Net-Zero 1 Deep-Dive

Sustainable and Scalable

NASDAQ: GEVO

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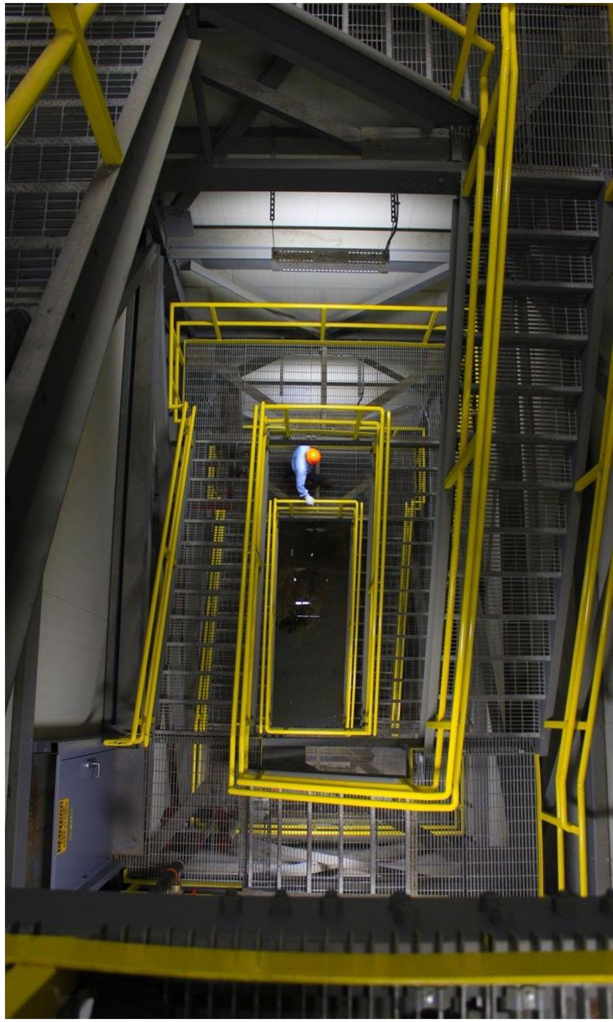

Picture: R&D and demonstration facility in Luverne, Minnesota

What is SAF?

Why SAF?

Gevo’s competitive position

Additional opportunities in bio-chemicals

What is SAF?

SAF: Sustainable Aviation Fuel

- **Drop-in** to existing engines and infrastructure
  - Same molecules as petroleum-based jet fuel
- **Low-carbon** inputs and production process
  - Our molecules come from CO_2 in the atmosphere and wind power

Our SAF Has Been Used Globally

gevo

CHICAGO O'HARE

UNITED, air bp, Emirates, ETIHAD AIRWAYS, KOREAN AIR, CATHAY PACIFIC, Lufthansa, KINDER MORGAN, ATLAS AIR

FARMINGDALE NEW YORK AIRPORT

EMBRAER, BOMBARDIER, DASSAULT AVIATION, Gulfstream

FARNBOROUGH AIRPORT

PIAGGIO, Cessna

SEA TAC AIRPORT

Alaska Airlines

VAN NUYS

AVFUEL, VNAA, PHILLIPS 66, IBAC International Business Aviation Council, JAL, ASIG, NATA

ATLANTA

U.S. ARMY, United States Navy, United States Air Force, United States Coast Guard

DEHLI

airasia

BRISBANE AIRPORT

BRISBANE AIRPORT, Virgin australia, Queensland Government, CALTEX, VIVA Energy Australia

FLY GREEN
Fueled by Gevo

Map denotes Gevo supplied ATJ SAF from our demonstration facilities.

What is SAF?

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Why SAF?

❶ **Growing demand for air travel**

❷ **SAF is currently the <u>only</u> scalable aviation industry solution for carbon abatement**

