



RESOURCE UTILIZATION & DEVELOPMENT RESEARCH

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Petroleum Development Lab
Institute of Northern Engineering*

Alaska Support Industry Alliance
Fairbanks Chapter
Jan 5, 2022



OUTLINE



- Combined Heat & Power
- Heavy Oil Research
 - CO₂ EOR
 - Polymer Flood
- Critical Minerals



**Modular Gasification for Syngas/Engine
Combine Heat & Power Applications in Challenging Environments**

This material is based upon work supported by the Department of
Energy Award Number DE-FE0031601

MAKING COAL RELEVANT FOR SMALL SCALE APPLICATIONS

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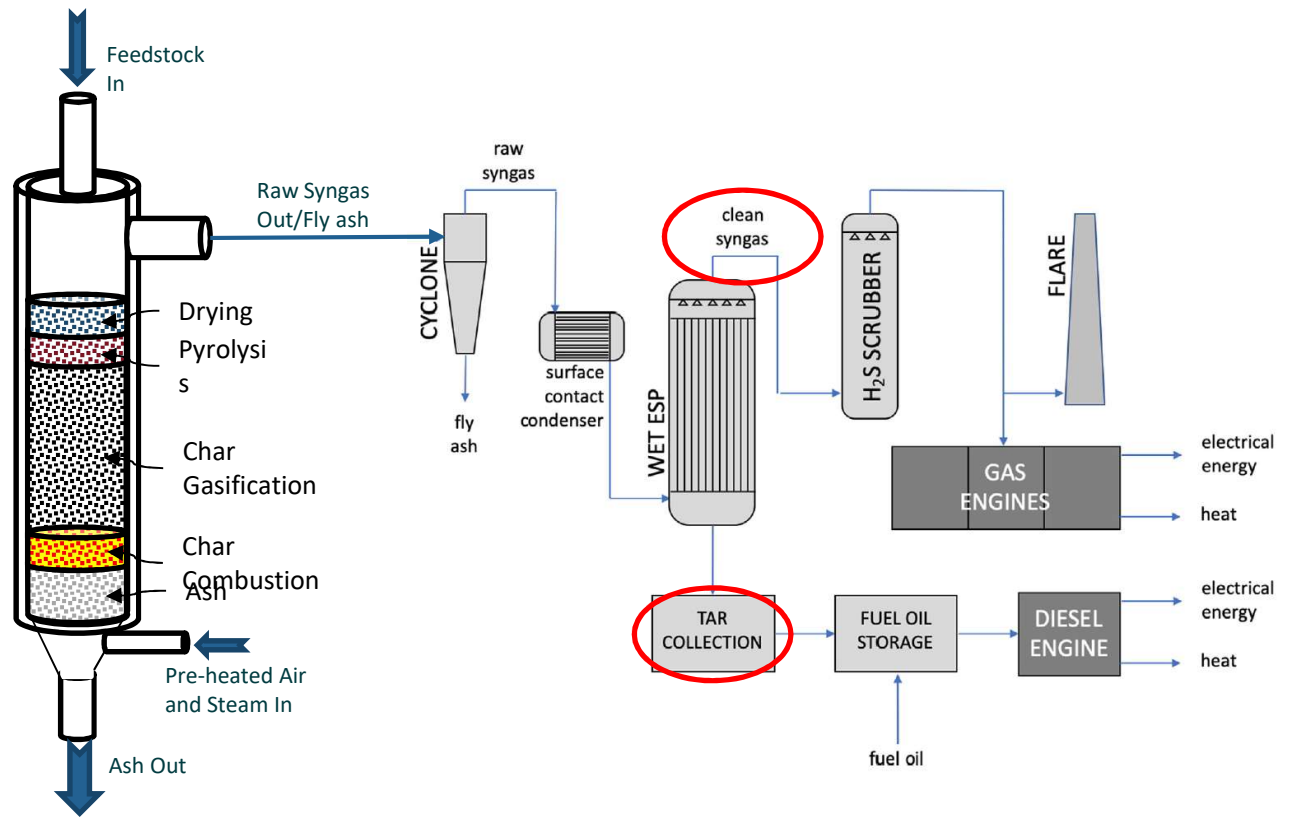
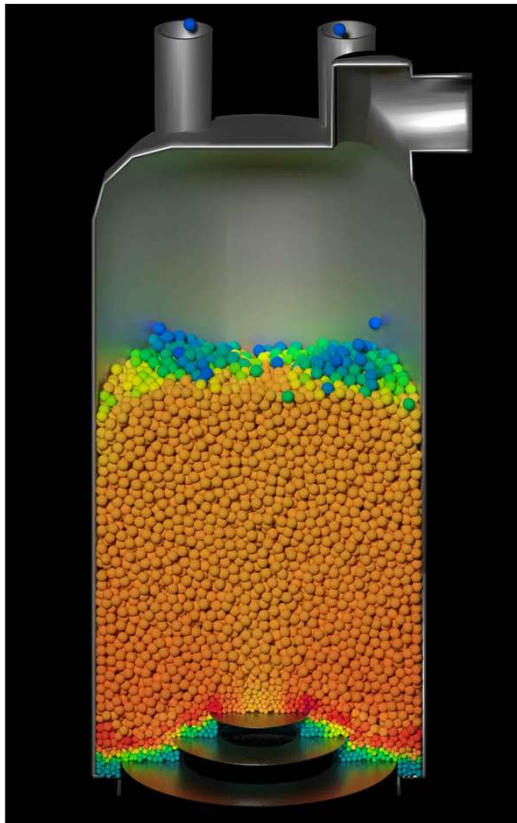
PROJECT DESCRIPTION AND OBJECTIVE

Demonstrate small scale coal gasification to fuel reciprocating engine generators

