC was identified as the applicant to lead an Alaska H2Hub pursuit



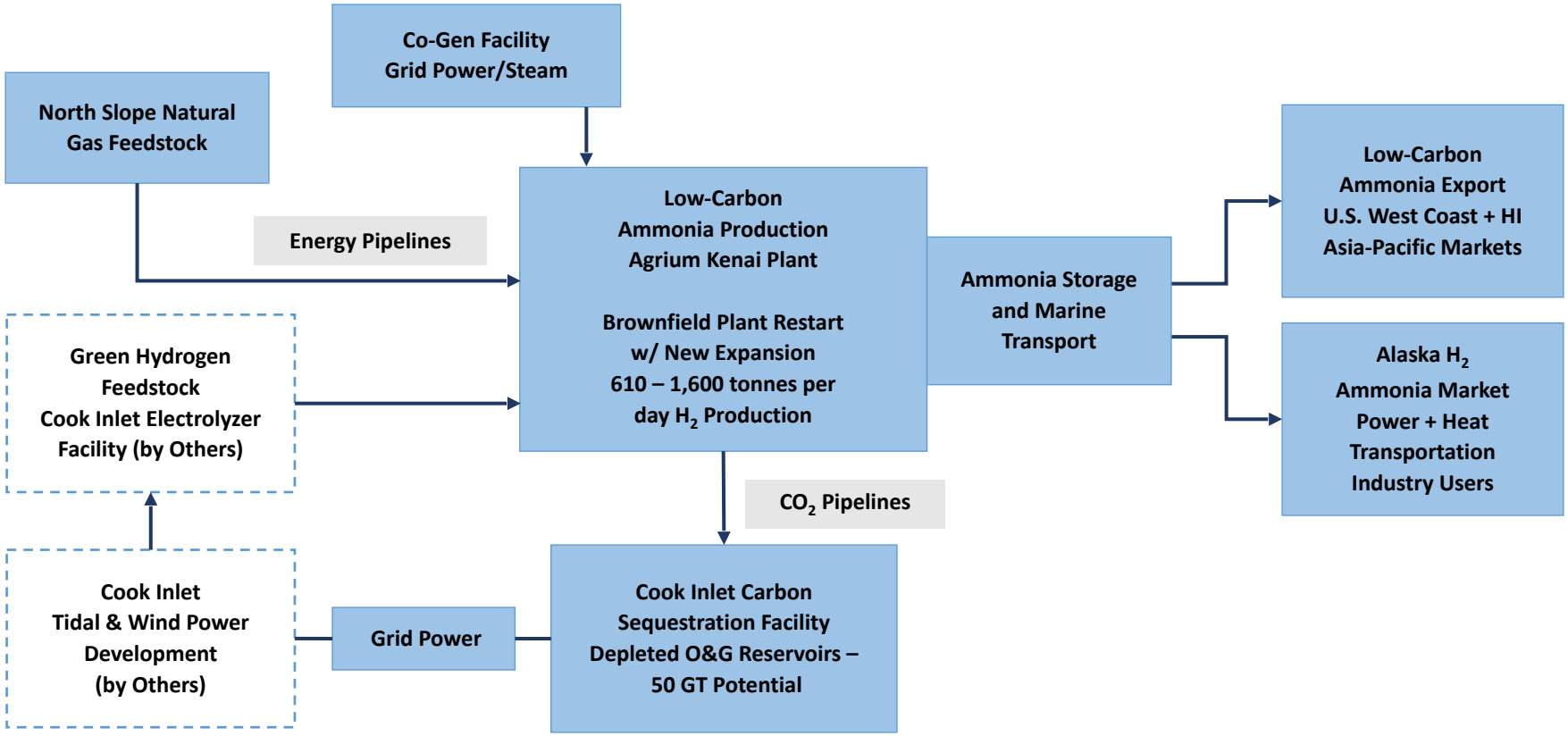
DOE's H2@Scale® initiative will enable decarbonization across sectors using clean hydrogen