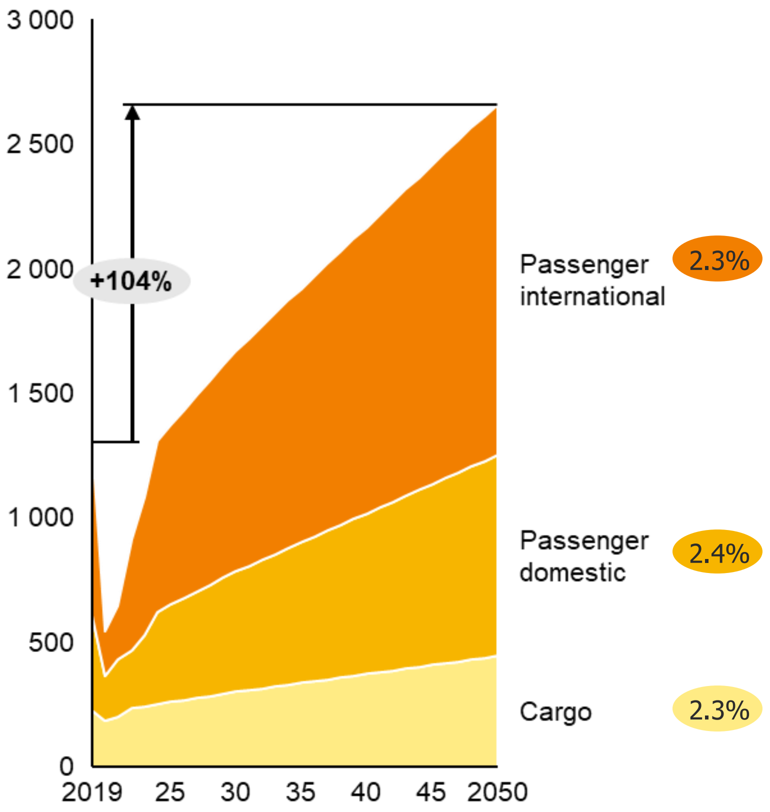
❸ **Enormous, growing demand for SAF**

① Growing Demand for Air Travel

Air traffic activity

RPK and RTK expressed as RTK[1], billion

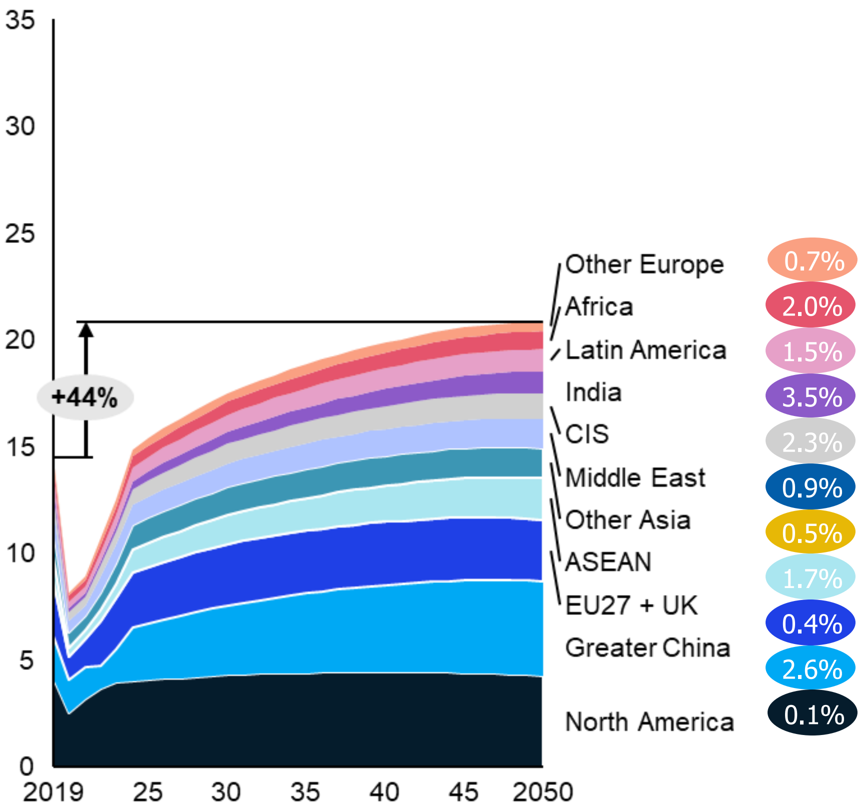
CAGR 2019-2050



Aviation Energy consumption

Mn TJ

CAGR 2019-2050



Air traffic activity expected to double by 2050

Emissions will increase if left unabated

Efficiency improvements in aircraft and ground operations will offset less than half of growth emissions

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[1] Assuming 125kg per passenger (incl. passenger weight, luggage and chair)

Source: Global Consulting Firm, Energy Insights Global Energy Perspective 2023

② SAF is Currently the <u>Only</u> Scalable Aviation Industry Solution

- SAF is currently the **<u>only</u>** scalable option for carbon abatement of ~75% of jet fuel emissions
- Medium and long-range travel make up ~75% of fuel consumption and require lightweight, energy dense liquid fuels