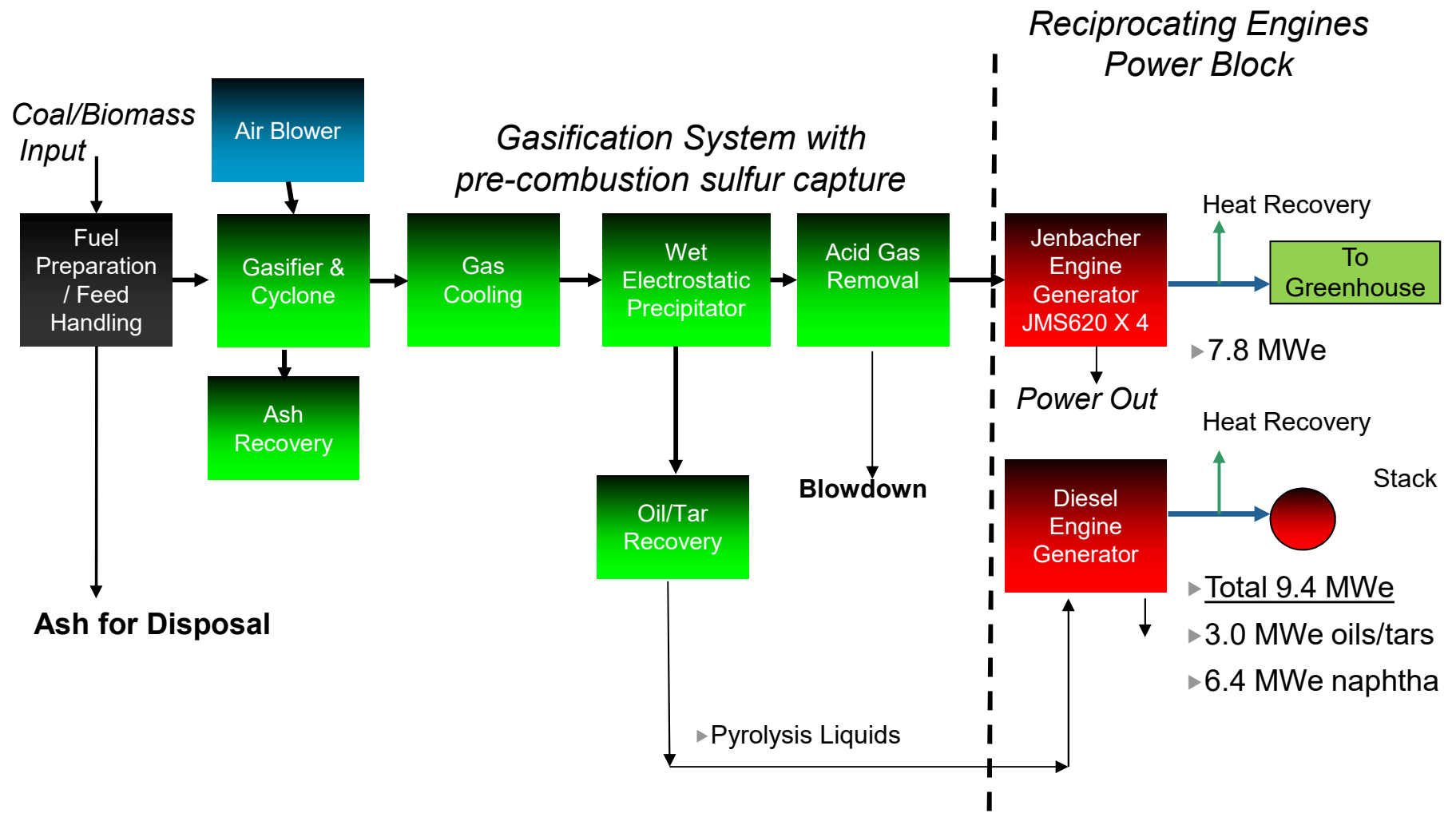
- Cost effective coal generating capacity for small applications
- Provides load following services
- Ideal for islanding systems
- Local jobs and local food



Updraft Moving-bed Gasifier



BLOCK FLOW DIAGRAM



HORTICULTURE

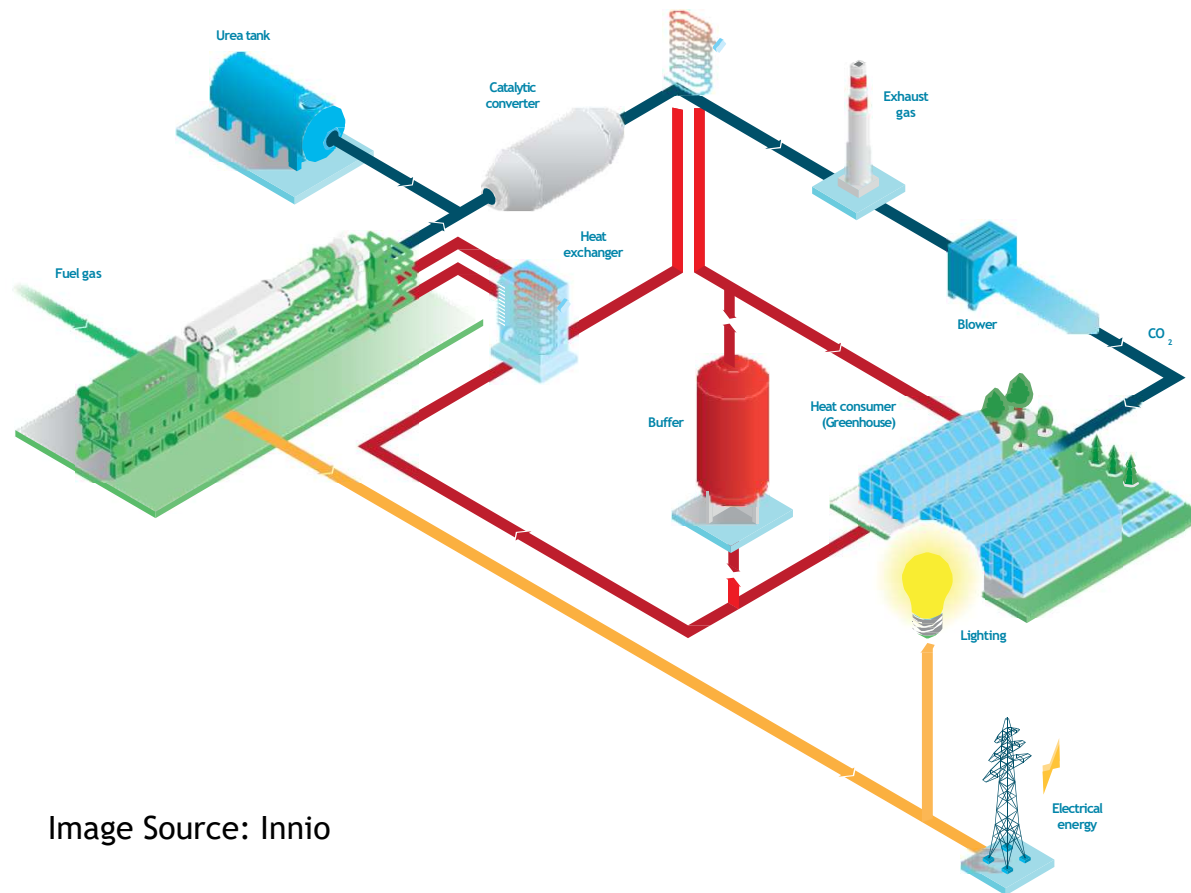


Image Source: Innio



REGULATORY/PERMITTING

The EPA designated the Fairbanks vicinity as a “serious nonattainment area for PM2.5”