U.S. DEPARTMENT OF ENERGY

Alaska H2Hub Concept



Cook Inlet Clean Ammonia Production



Alaska H2Hub Proposal

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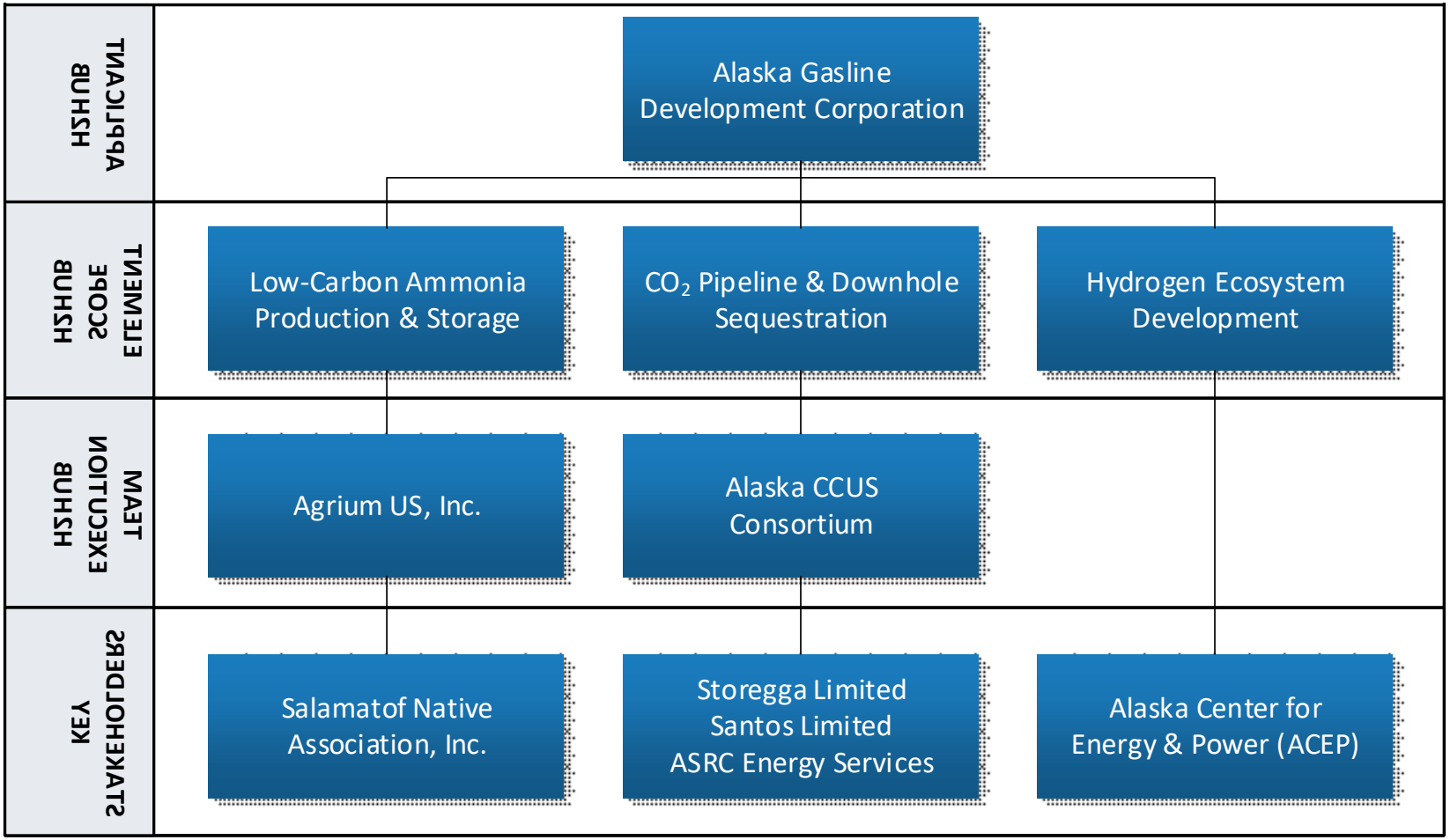

Alaska H2Hub Results

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- AGDC submitted the Alaska H2Hub Concept Paper November 4, 2022, to the DOE for consideration
- Proposed using $850 million in federal funds, along with $3.75 billion in private-sector funds
- 79 submissions received by the DOE that requested nearly $60 billion in federal funds, roughly eight to nine times the size of DOE's $6-7 billion solicitation
- Result was 33 "encouraged: and 46 "discouraged" for submitting a Full Application
- The Alaska H2Hub received a "discouraged" notification