Share of total fuel consumption ☐ < 0.1% ░ 0.1-2% ▓ 2-5% 🟦 5-10% ■ 10-15%

Aviation fuel demand per segment and range - 2018										**Share of total**		**Decarbonization option**			
PAX	**Range up to in thousand km**									**Fuel consumption**	**Global fleet**	**Fuel eff. improvements**	**Battery electric**	**Hydrogen (fuel-cell or combustion)**	**SAF**
	0.5	**1**	**2**	**3**	**4.5**	**7**	**8.5**	**10**	**>10**						
Commuter <19	░	☐	☐	☐	☐	☐	☐	☐	☐	<1%	4%	✓	✓	✓	✓
Regional 20-80	░	░	░	☐	☐	☐	☐	☐	☐	3%	13%	✓	✓	✓	✓
Short-range 81-165	░	🟦	■	▓	░	☐	☐	☐	☐	24%	53%	✓	⋰	✓	✓
Medium-range 166-250	░	▓	■	🟦	🟦	▓	░	░	░	43%	18%	✓		⋰	✓
Long-range >250	☐	░	░	░	░	🟦	▓	▓	🟦	30%	12%	✓		⋰	✓

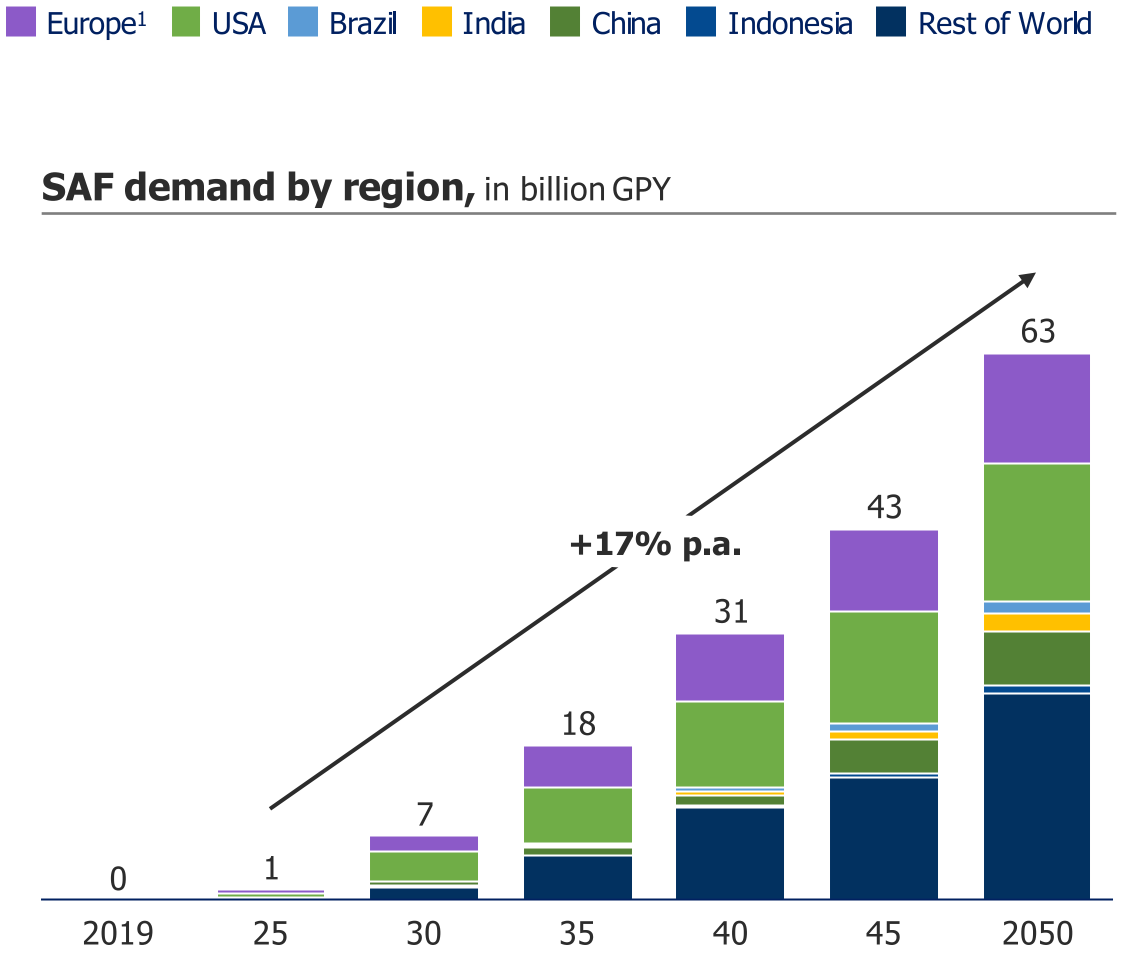
Source: FCH and Clean Sky 2: Hydrogen-powered aviation report (May 2020). Global Consulting Firm.