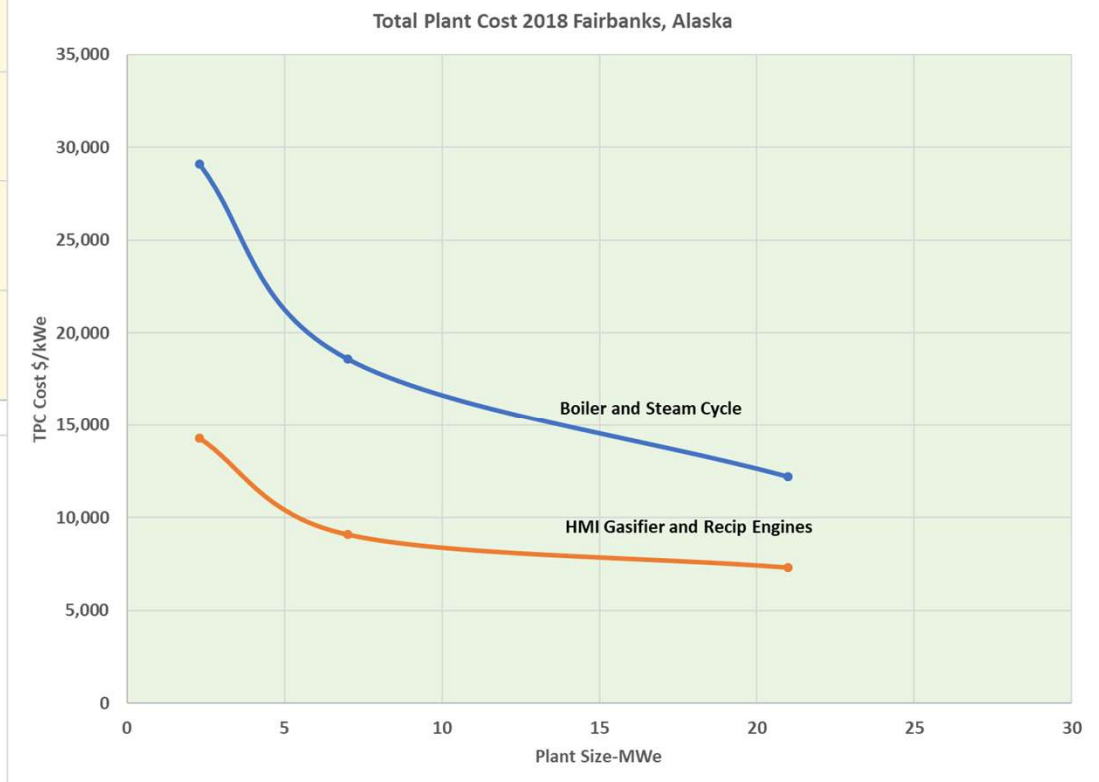
- PM2.5 and precursors (NO_x, SO₂, volatile organic compounds, and ammonia) will be regulated under the nonattainment New Source Performance Standard
- Even with Best Available Control Technology, this project is economical





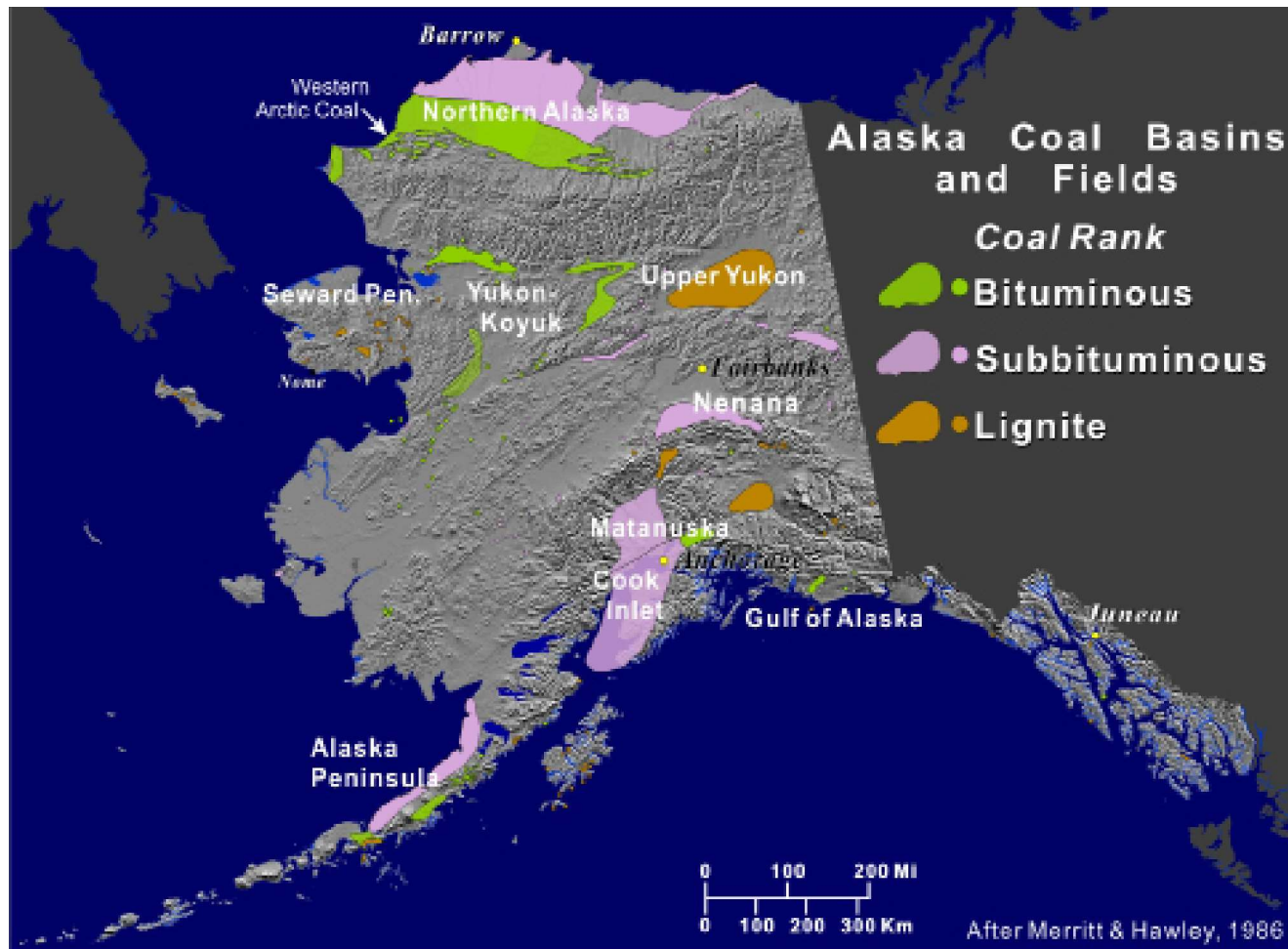
MODULARITY and SCALING

Gasifier/Engine System is Modular and Scalable



Multiple gasifier trains and engines can create powerplants from 1 MWe to 30 MWe+

