June 5, 2025

NORTH
TO THE FUTURE

# Alaska Next-Gen SynFuel Refinery (ANSyR)

## Alaska Department of Transportation & Public Facilities

Deputy Commissioner Katherine Keith, PMP, PMI-ACP

# What Is Sustainable Aviation Fuel?

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

SAF is a **low-carbon alternative to conventional Jet-A**.
It is chemically similar to fossil jet fuel and requires **no aircraft or infrastructure modifications**.

## Why SAF Matters in Alaska

- Reduces reliance on imported fossil fuels
- Supports energy security, job creation, and climate goals
- Leverages in-state feedstocks like fish oil and forest biomass

**Reduces reliance on imported fossil fuels**

## How Is It Made?

SAF is produced by refining renewable feedstocks such

- Waste oils and fats (e.g. fish oil, tallow)
- Woody biomass (e.g. forestry residues)
- Municipal solid waste
- Captured $CO_2$ (for some advanced pathways)

## What Else Is Produced?

In addition to SAF, refineries may also produce:

- **Renewable Diesel** – for road, marine, or heavy equipment use
- **Renewable Naphtha** – a blendstock or petrochemical feed
- **Electricity, steam**, or carbon credits – depending on process design

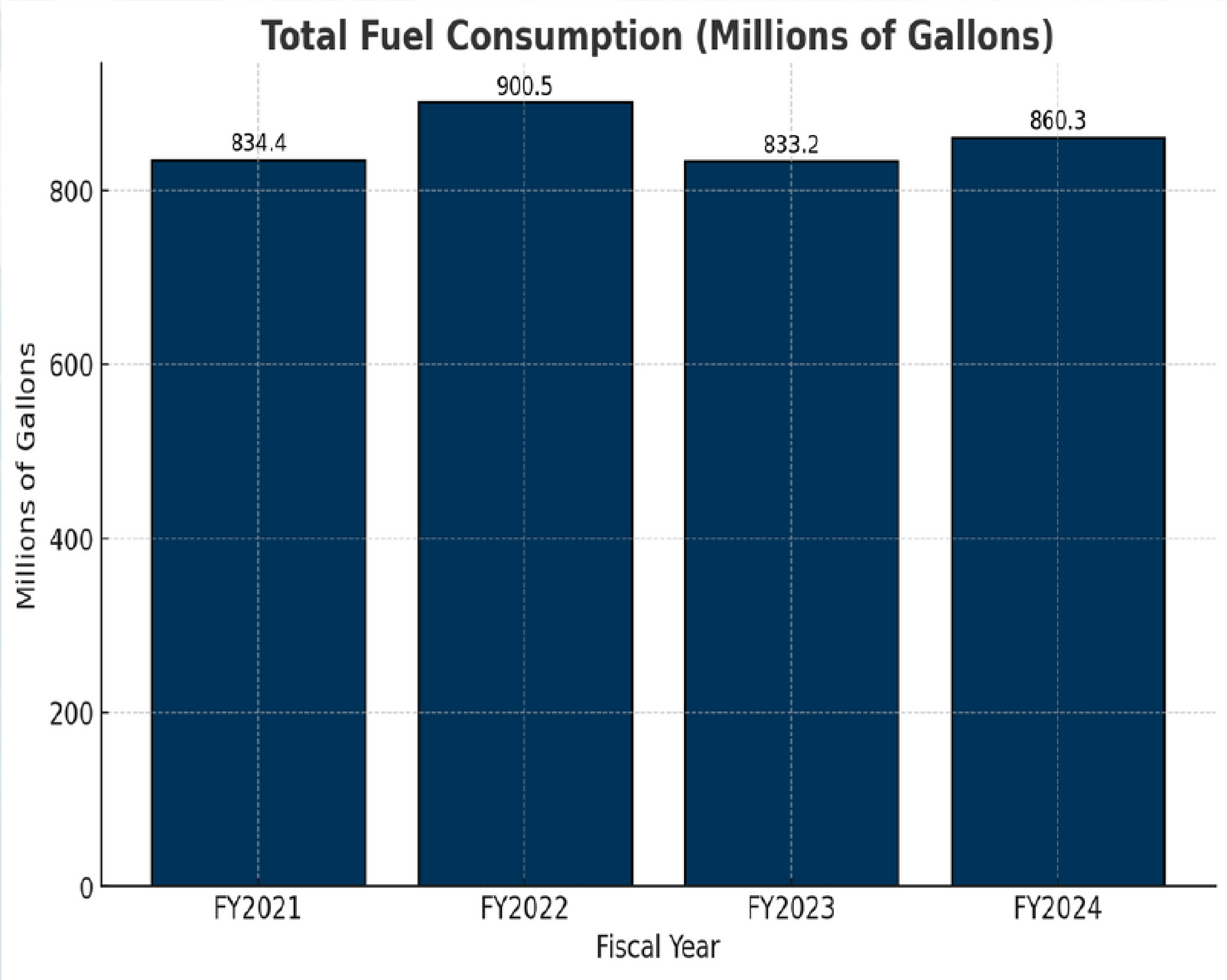


**A Drop-In Fuel for Today's Aircraft**

# Alaska International Airport System

## STRATEGIC CROSSROADS FOR GLOBAL AIR CARGO

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY




**~850 MGY handled through this supply chain at Ted Stevens Anchorage International Airport**

### Ted Stevens Anchorage International Airport

- Major international cargo hub
- $4^{th}/3^{rd}$ busiest cargo airport in the world

### Fairbanks International Airport

- Passenger hub and reliever cargo airport
- Connected by Rail to Southcentral Alaska

### Lake Hood Seaplane Base

- Seaplanes and Regional Air Carriers
- Busiest seaplane base in the world

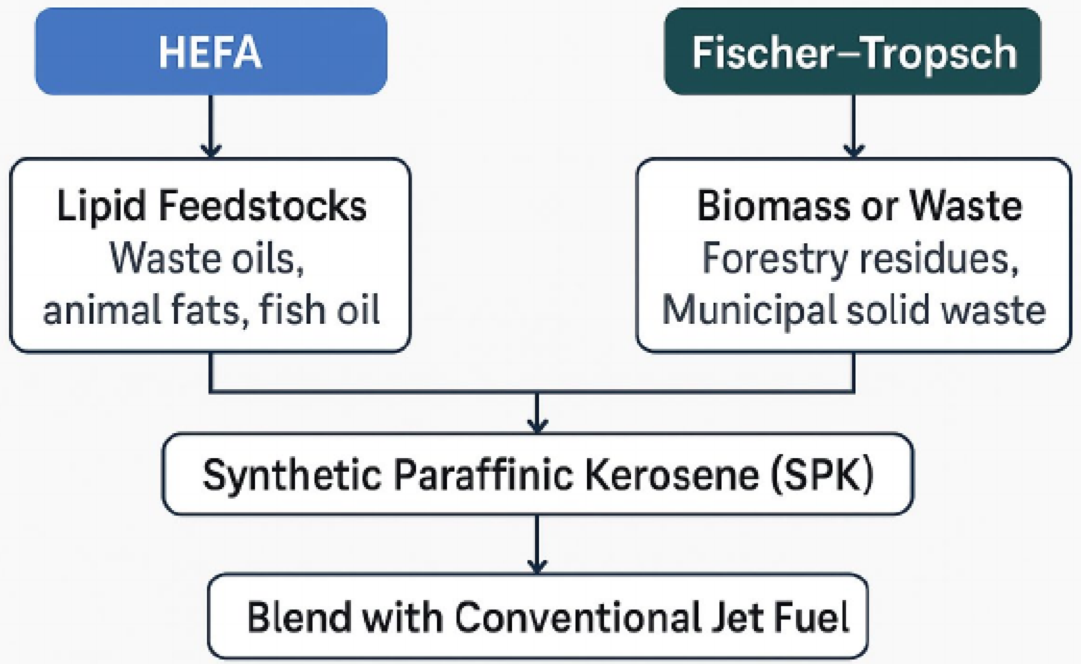
ICN NRT PVG SZX TPE HKG AIAS SDF MEM MIA