③ Enormous, Growing Demand for SAF

SAF mandates (not exhaustive)

EU[1]	2% SAF blends by 2025[2]
USA	3 bn gal of SAF by 2030[3]
Finland	30% SAF blends by 2030
Norway	30% SAF blends by 2030
UK	10% SAF blends by 2030
Netherlands	14% SAF blends by 2030
Indonesia	5% SAF blends by 2027

SAF demand by region, in billion GPY



Growth in SAF demand is largely driven by US and Europe, due to high ambition on the supply side in the US supported by financial incentives as well as proposed concrete mandates for blending of SAF at all EU airports

In the US, demand for SAF largely driven by corporate and state commitments (e.g., SAF Grand Challenge) as well as incentives and cap-and-trade systems to accelerate commercialization (e.g., Inflation Reduction Act 45Z, Minnesota and Illinois SAF tax credits, Low Carbon Fuel Standards in California, Washington, Oregon, British Columbia, New Mexico, Canada)

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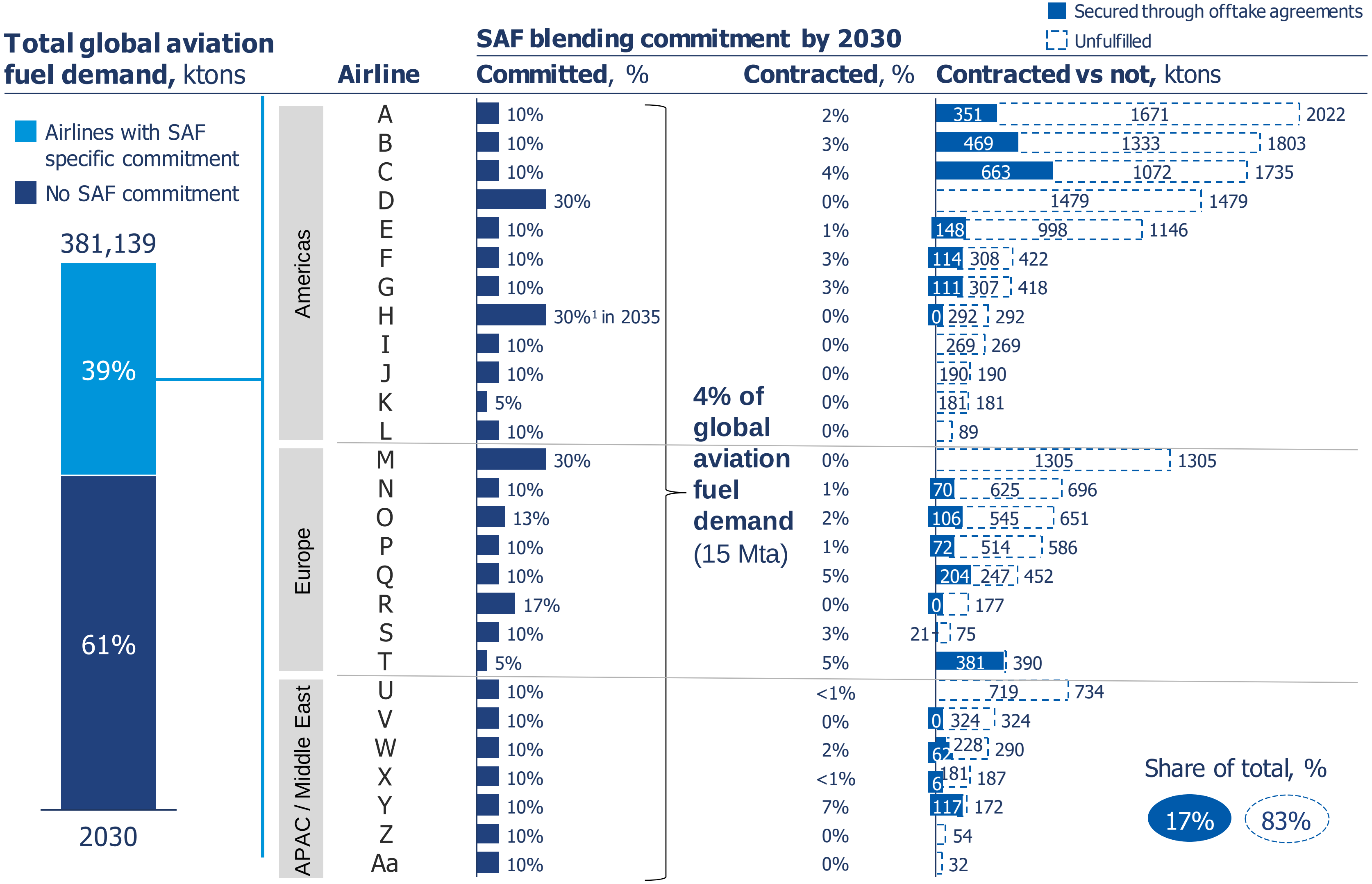
1. EU27+UK+Norway
2. 2% by 2025, 5% by 2030, 63% by 2050 from ReFuelEU proposal
3. Sustainable Aviation Fuel Grand Challenge (not a mandate); Represents 8-11% of U.S. aviation fuel sales in 2030, assuming projected sales of 28-38 bn gallons