AK-DGGS IDENTIFIED 37 VILLAGES WITH COAL NEARBY





RADICALLY ENGINEERED SYSTEM



- Make it work at 10 to 18 MWe
- Make it work at village scale <2MWe
- Integrate with diesel infrastructure
- Make it work with biomass & waste products
- Match greenhouse to CO₂ + Heat availability + Power



NEXT STEPS

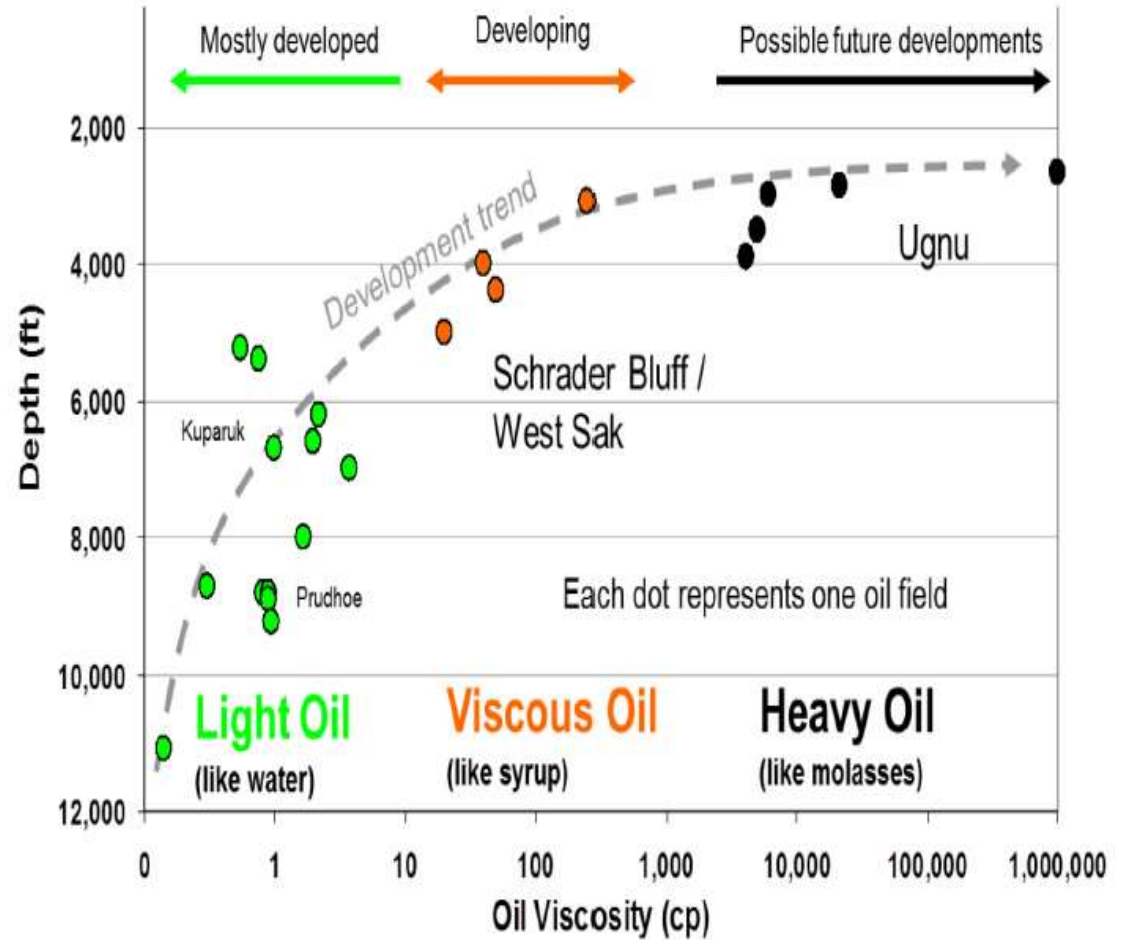
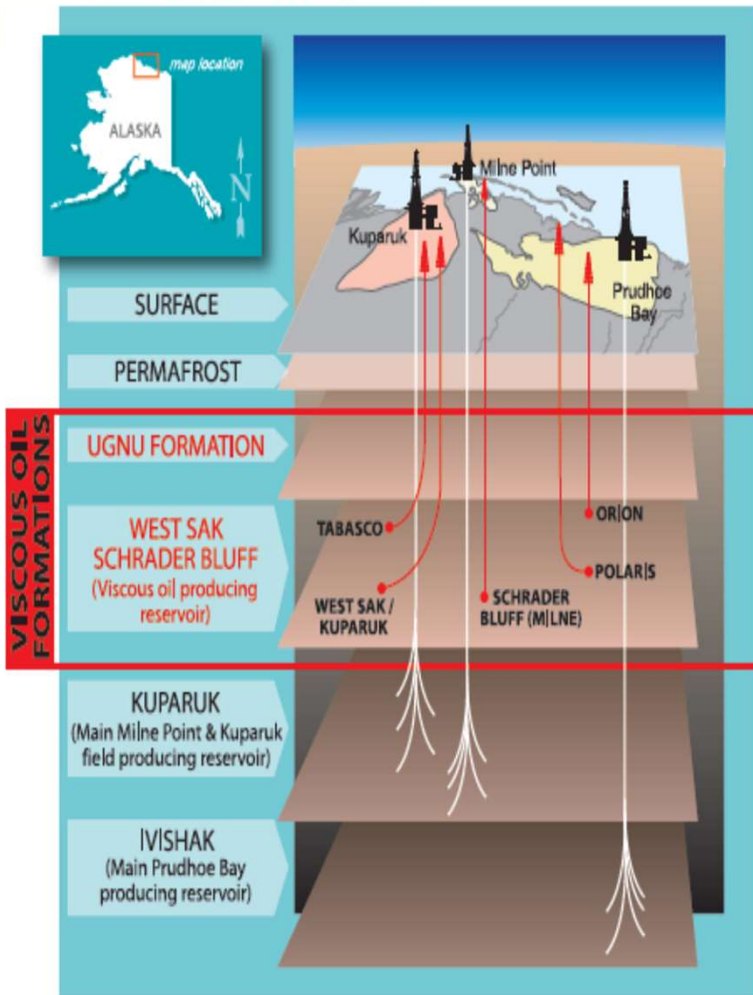
- Construction Application due to DOE by May 31, 2022
- Must have secured 20% cost share of about \$23 million
 - Greenhouse construction costs about \$40 million, provided by investors
- Must submit air permit applications prior to submitting construction application