# Synfuel Production Pathways

| Category | Hydroprocessed Esters and Fatty Acids (HEFA) | Fischer–Tropsch (FT) |
| --- | --- | --- |
| Tech Maturity | Commercial, deployed globally | Early-stage for biomass, mature for fossil gas-to-liquid |
| Primary Alaska Feedstocks | Waste oils, tallow, fish oil | Woody biomass, municipal solid waste, CO2 |
| Best Fit for Alaska | Near-term option using seafood waste infrastructure; limited scalability | Long-term solution using forest biomass; aligned with carbon removal and forest health goals |
| Est. Cost per Gallon | $6.50 | $4.30 |
| Production Volume (MGY - millions gallon per year) | 215 MGY (150 SAF, 54 diesel, 11 naphtha) | 230 MGY (150 SAF, 58 diesel, 22 naphtha) |
| CapEx: Installed Cost | $1.04B | $2.8B |
| OpEx: Annual Operating Cost | $1.04B/year ($4.84/gal) | ~$534M/year ($2.32/gal) |
| Feedstock Cost per gallon | Fish oil ($4.35/gal) | Woody biomass ($1.20/gal) |

ANSyR
ALASKA NEXT-GEN SYNFUEL REFINERY

**Synfuel Production Pathways – HEFA vs. Fischer–Tropsch**



# Alaska's Biomass Landscape

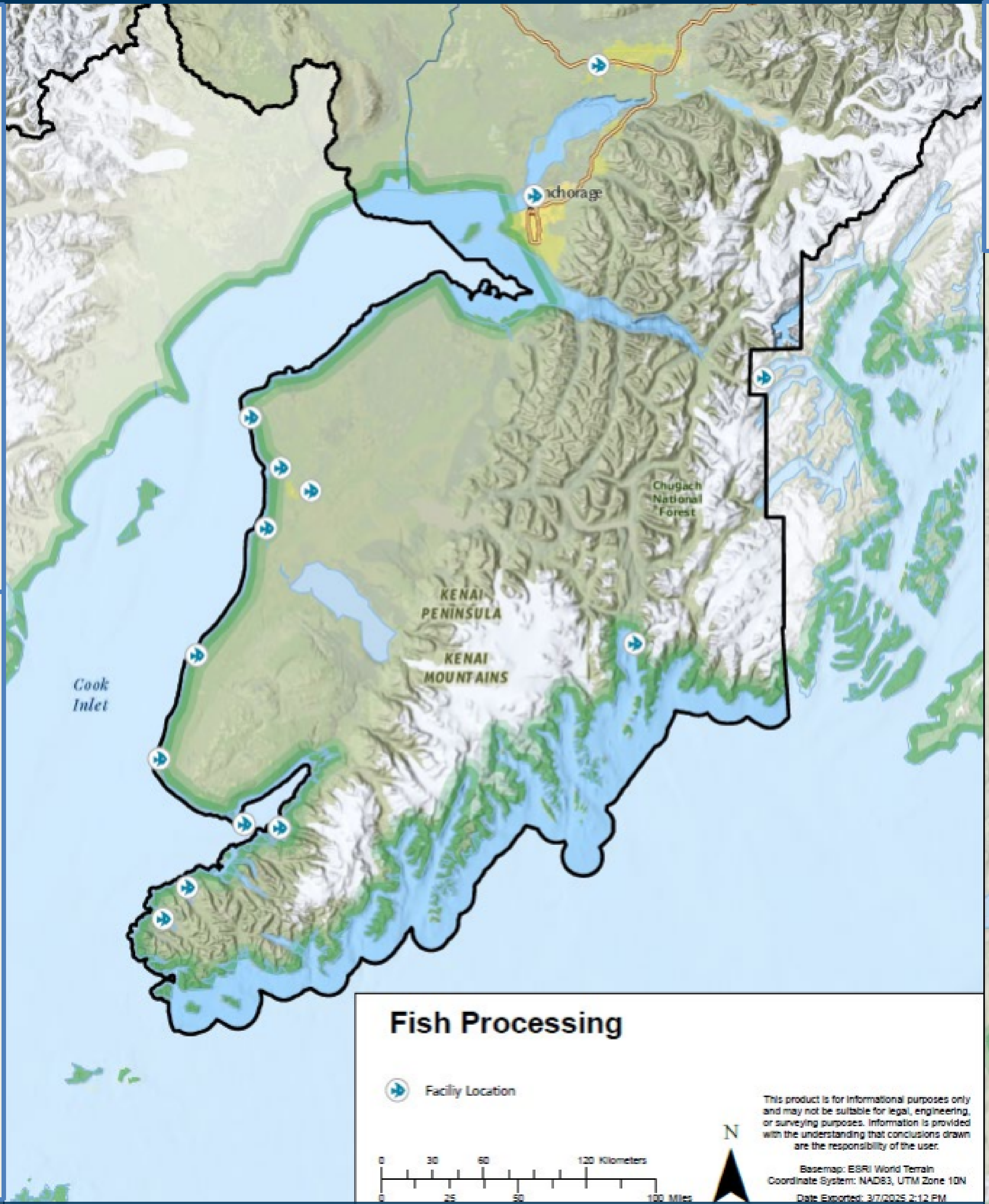
ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

*Annual statewide fisheries production in 2023 was* ***~1.172 million tons (net weight)****, based on aggregated COAR data.*
*Processing concentrated in Kodiak, Dutch Harbor, Prince William Sound, Southeast Alaska, and Cook Inlet.*

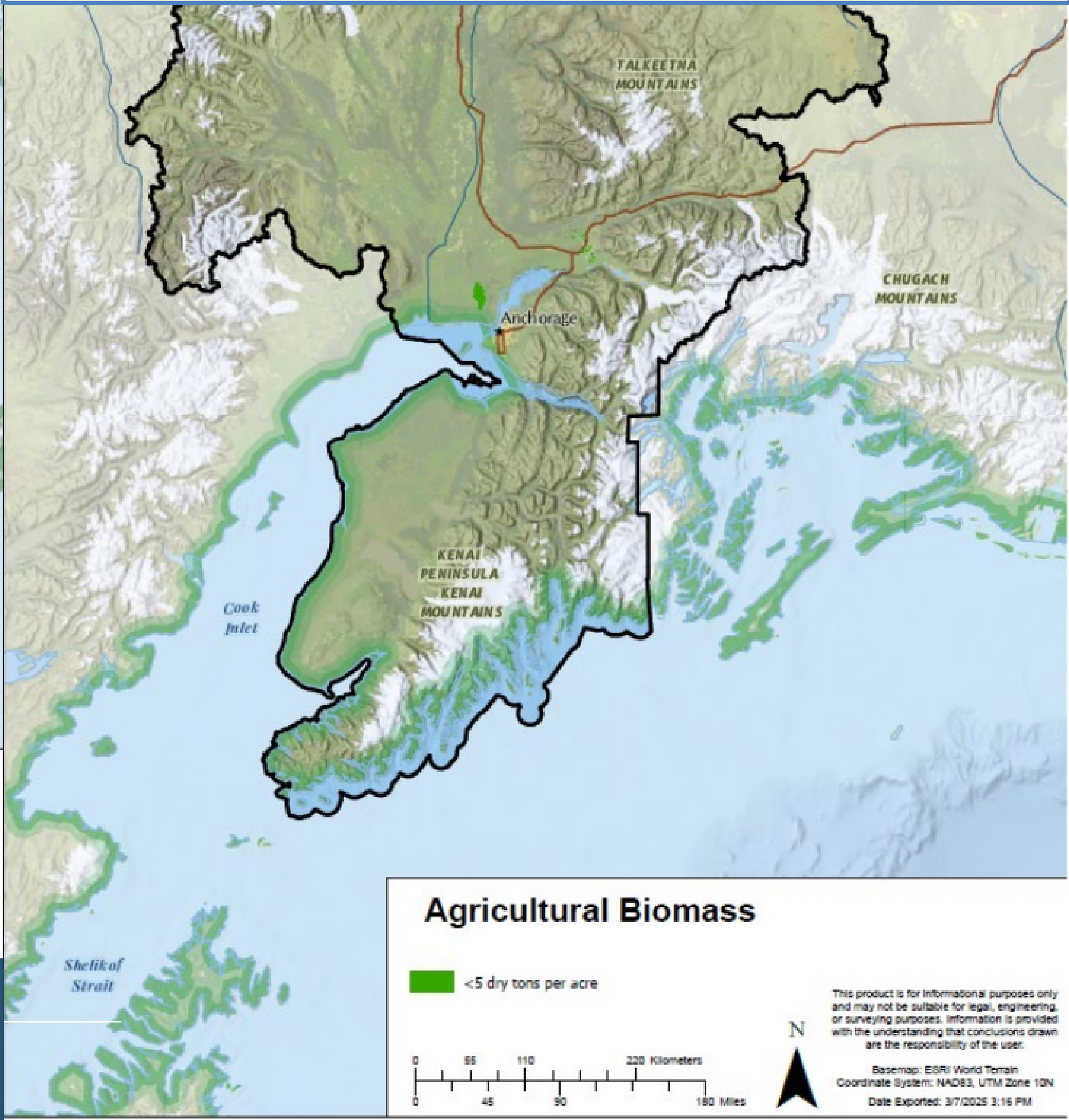
⚠️ *COAR estimates exclude AYK and Bering Sea regions due to confidentiality thresholds.*