Source: Global Consulting Firm, Sustainable Fuels Demand Model

③ Enormous, Growing Demand for SAF (Cont'd)



SAF blending commitment by 2030

	Airline	Committed, %	Contracted, %	Contracted vs not, ktons
Americas	A	10%	2%	351 1671 2022
	B	10%	3%	469 1333 1803
	C	10%	4%	663 1072 1735
	D	30%	0%	1479 1479
	E	10%	1%	148 998 1146
	F	10%	3%	114 308 422
	G	10%	3%	111 307 418
	H	30%[1] in 2035	0%	0 292 292
	I	10%	0%	269 269
	J	10%	0%	190 190
	K	5%	0%	181 181
	L	10%	0%	89
Europe	M	30%	0%	1305 1305
	N	10%	1%	70 625 696
	O	13%	2%	106 545 651
	P	10%	1%	72 514 586
	Q	10%	5%	204 247 452
	R	17%	0%	0 177
	S	10%	3%	21 75
	T	5%	5%	381 390
APAC / Middle East	U	10%	<1%	719 734
	V	10%	0%	0 324 324
	W	10%	2%	62 228 290
	X	10%	<1%	6 181 187
	Y	10%	7%	117 172
	Z	10%	0%	54
	Aa	10%	0%	32

4% of global aviation fuel demand (15 Mta)

Share of total, %

17% 83%

27 major airlines representing ~39% of global aviation fuel consumption have made SAF specific commitments

However, only 17% of airline SAF commitments are contracted

Additional SAF volumes are necessary to achieve 2030 airline targets

[1] H has committed to 30% SAF blend in 2035, 2030 value was derived using an assumed ramp-up curve with ~7.5% SAF blend in 2030

Source: Company websites, press search, OAG, Fleet Analyser, Global Consulting Firm

③ Enormous, Growing Demand for SAF (Cont'd)