Polymer Flood Project

ENHANCED OIL RECOVERY

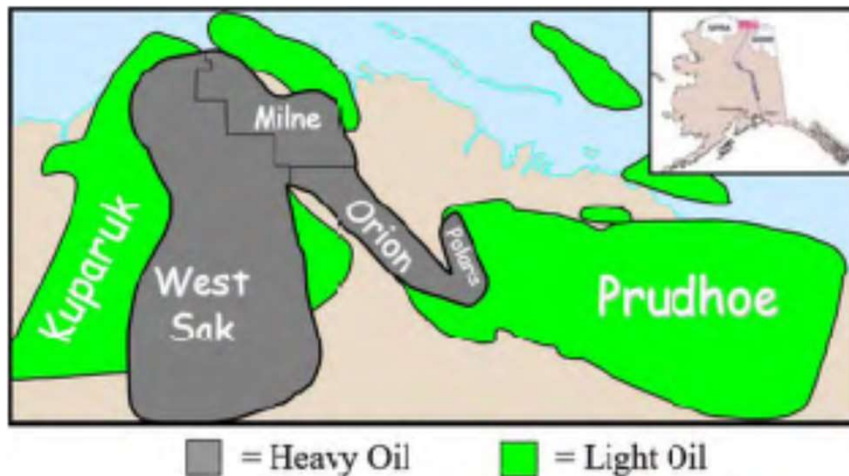
Heavy Oil Primer





HEAVY OIL ALASKA NORTH SLOPE FIELD LABORATORY

First Ever Field Pilot on Alaska North Slope to
Validate the Use of Polymer Floods for Heavy Oil



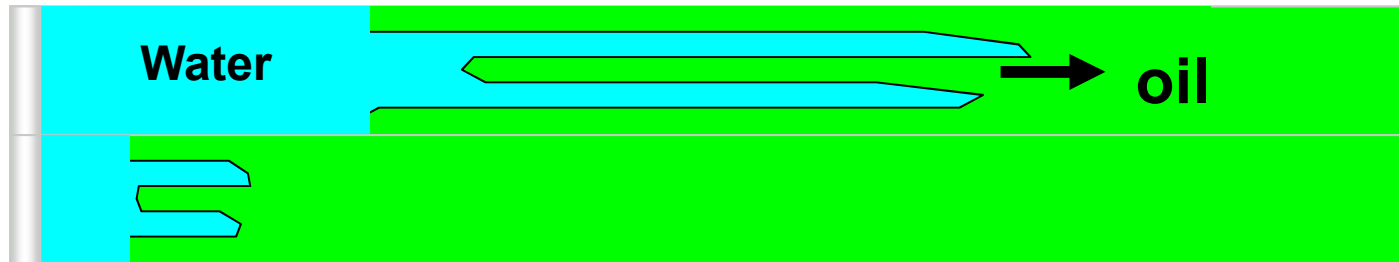
- 20-25 billion bbls of heavy oil—
too large to ignore
- Poor waterflood mobility due to
mobility contrast
- Cannot use heat due to
permafrost
- Need to get after this resource
while light oil is still available to
serve as a transportation diluent