Cook Inlet Opportunity

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Japanese-Led Work Team

Mitsubishi Corporation

TOYO ENGINEERING

Cook Inlet Opportunity

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- ✓ Driven by market demand
- ✓ Enormous Alaska natural gas resources
- ✓ Idled Nutrien Kenai Ammonia Plant
- ✓ Significant potential for carbon sequestration to achieve “blue” hydrogen
- ✓ Production at world-class scale with positive economics
- ✓ Multimodal transportation infrastructure
- ✓ Renewable resource potential for future electrolysis of “green” hydrogen

Kenai Ammonia Plant

- Agrium Kenai Plant: Located in Nikiski, Alaska, and owned and operated by Agrium U.S., a subsidiary of Nutrien, and key teaming partner in the Alaska H2Hub.
- Since the 2007 shutdown, the Kenai Plant has been maintained for potential restart.
- Two anhydrous ammonia plants, power and steam plants, a docking terminal for loading cargo ships, and significant maintenance and support facilities.
- On-site 30,000-ton and 50,000-ton interconnected liquid ammonia storage tanks.
- Terminal in water 40 feet deep at MLLW and can accommodate ships 650 feet in length or 50,000 deadweight tons.

New Ammonia Facility Siting

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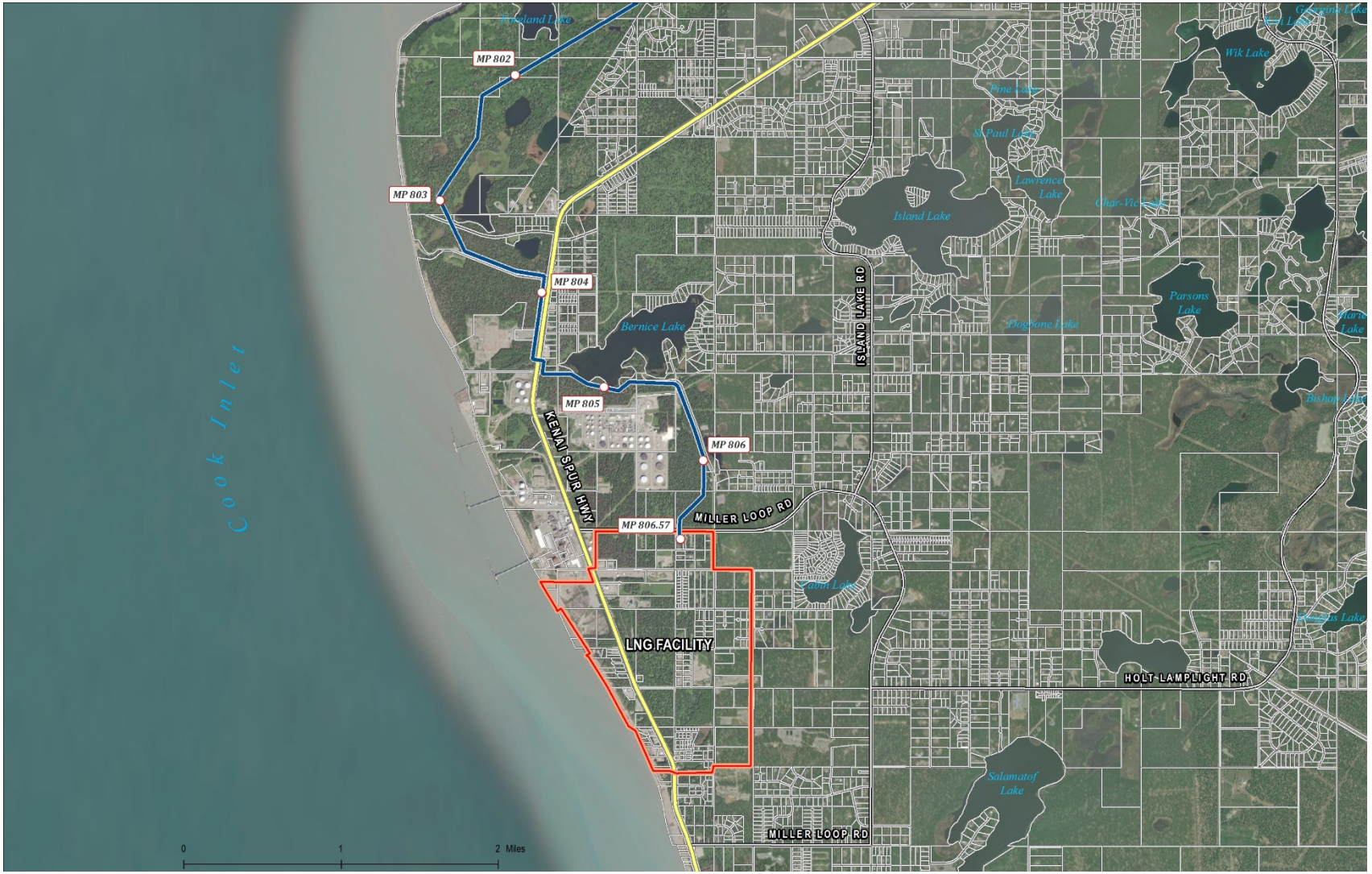