**Fish oil accounts for ~10% of total fish biomass.**
For HEFA SAF production at a scale of **215 MGY**, estimated fish oil input requirements are **~0.7–0.9 million tons/year**, assuming typical industry conversion yields.

*Availability depends on species composition, lipid yield, and interannual catch variability.*




Hay production within the analysis area (Mat-Su Valley & Kenai Peninsula) is estimated at **16,600 dry tons per year**.
Key growing regions: Palmer and Point MacKenzie.

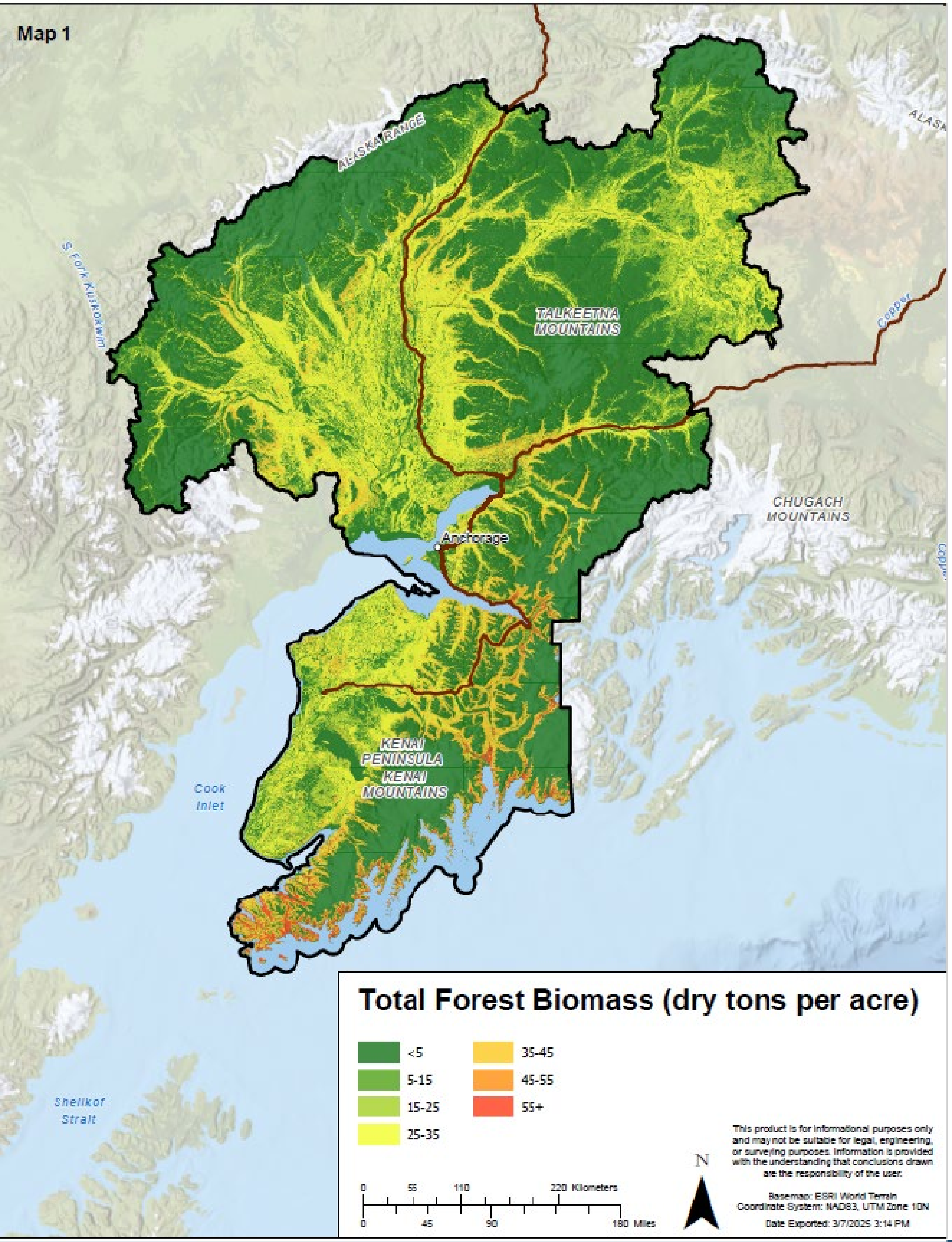



*DOT&PF Preliminary Biomass Inventory by Mason, Bruce & Girard and Evergreen Economics, March 2025
COAR (Commercial Operator's Annual Report) data exclude estimates from AYK and Bering Sea regions due to confidentiality thresholds.

# Alaska's Woody Biomass

## Preliminary Inventory – Mat-Su Valley & Kenai Peninsula

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY




For a target output of **230 MGY** of synfuel, approximately **4.9 million dry tons** (equivalent to **9.8 million green tons**) of woody biomass are required, assuming standard moisture content and conversion yields.

The woody biomass in this studied area alone holds enough energy to power nearly 100,000 Alaskan homes for a year — the equivalent of supplying every home in Anchorage with electricity.

**Road-Accessible Woody Biomass and Growth (Dry Tons)**

| Biomass Type | Within ¼ Mile of Road | Within 1 Mile of Road |
|---|---|---|
| Standing Live Volume | 16,177,000 | 39,982,000 |
| Standing Dead Volume | 2,578,000 | 6,255,000 |
| **Total Dry Tons** | **18,755,000** | **46,236,000** |
| **Annual Growth Total** | **231,095** | **571,114** |

*Forest biomass is primarily harvestable during winter due to wet soil conditions in Mat-Su.

1 dry ton = ~18 gigajoules = ~47 gallons Sustainable Aviation Fuel

Source: DOT&PF Preliminary Biomass Inventory, Mason, Bruce & Girard and Evergreen Economics, March 2025.
Estimates based on U.S. Forest Service FIA data, LANDFIRE EVT layers, and Alaska Forest Vegetation Simulator modeling. Assumes green-to-dry ton ratio of ~2:1.

# Optimizing Synfuel Yields

## Target Output = 150 Million Gallons per Year (MGY) Sustainable Aviation Fuel

| HEFA Pathway | | | | | |
|---|---|---|---|---|---|
| **Scenario** | **SAF Yield** | **Diesel Yield** | **Estimated Incremental Cost ($/gallon SAF*)** | **Hydrogen Use (kg per barrel of SAF)** | **Co-Product Impact** |
| **Baseline** | 60% | 35% | $3.50 – $4.50 | 3.0 | Balanced SAF/Diesel |
| **High SAF** | 75% | 20% | $4.00 – $5.00 | 4.0 | Lower diesel revenue |
| **Max SAF** | 80% | 15% | $4.50 – $5.50 | 4.5 | Minimal diesel, high SAF |

| Fischer-Tropsch Pathway | | | | | |
|---|---|---|---|---|---|
| **Scenario** | **SAF Yield** | **Diesel Yield** | **Estimated Incremental Cost ($/gallon SAF*)** | **Hydrogen Use (kg per barrel of SAF)** | **Co-Product Impact** |
| **Baseline** | 55% | 35% | $4.50 – $6.00 | 2.5 | Balanced SAF/Diesel |
| **High SAF** | 70% | 20% | $5.00 – $6.50 | 3.5 | Reduced diesel revenue |
| **Max SAF** | 75% | 15% | $5.50 – $7.00 | 4.0 | Minimal diesel, high SAF |

| Comparative Output Summary Table | | | | | |
|---|---|---|---|---|---|
| **Production Pathway** | **SAF (MGY)** | **Diesel (MGY)** | **Naphtha (MGY)** | **Total Fuel (MGY)** | **Co-Product Share (%)** |
| **HEFA** | 150 | 54 | 11 | 215 | 30.2% |
| **Fischer-Tropsch** | 150 | 58 | 23 | 231 | 35.1% |

Suggested values based on average Minimum Selling Retail Price (MSRP)

**Assumptions**: Commercial-scale hydrotreatment (HEFA) and gasification–FT synthesis based on optimized catalyst ratios, thermal efficiency, and hydrogen procurement strategy. Assumes stable input feedstock costs and consistent reactor efficiency.