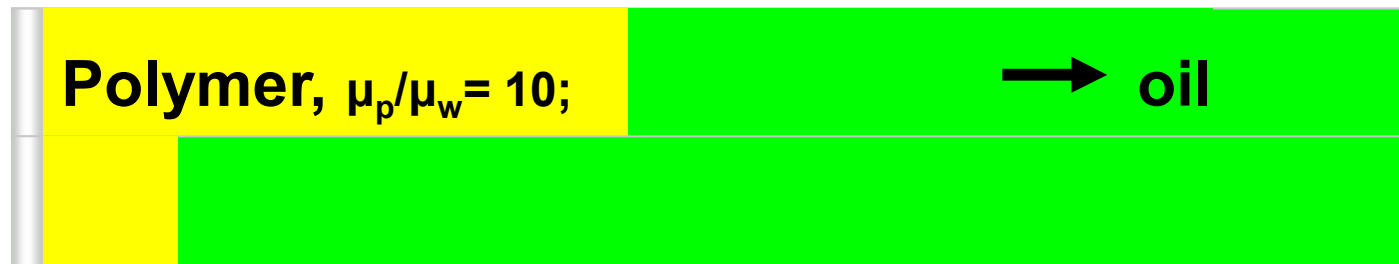
Heavy Oil

Sweep Efficiency is a Key Factor

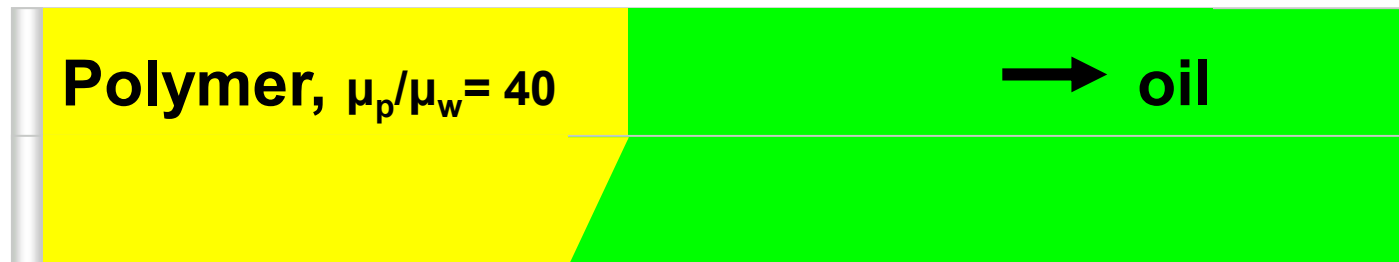
Water
flood:
 $M = 10$



Polymer
flood:
 $M \sim 1$

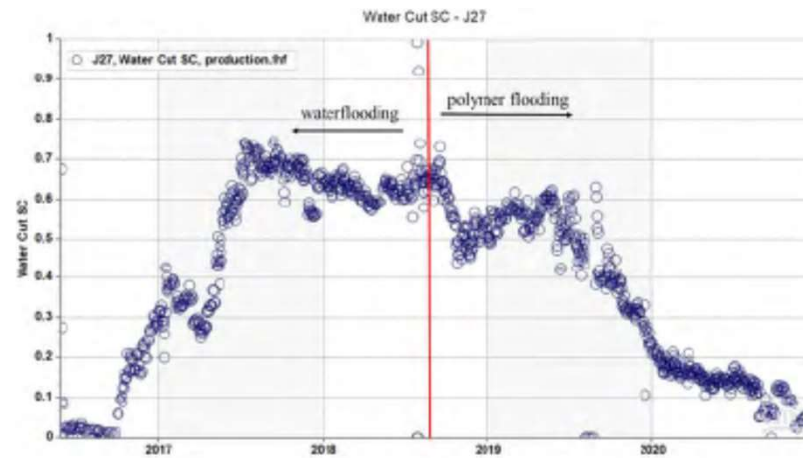


Polymer
flood:
 $M \sim 0.25$

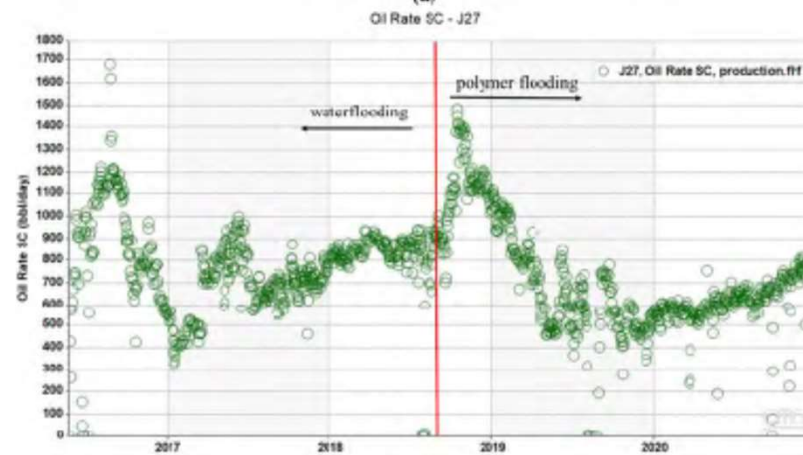




Heavy Oil Water Cut & Oil Production



(a)

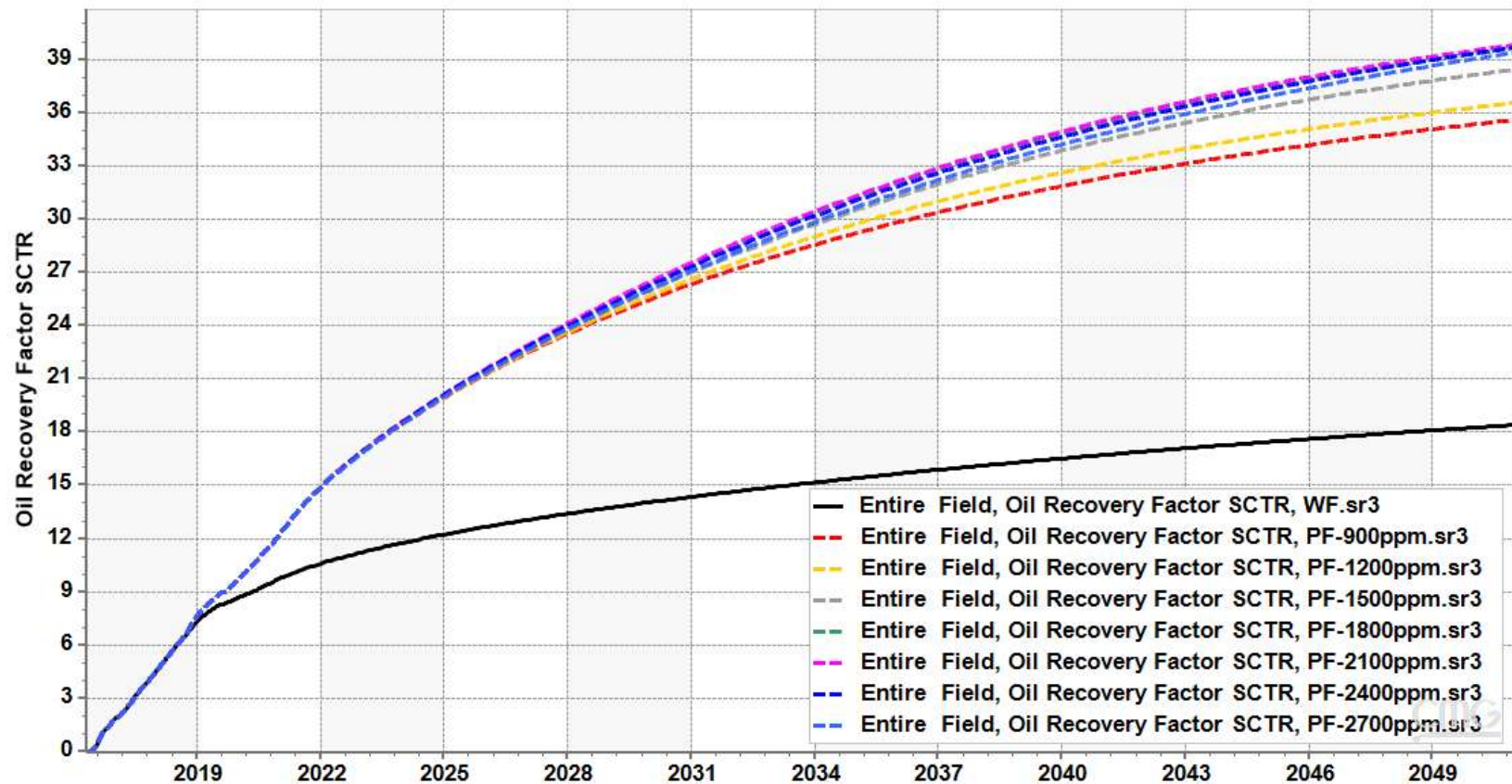


(b)



Heavy Oil Oil Recovery Factor

Oil Recovery Factor SCTR - Entire Field





Beneficial Uses for

CARBON CAPTURE UTILIZATION AND STORAGE



PLAINS CO₂ REDUCTION (PCOR) PARTNERSHIP

The PCOR Partnership Initiative is addressing regional capture, transport, use, and storage challenges facing commercial CCUS deployment:

- Strengthening the technical foundation for geologic CO₂ storage and enhanced oil recovery.
- Advancing capture technology.
- Promoting integration between capture, transportation, use, and storage industries.
- Facilitating regulatory frameworks.
- Providing scientific support to policy makers.