Cook Inlet CO_2 Sequestration

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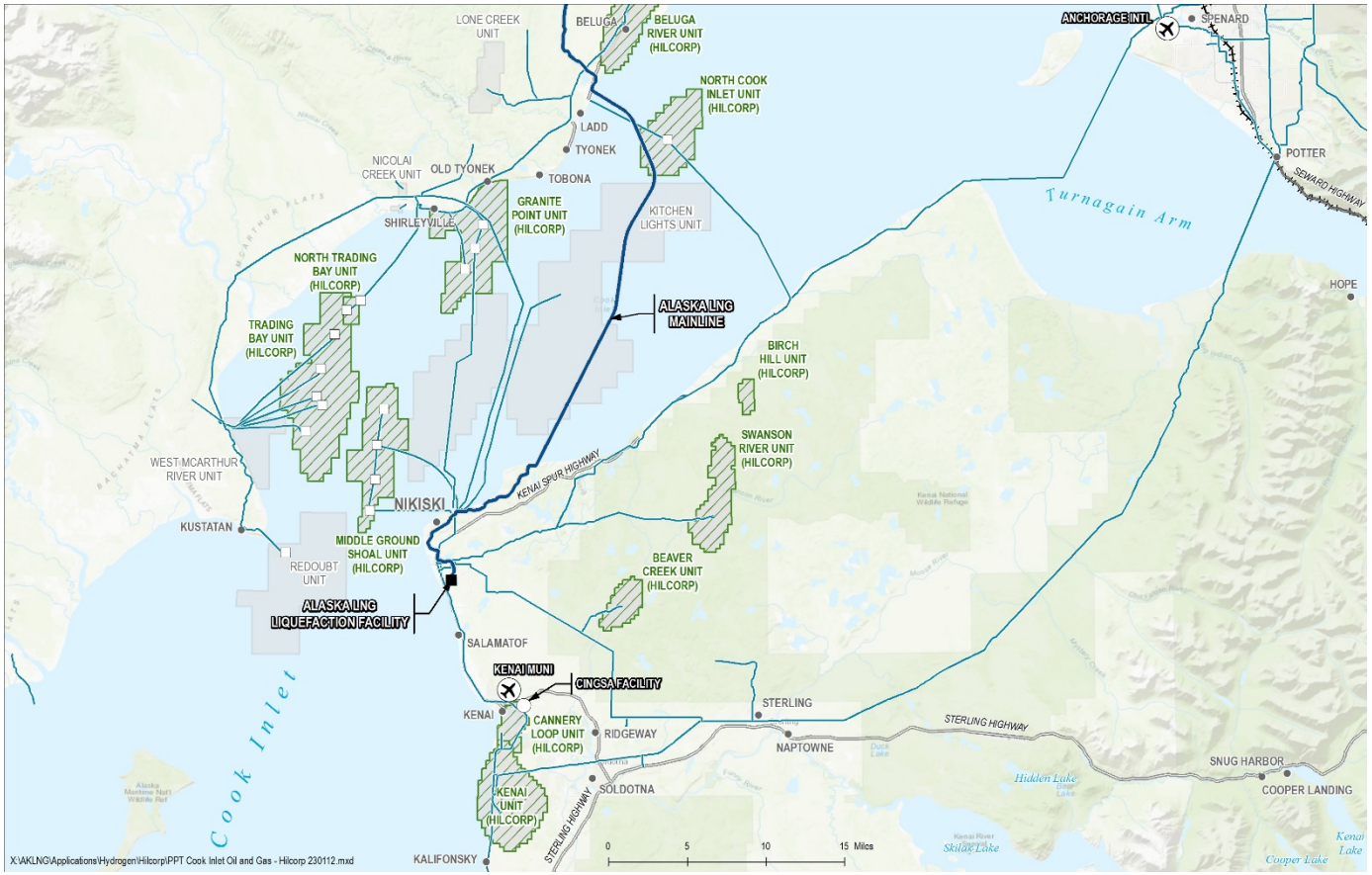

The Alaska Department of Natural Resources identified that Cook Inlet Basin has the highest CO_2 storage potential in Alaska with an estimated 50 GT in depleted reservoirs, saline aquifers, and coal beds. A transmission pipeline(s) from the CO_2 sources at Nikiski can deliver CO_2 to one or more of the CO_2 sequestration fields in Cook Inlet, including the Kenai Gas Field.