# Existing Infrastructure in Alaska

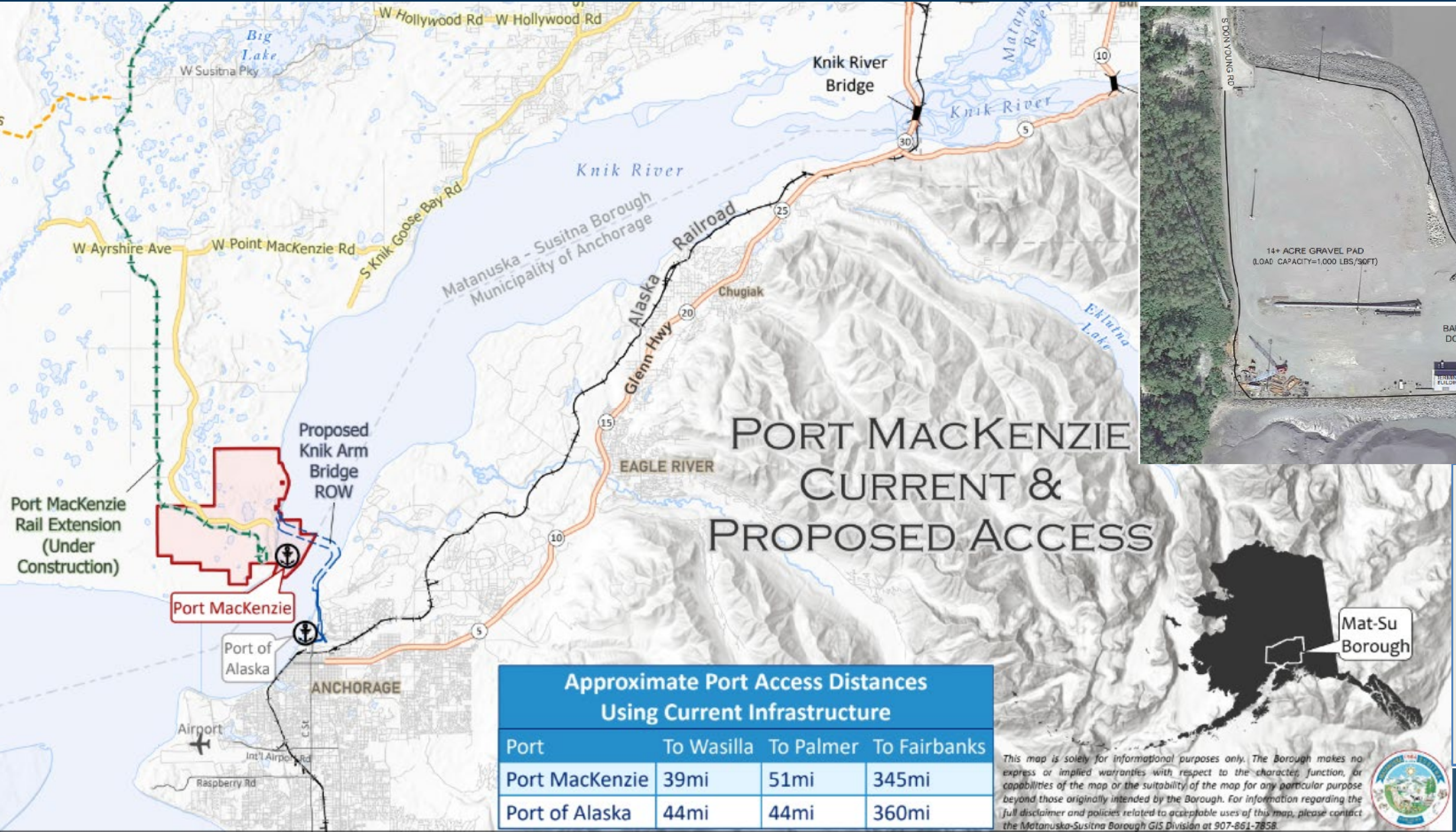
ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

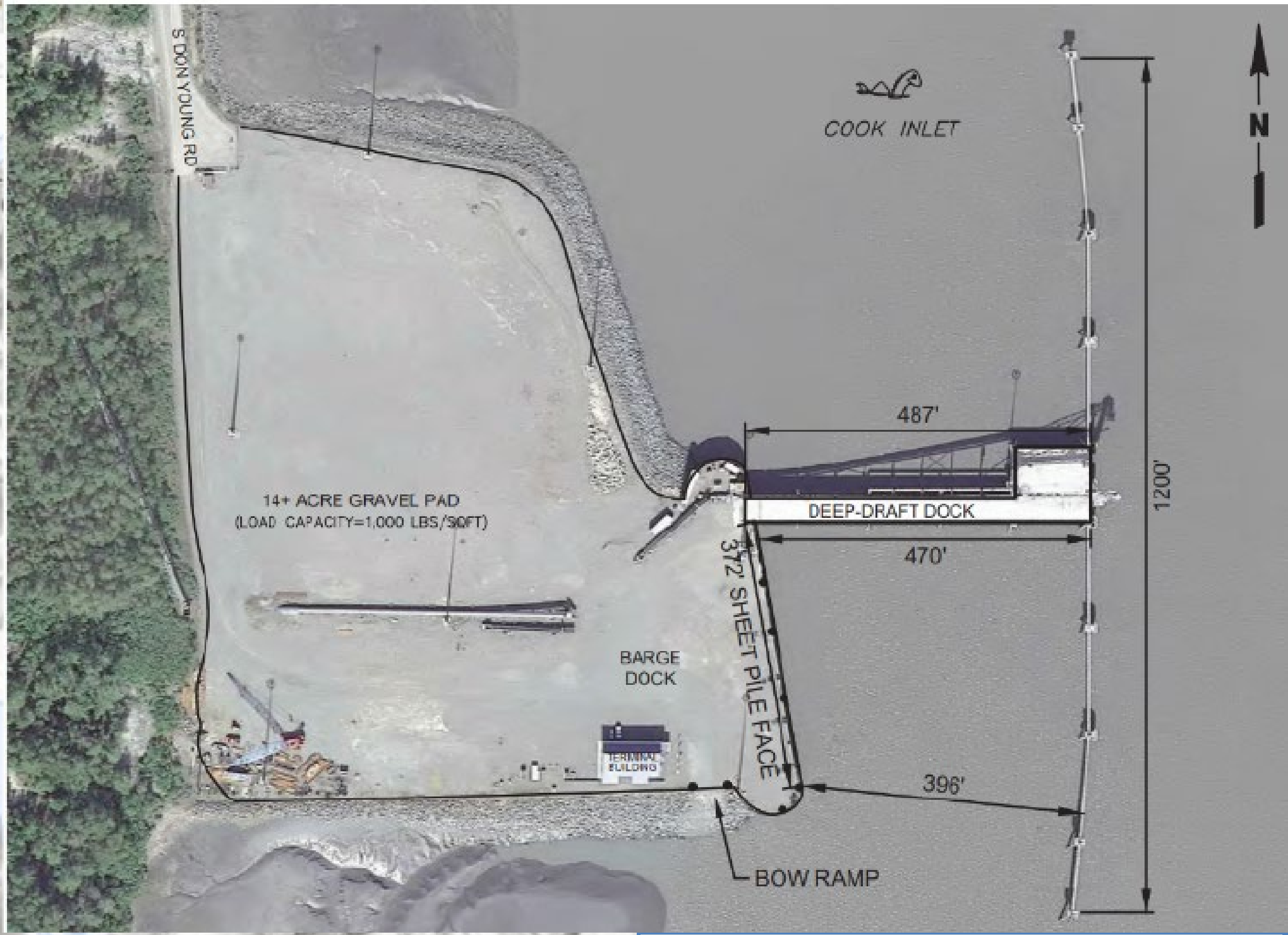
| | Site | Existing Infrastructure | Readiness | Required Upgrades | Opportunities/Constraints |
|---|---|---|---|---|---|
| **Refineries** | **Petro Star Refineries (Valdez & North Pole)** | Small topping refineries (~22,000 bpd combined), limited hydrotreating-may co-process up to 5% bio-feed | ❌ Minimal | Major upgrades: feedstock pretreatment, hydrogen plant, catalyst changes | ⚠️ Remote, limited capacity; not viable for large-scale SAF |
| | **Marathon Kenai Refinery** | Large-scale refinery: distillation, hydrotreaters, tank farm, dock, workforce, permits | ✅ High | Feed pretreatment, catalyst switch, hydrogen expansion, PSA/CCS, possible dock heating | ✔ Retrofit-ready; proximity to NG; reduced CAPEX |
| **Pipeline** | **Port-to-Airport Pipeline (Anchorage)** | ~5M barrels/year throughput, trending upward | ⚠️ Approaching capacity | Pump upgrades or twinning by ~2030 | ⚠️ Critical link for SAF; pressure spec & future compatibility to assess |
| **Airports & Storage** | **TSAIA (Anchorage Airport)** | Modern fuel farm, hydrant system, large-volume throughput | Available | Optional: fuel stratification mixers, SAF tank if segregated | ✔ SAF-ready fueling system; minor additions only |
| | **Port of Alaska (Anchorage)** | Tank farms, fuel terminals, marine dock, pipeline to airport | ✅ High | SAF-dedicated tanks, blending systems, minor pipeline upgrades | ✔ Excellent for SAF distribution; limited local feedstock access |
| | **Storage and Blending (Kenai & Anchorage)** | Tank farms, in-line blending systems | Available | Blend controllers, SAF-dedicated tanks, certification metering | ✔ Leverages existing systems; minor retrofits needed |
| **Ports** | **Port MacKenzie** | Accommodates Panamax-class vessels; 1,000 psf live load on the bulkhead staging pad; 200-ton crawler crane and 200,000 lb axle load capacity on the deep-draft dock | Available | No dedicated Ro-Ro ramp; Rail extension to the port not completed | ✔ Excellent for refinery construction and synfuel distribution. |