PCOR Initiative
PCOR Partnership





MEMBERSHIP



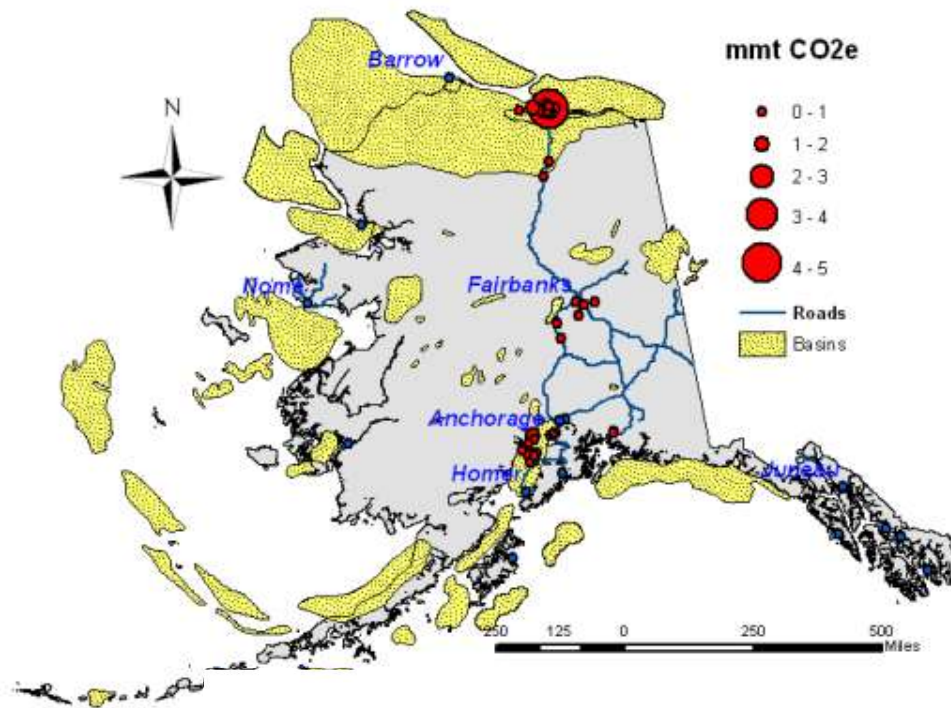


PCOR OBJECTIVES FOR ALASKA

UAF, Hilcorp and UND-EERC are drafting a SOW to:

1. Investigate the phase behavior of heavy oil when contacted by CO₂-enriched miscible injectant (CO₂-enriched MI)
2. Evaluate the EOR potential of CO₂-enriched MI in the Prudhoe Bay oilfield through displacement experiments
3. Predict CO₂-enriched MI EOR performance and CO₂ sequestration potential through Numerical Simulation Studies
4. Investigate the influence of CO₂ on facility corrosion and propose corrosion prevention techniques

SOURCE MATCHING



**ALASKA GEOLOGIC CARBON SEQUESTRATION POTENTIAL
 ESTIMATE: SCREENING SALINE BASINS AND REFINING COAL
 ESTIMATES**

Diane P. Shellenbaum & James G. Clough
Alaska Department of Natural Resources

- Reinjecting natural gas requires a lot of energy, generating a lot of CO₂
- Central Gas Facility is ideally located to facilitate CO₂ injection



CONCLUSIONS

- Major gas sales could generate 400mmcf/d of CO₂ stream
- Sourcing CO₂ from the Central Gas Facility seems much more likely than Major Gas Sales
- CO₂ is a highly efficient liquid injectant (super critical) at viscous & heavy oil reservoir conditions
- **It always comes down to economics**





BRINGING ALASKA'S CORE-CM POTENTIAL INTO PERSPECTIVE

Brent J Sheets

*Director, Petroleum Development Lab
Institute of Northern Engineering*

Steve Masterman

*Director, Alaska Division of Geological
and Geophysical Surveys*





VISION & MISSION

Vision: Bring Alaska's CORE-CM potential into perspective

Mission: Establish a CORE-CM industry in Alaska by working with industry and other stakeholders to ID opportunities (create a basinal assessment database) and establish plans for a Technology Innovation Center for addressing barriers inhibiting investment



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KEY ELEMENTS (DATASET)

Unlike the continental U.S., characterization of carbon ores for their REE/CM content in Alaska's many basins is still in its infancy

Therefore, an essential component of this project is to create a robust statewide dataset on the REE/CM content of carbon-based ores, centering on three principal sources

- 1) existing published and unpublished data
- 2) new data from archived legacy samples
- 3) new data from newly acquired field samples

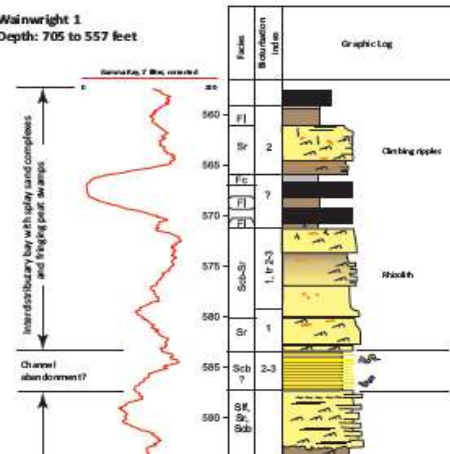


KEY ELEMENTS(GMC)

- 3096 Alaska energy wells
- 26,500,000 feet of energy strata drilled
- 16,700,000 representative feet of energy core and cuttings
- 76,000 linear feet of energy core
- 22,000 Alaska minerals boreholes
- 766,000 feet of mineral rock drilled
- 617,000 representative feet of mineral core and cuttings
- 354,000 linear feet of mineral core
- 250,000 processed slides and thin sections
- 507,000 surface samples



Wainwright 1
Depth: 705 to 557 feet





KEY ELEMENTS: PRIVATE SECTOR INVESTMENT





KEY ELEMENTS (PUBLIC INVOLVEMENT)

January 18, Anchorage,
Geological Materials Center
Register at DGGs' Home Page





TEAM MEMBERS



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THE STATE
of ALASKA
GOVERNOR MIKE DUNLEAVY