Kenai Gas Field CO_2 Capacity

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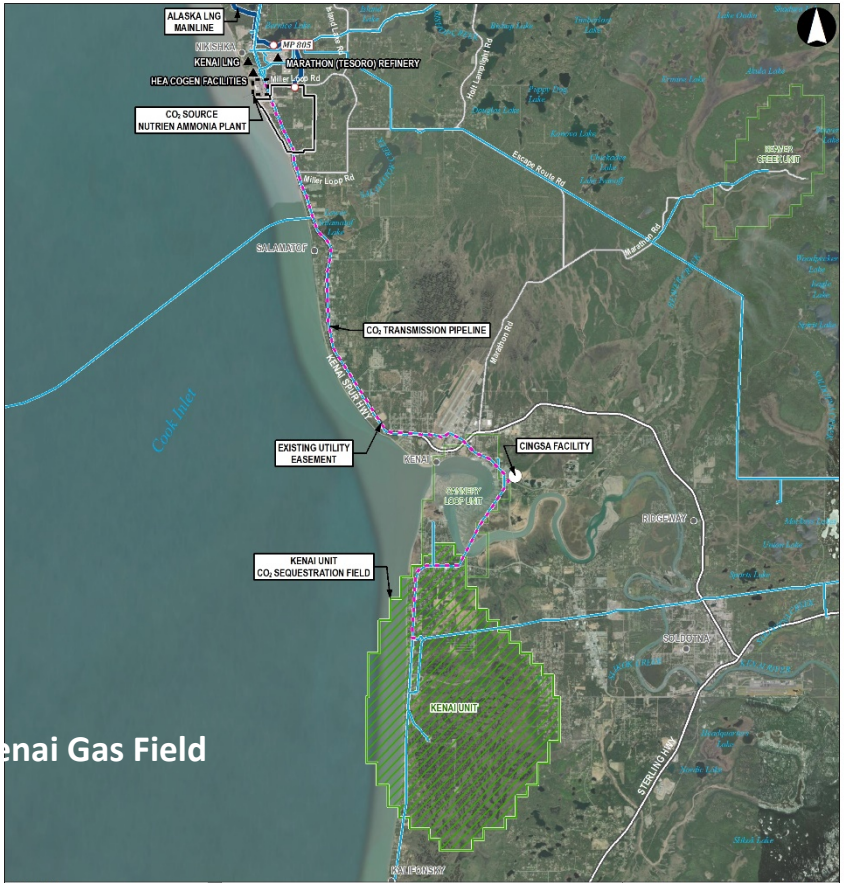
- Discovered in 1959
- Combined Kenai/Cannery Loop units approaching 4 TCF of total natural gas production
- Anticline structural with little to no faulting
- Producing horizons are the Sterling, Beluga, and Tyonek Formations
- Depleted gas sands alone is >100 million metric tons CO_2



What's Next?

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Governor Dunleavy Outlines Carbon Management Bill Package

Jan 12, 2023

Today, Alaska Governor Mike Dunleavy outlined his Carbon Management Bill Package, previewing legislation he will introduce, creating statutory and regulatory structures needed to capitalize on the carbon markets.

"Shortly, we will introduce our Carbon Management Bill package to launch the State into the emerging carbon market," **said Governor Dunleavy.** "Managing this resource is clearly in Alaska's best interest. It is in alignment with our constitutional mandate to develop all resources. This opportunity does not exclude or negatively impact current industries in Alaska, such as logging. Monetizing carbon has a very real potential of bringing revenue to the State of Alaska to the tune of millions, if not billions, of dollars. We will be asking legislators to seriously consider the legislation that will be introduced."

Carbon management is required or incentivized in multiple ways around the world, driving growth and investment in carbon markets and projects. This opportunity can generate carbon

- Alaska LNG Project development
- Japanese-led feasibility study – in progress
- Other private sector companies exploring CO_2 sequestration infrastructure development
- Governor's Carbon Management Bill Package

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