# Port MacKenzie

## Potential Greenfield Site

- 1,200 ft Deep Draft Dock -60’ at low tide
- 375 ft Barge Dock -20’ at low tide
- Open year round




| Approximate Port Access Distances Using Current Infrastructure | | | |
|---|---|---|---|
| Port | To Wasilla | To Palmer | To Fairbanks |
| Port MacKenzie | 39mi | 51mi | 345mi |
| Port of Alaska | 44mi | 44mi | 360mi |

**Zoning Overview**

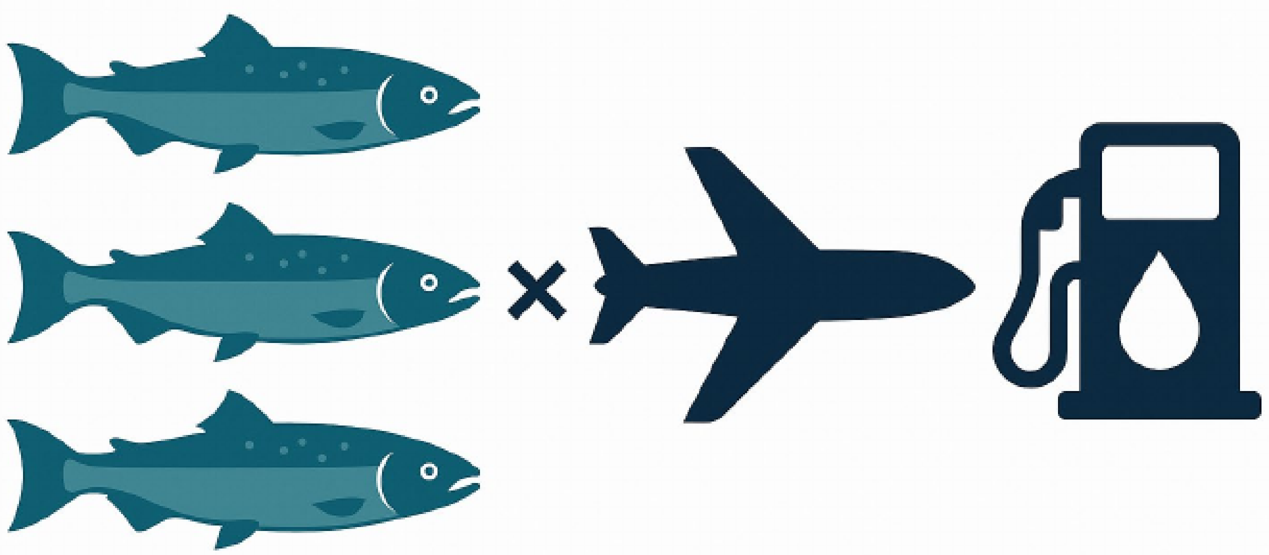
Port Industrial District I = 3,047 acres

Port Industrial District II = 4,836 acres

# Fish Oil Conversion to Synfuel

| Items | Material / Input | Units/Notes |
|---|---|---|
| Fish Biomass | ~25 lbs per fish | Assumed 10% yield of oil |
| Fish Oil (Feedstock) | 1 gallon (≈3.5 kg) | Average energy content ≈ 33 MJ/kg |
| Hydrogen | ~0.1 kg per gallon SAF | Required for hydroprocessing: deoxygenation and saturation |
| Utilities (Steam, Power) | ~7.5 MJ thermal energy | Used for heating, compression, and separation processes |
| Final Output | 1 gallon SAF | Energy content ≈ 42.8 MJ/gal |

**It takes 3 salmon to make 1 gallon of sustainable aviation fuel.**



| Alaska Fish | Oil Yield (% by weight) | Energy Content (MJ/kg) | Typical Annual Harvest in Alaska (Metric Tons) | Oil yield (MT) | SAF Yield (Million Gallons) |
|---|---|---|---|---|---|
| Herring | 10–20% | ~39–41 | 345,000 (138,000 in by-products) | 27,600 | 7.3 |
| Salmon | 8–12% | ~39–42 | 468,800 (187,520 in by-products) | 22,502 | 5.9 |
| TOTAL | | | | 50,102 Metric Tons | 13.2 MGY |