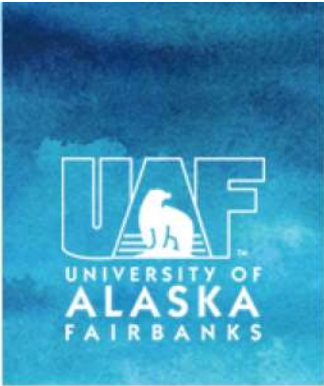
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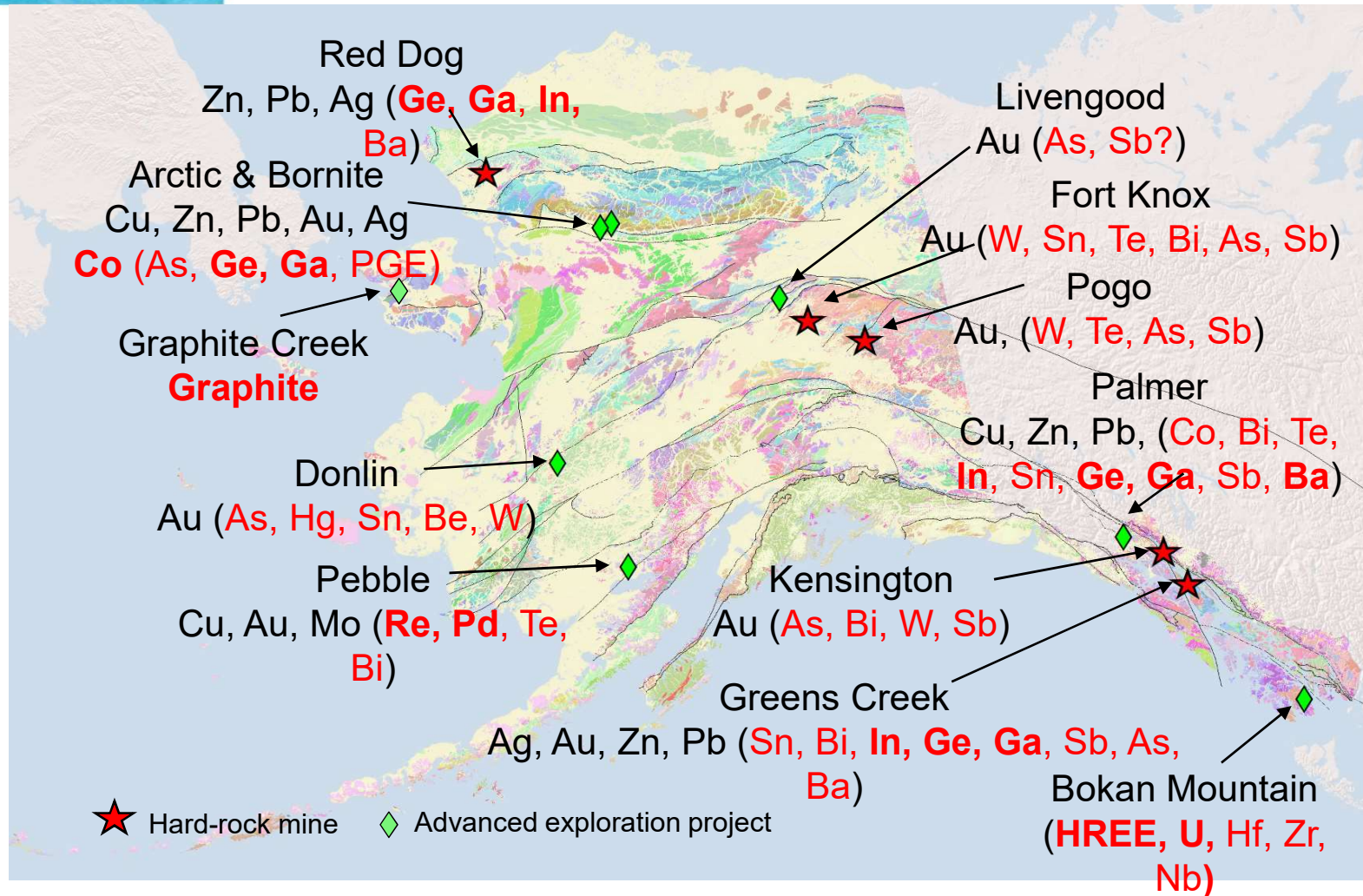


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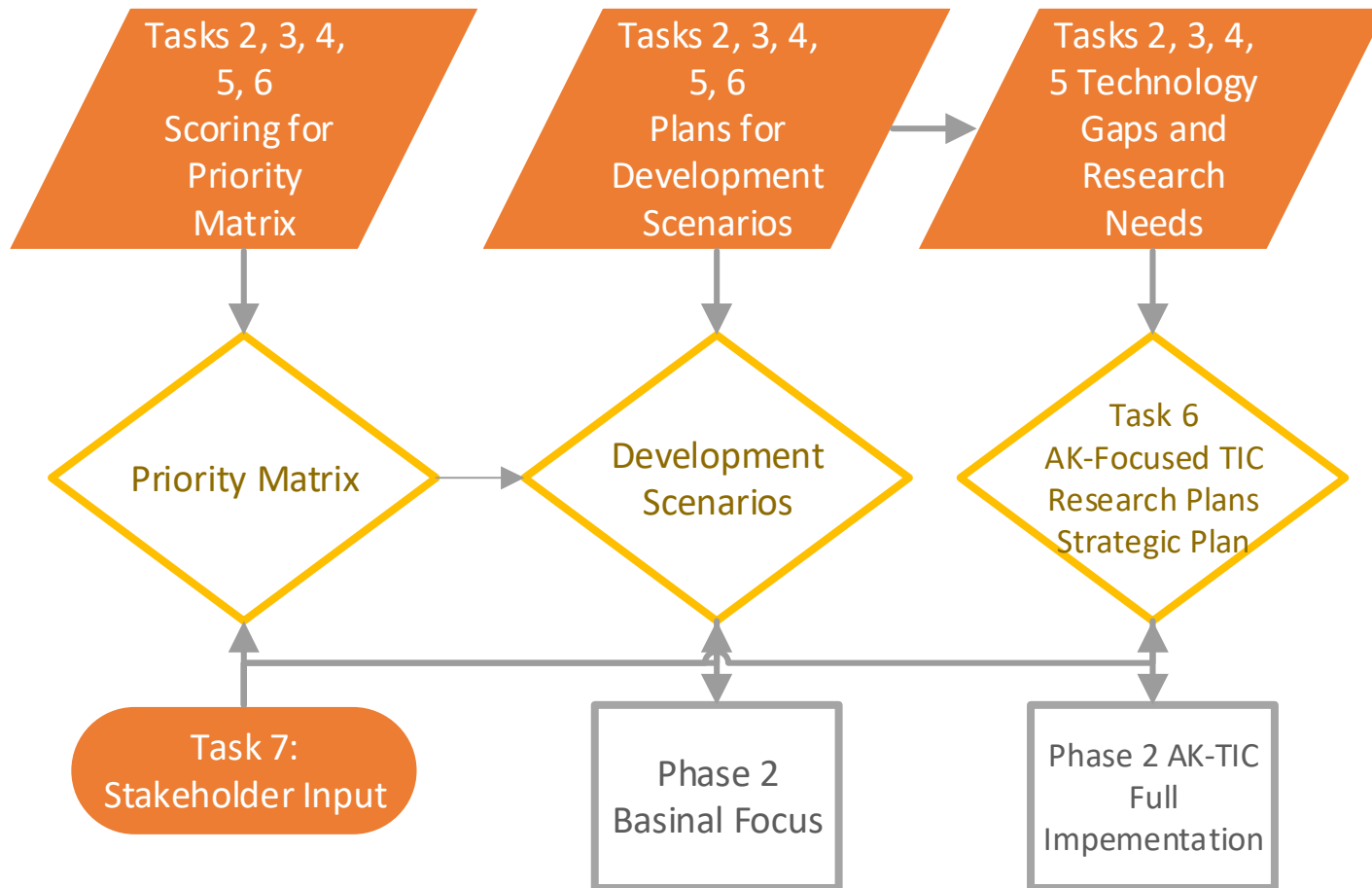
WHY IS THIS PROJECT IMPORTANT TO ALASKA?





STAKEHOLDER ENGAGEMENT

Period of Performance





THANK YOU



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Critical Minerals Meeting:
January 18, Anchorage,
Geological Materials Center

Register at DGGs' Home Page