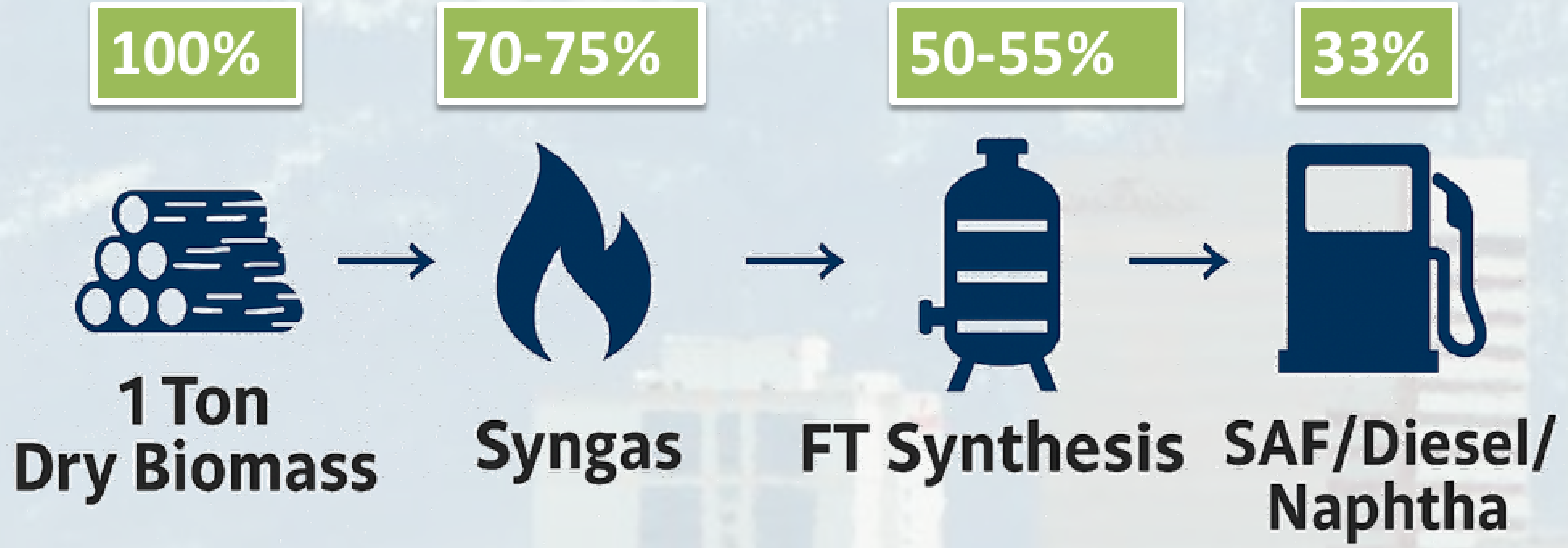
**Alaska's current fisheries byproducts could support a small-scale, synfuel refinery—potentially modular or co-located with existing rendering infrastructure—producing approximately 9% of the targeted SAF output of 150 MGY.**

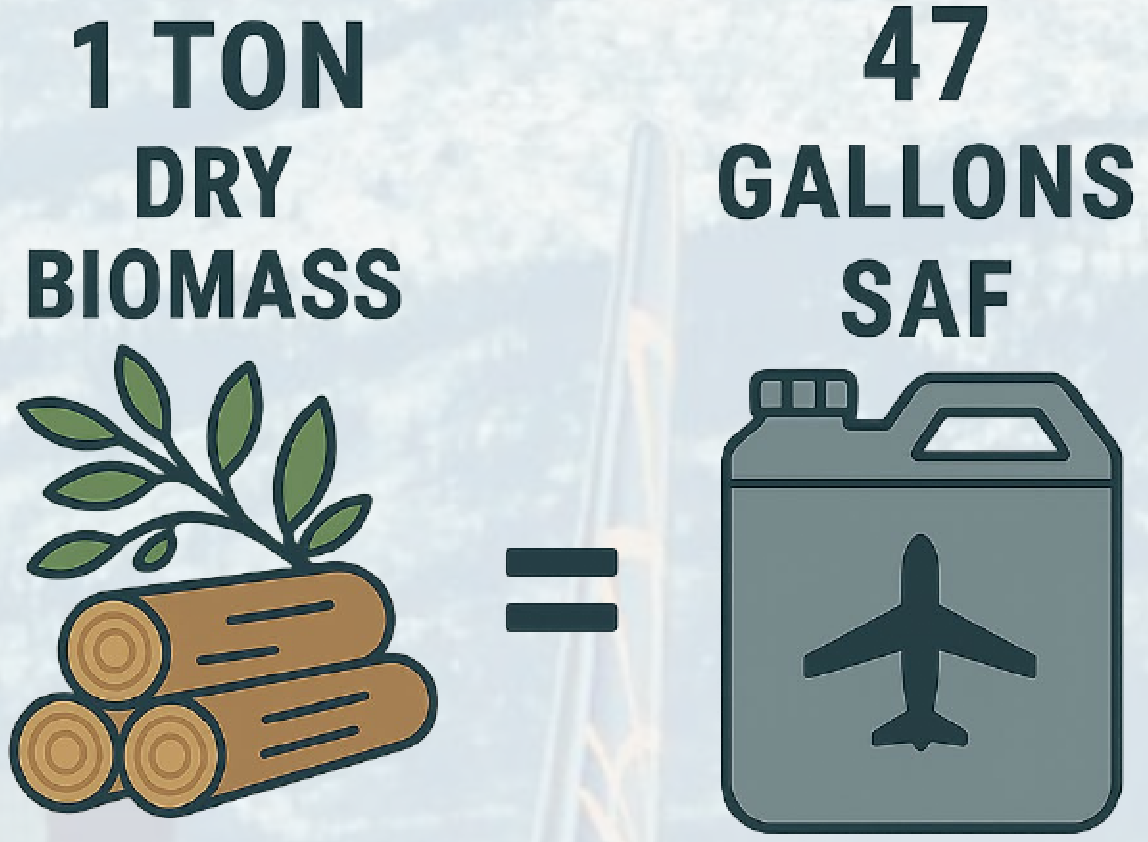
# Woody Biomass Conversion to Synfuel

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

**Biomass Intake Requirements**

- Annual Fuel Output Target: 230 million gallons/year
- Biomass Needed (dry basis): 4.9 million metric tons
- Equivalent Moisture-Adjusted Feedstocks:
  - 5.75 million metric tons @ 15% moisture content
  - 9.78 million metric tons @ 50% moisture content




**Carbon and energy yield into liquid fuel is ~33%**

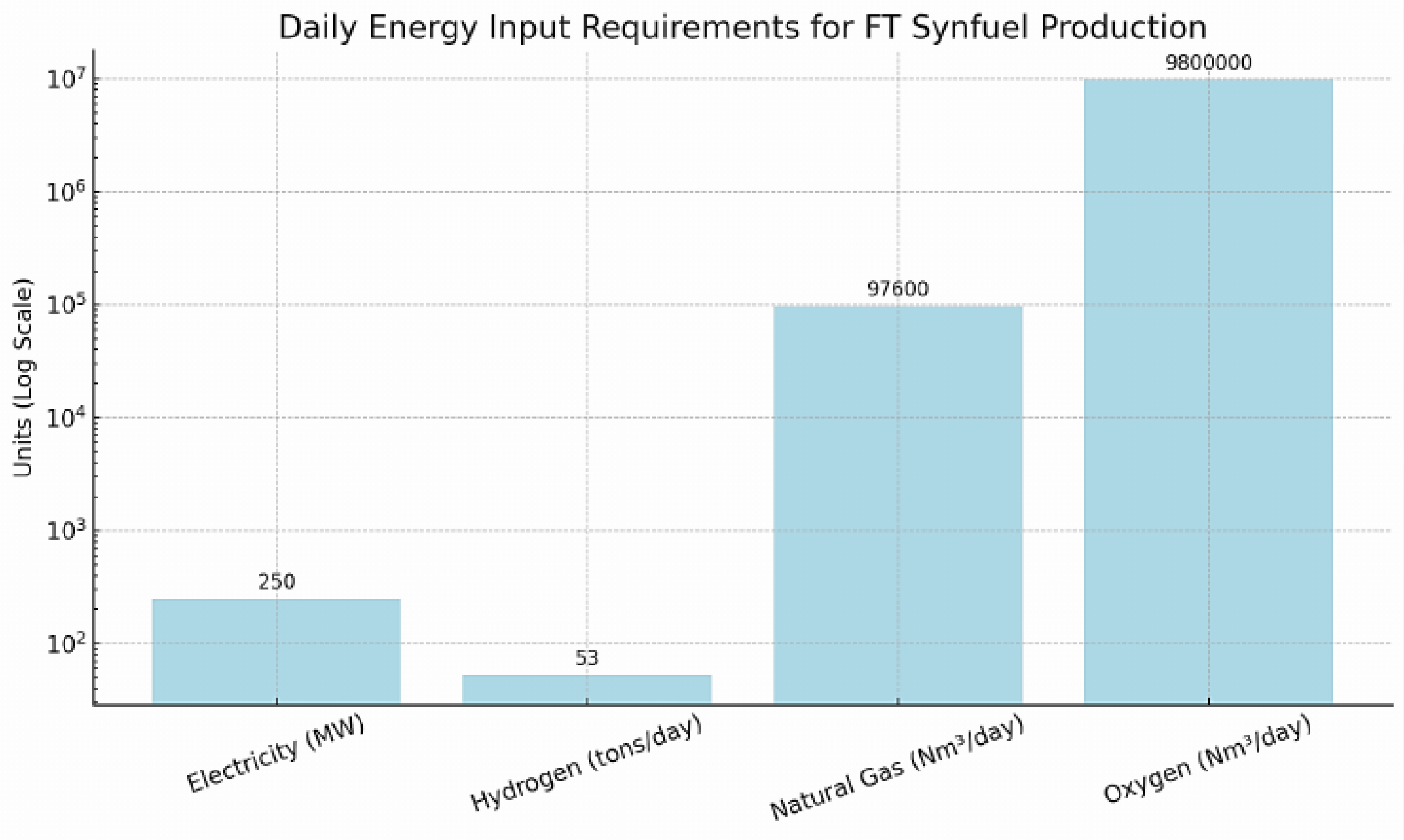
Based on HHV-converted energy yield for woody biomass (FT pathway)
Based on facility design capacity of 230 million gallons per year and typical biomass drying yields. Assumes average moisture content per NREL TEA standards.
Source: NREL, DOE TEA models (2024), internal engineering assumptions

# Fisher-Tropsch 230 MGY Refinery

## Daily Energy & Mass Balance

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

| Input | Daily Input Requirement | Primary Use |
|---|---|---|
| Electricity | Approximately 250 MW of continuous power | Powers air separation unit, industrial compressors, and plant support systems |
| Hydrogen ($H_2$) | 52.6 metric tons per day | Used to convert waxy synthetic fuel into jet fuel through catalytic processing |
| Natural Gas | 50,600 normal cubic meters per day (Steam Methane Reformer- SMR) | Provides hydrogen via steam reforming |
| | 47,000 normal cubic meters per day (Combined Heat And Power - CHP) | Supplies fuel for power generation |
| Oxygen ($O_2$) | 14,000 metric tons per day (approx. 9.8 million cubic meters) | Required for converting biomass into synthesis gas using high-temperature gasification |



# Fisher-Tropsch 230 MGY Refinery
## Key Design Parameters

**230 million gallons per year total**
150 MGY of sustainable aviation fuel
58 MGY of renewable diesel
22 MGY of renewable naphtha

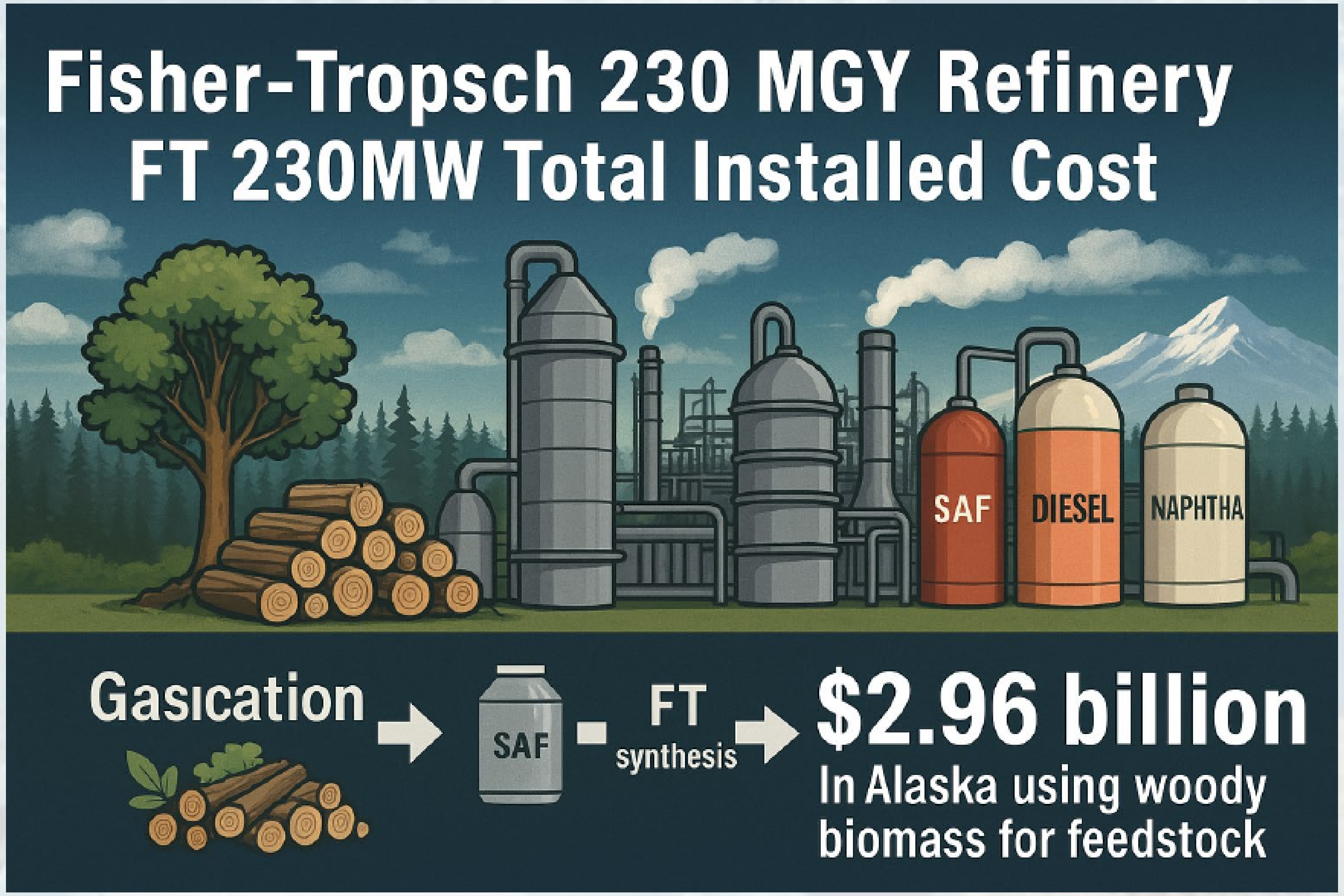
| System Area | Design Sizing & Capability |
|---|---|
| **Biomass Feedstock** | 15,000 metric tons per day of green woody biomass (approximately 7,500 dry tons per day); 4.0 million metric tons per year total input |
| **Feedstock Preparation** | 7 industrial wood chippers, 10 hammer mills, and 15 rotary biomass dryers |
| **Gasification System** | 5 oxygen-blown, entrained-flow gasifier reactors (approximately 3,000 dry tons per day each) |
| **Oxygen Supply System** | 14,000 metric tons per day via cryogenic air separation; power demand: 120–130 MW |
| **Fischer–Tropsch Reactor System** | 5 reactor trains using slurry bubble column reactors; approximately 20,000 barrels per day of synthetic hydrocarbon liquids |
| **Fuel Upgrading (Hydroprocessing)** | Hydrocracker with 20,000 barrels per day capacity; includes isomerization to improve jet fuel and diesel properties |
| **Hydrogen Production System** | 50 metric tons per day of hydrogen via steam methane reforming; includes pressure swing adsorption purification and carbon dioxide capture from reformer flue gas |
| **Carbon Dioxide Capture and Storage** | Approximately 4 million metric tons per year captured; includes drying, compression, a 20-mile pipeline, and subsea geologic injection infrastructure |
| **Onsite Power and Steam Generation** | 250 MW combined heat and power system (gas turbines, heat recovery steam generator, steam turbine); approximately 100 megawatts available for export. 100 MW surplus electricity may be exportable |
| **Water Treatment and Cooling Systems** | $15 million for process and boiler water treatment; $15 million for cooling towers capable of rejecting approximately 230 megawatts of thermal load |
| **Fuel Storage Capacity** | Two tanks for sustainable aviation fuel (~300,000 barrels total), one tank for renewable diesel (~150,000 barrels), and one tank for renewable naphtha (~75,000–100,000 barrels), providing approximately 30 days of product storage |
| **Product Loading and Distribution** | $15 million for marine loading dock and infrastructure; 10-mile pipeline to Port MacKenzie terminal; optional truck and rail loading systems |

# Fisher-Tropsch 230 MGY Refinery

## Class Four Estimate: Total Installed Cost

| | |
|---|---|
| Feedstock Logistics & Handling | $83,250,000 |
| Gasification & Syngas Production | $609,400,000 |
| Fischer–Tropsch Synthesis & Product Upgrading | $492,500,000 |
| Utility Systems (CHP, SMR, ASU) | $649,600,000 |
| Product Storage & Distribution | $62,400,000 |
| CO2 Management | $191,200,000 |
| Site Infrastructure | $69,300,000 |
| **Direct Costs** | **$2,157,650,000** |
| **Contingency (15%)** | **$323,647,500** |
| **Preconstruction Costs (14%)** | **$302,071,000** |
| **Total** | **$2,783,368,500** |

The total installed cost of a 230 million gallons per year Fischer–Tropsch refinery is estimated at approximately **$2.78 billion**, based on a Class 4 level estimate (–30% to +50%).



# Fisher-Tropsch 230 MGY Refinery

## Rough Order of Magnitude Annual Operating Costs (OpEx)

~$534 million per year to operate

| Cost Category | Annual Cost ($M) | $ per Gallon | Key Assumptions (Base Year) |
|---|---|---|---|
| **Fixed** | **152** | **0.66** | |
| Insurance & Property Tax | 46 | 0.20 | ~0.5% insured value + ~1% capital PILOT tax |
| Labor (Ops & Maint.) | 21 | 0.09 | ~180 FTE @ ~$100k/yr fully burdened |
| Admin & Overhead | 5 | 0.02 | G&A ~20% of labor cost, incl. office staff, HR, accounting, admin systems |
| Maintenance (Routine) | 60 | 0.26 | ~2% of capital in spare parts/repairs; routine inspections and contractor services |
| Maintenance (Turnaround) | 5 | 0.02 | Major overhauls 5-yearly (~$25–30 MM each, amortized) |
| Regulatory & Compliance | 7 | 0.03 | Title V air permit, stormwater/WQ, hazardous materials tracking, CEMS maintenance, EPCRA |
| Misc Operations | 8 | 0.04 | Tied to financing, compliance, and digital operations |
| **Variable** | **295** | **1.28** | |
| Water & Utilities | 2 | 0.01 | Well water ~1.5 MGD @ $0.50/kgal; on-site $O_2$ production |
| Supplemental Natural Gas for CHP | 4 | 0.01 | Electricity/steam generation supplement to FT off-gas; $11,448/day gas cost |
| Natural Gas for SMR | 5 | 0.02 | ~50k $Nm^3$/day for $H_2$ production via SMR (~1.8 MMSCFD) @ $6.90/Mcf |
| Feedstock | 276 | 1.20 | 8.9M green tons × $75/ton = $667M/year; procured on wet basis |
| Waste Disposal | 1 | 0.01 | Minor solid/hazardous waste: spent catalyst, sorbents, filters, water treatment sludges |
| Chemicals & Catalysts | 7 | 0.03 | Cobalt-based FT catalyst and Pt hydrotreater catalyst (5-yr cycles); solvents, water treatment |
| **Distribution** | **20** | **0.09** | |
| Marine Barge (Port MacKenzie → Anchorage) | 10 | 0.04 | Cook Inlet barge ops; tug fuel, crew, mooring, terminal ops at both ends |
| TSAIA Jet Fuel System Integration Costs | 5 | 0.02 | Storage tank leasing, hydrant fees, safety compliance, aviation liability insurance |
| Storage and Blending at the Port of Alaska | 5 | 0.02 | Tank heating, maintenance, metering, throughput fee, fuel quality testing (ASTM D1655 compliance) |
| **CCS** | **67** | **0.29** | |
| $CO_2$ Transport & Storage | 67 | 0.29 | ~6.55 $MtCO_2$/year captured and injected @ $10/ton; compression, pipeline, well monitoring |
| **Total OpEx (Year 1)** | **534** | **2.32** | **All costs in constant 2025 dollars; excludes power export, excludes LCFS/45Q revenue credits.** |

# Delivered Cost of Synfuel

## Preliminary Pre-Incentive Pricing Model

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

| Cost Component | HEFA ($/gal) | FT ($/gal) | Explanation |
|---|---|---|---|
| **Capital Recovery (Depreciated CapEx)** | $0.19 | $0.48 | Capital recovery amortized over 25 years. Includes full EPC cost, contingency, and indirect costs. |
| **Operating Expenses** | $4.84 | $2.32 | Includes all fixed and variable O&M: feedstock, labor, maintenance, utilities, and catalysts. |
| **Debt Service (Interest Only)** | $0.19 | $0.28 | Interest-only cost from DOE loan (i.e., $2.07B @ 6% over 30 years). Equity cost captured in Capital Recovery above. |
| **Net Production Cost** | **$5.22** | **$3.08** | **Final estimated cost per gallon of fuel produced after accounting for financing.** |
| **Equity Return** – IRR target | $0.75 | $0.75 | Includes both principal repayment + return on equity (ROE) |
| **Optional Market Uplift** | $0.50 | $0.50 | Market-driven uplift; optional depending on buyer |
| **Total Cost to Airlines** | **$6.47** | **$4.33** | Excludes credits (e.g., LCFS, RFS, SAF tax credits, 45Q) |

# Pathway Comparisons

ANSYR
ALASKA NEXT-GEN SYNFUEL REFINERY

| Metric | HEFA Pathway Refinery | Fischer–Tropsch Pathway Refinery |
|---|---|---|
| **Total Cost per Gallon** | $6.47 | $4.33 |
| **Production Volume** | 215 MGY (150 SAF, 54 diesel, 11 naphtha) | 230 MGY (150 SAF, 58 diesel, 22 naphtha) |
| **CapEx: Total Installed Cost** | $1,044,126,000 | $2,783,368,500 |
| **OpEx: Total Annual Operating Cost** | $1.04B/year ($4.84/gal) | ~$534M/year ($2.32/gal) |
| **Primary Feedstock / Cost per gallon** | Fish oil ($4.35/gal) | Woody biomass ($1.20/gal) |
| **Conversion Technology** | Hydroprocessing (HEFA) | Gasification + FT synthesis |
| **Reactor System** | 2 Hydrodeoxygenation + 1 Isomerization | 5 Slurry FT reactors + 1 Hydrocracker |
| **Hydrogen Source / Demand** | Steam Methane Reforming (SMR) / 88,000 kg per day | SMR + CHP integration / 50,000 kg per day |
| **Electric Power Demand** | ~50 MW (mainly hydroprocessing + SMR) | 250 MW (ASU, gasifier, CHP) |

The **Fischer–Tropsch pathway** offers a **lower-cost, higher-impact, and scalable long-term SAF solution** for Alaska, supported by biomass availability and deep $CO_2$ reduction potential.

-----------------------

The **HEFA pathway** may serve as a **modular, early-phase deployment** but is constrained by high feedstock cost and volume limitations.

# WE HAVE A PLAN

## SAF IN ALASKA: PATHWAY TO 2030

### Phase 1: SAF Feasibility Analysis
### January – July 2025

- Stakeholder Outreach: Airlines, airports, agencies
- Feasibility Studies: Feedstock, technology, logistics
- Partner Outreach: Producers, agencies, investors
- Financial Modeling: Costs, funding, partnerships

### Phase 2: Preliminary Design and Pre-Application
### August - December 2025

- Preliminary Design: Site selection, technology, infrastructure
- Environmental Scoping: Carbon lifecycle assessment
- Regulatory Work: Permitting agencies, key requirements, DOE pre-application

### Phase 3: Blending SAF Imports
### 2026 - 2030

- SAF Imports: Suppliers, agreements, blending logistics
- Blending Hubs: Anchorage or Fairbanks locations

### Phase 4: Final Design and Permitting
### 2026 – 2028

- Final Design: Complete SAF facility plans
- Permitting & Funding: Secure approvals and financing
- Construction: Build facility and infrastructure

### Phase 5: Staged Construction
### 2028 – 2030

- Construction: Suppliers, agreements, blending logistics
- 2030 Launch: SAF production begins in Alaska

# Alaska Department of Transportation & Public Facilities

**Deputy Commissioner Katherine Keith, PMP, PMI-ACP**
**Katherine.Keith@alaska.gov**

ANSyR
ALASKA NEXT-GEN
SYNFUEL
REFINERY