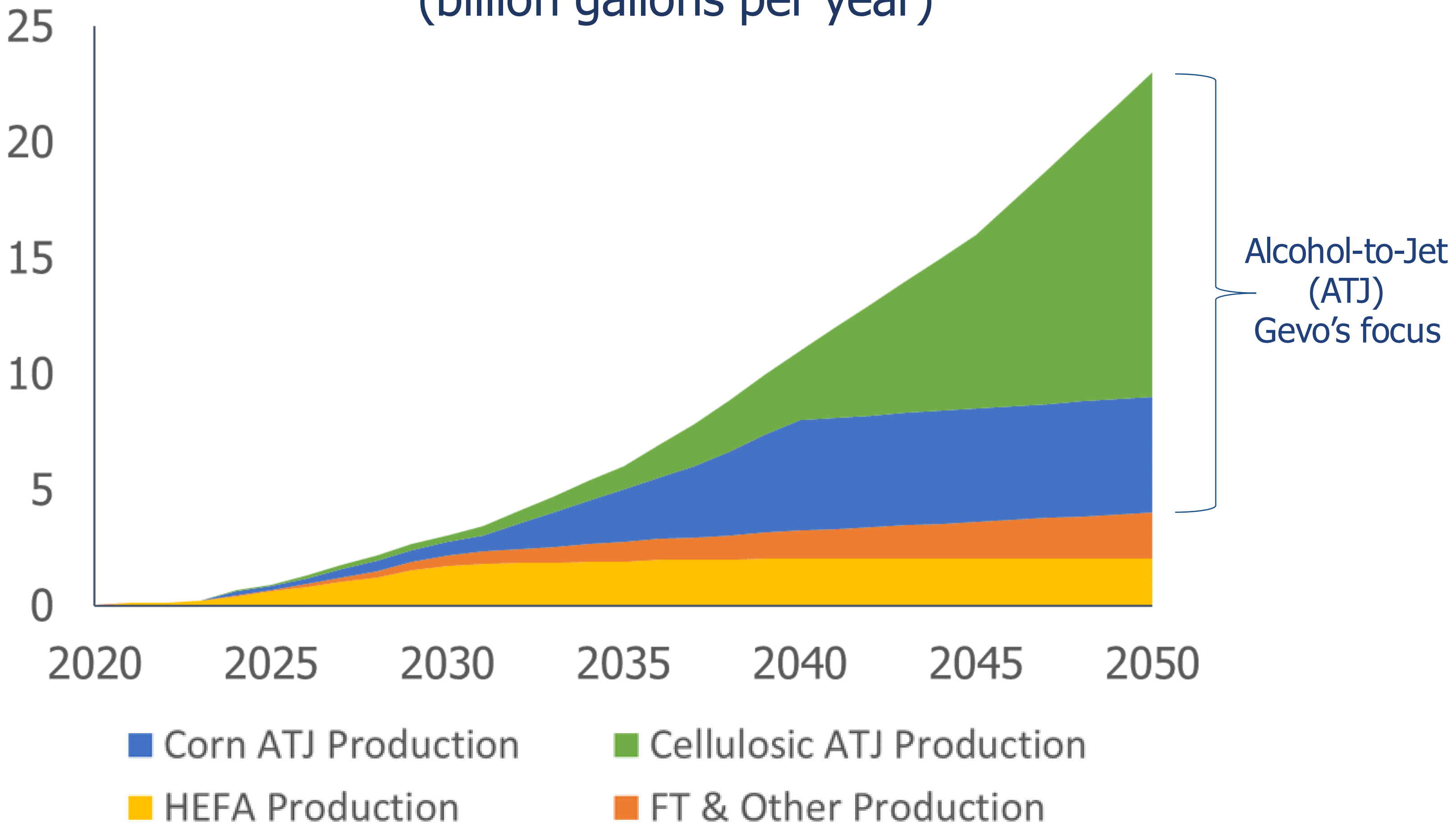
Forecasted SAF demand by 2050 in US alone equals:

400 times the size of our first greenfield plant

1,200 times existing supply

Forecasted US SAF Fulfillment

(billion gallons per year)



Sources: US EIA, ICF Resources, LLC and internal estimates.

What is SAF?

Why SAF?

Gevo’s competitive position

Additional opportunities in bio-chemicals

Gevo's Net Zero 1 SAF is Highly Competitive with Alternative SAF Production Pathways

SAF pathways: AtJ HEFA PtL

Competitive criteria		Assessment criteria	Net Zero 1 (Gevo AtJ[1])	UCO or Soybean Oil HEFA[2]	Power-to-Liquids[3]
Sustainable	Decarbonization Efficiency	How competitive is the \$/MT CO_2 abatement cost against alternative SAF pathways and across other decarbonization routes?	✅ ~\$450/MT CO_2	✓ ~\$720-800/MT CO_2	⊗ ~\$1,500+/MT CO_2
	Optionality	What additional levers exist to further decarbonize?	✅ Sust. ag	✓ Sust. ag	✓ RES[4], H2 optionality
	Resource Efficiency	Is this the most effective use of resources to decarbonize (e.g., land)? What alternative uses of resources would be more effective?	✅ 5x more fuel production potential than soy	✅ Crops with most efficient use of land often banned (e.g., Palm)	✓ Alternative use of RES / H2 needs to be considered
Scalable	Feedstock and Inputs	What are the feedstock and input limits to scaling?	✅ Corn could supply >3x projected 2030 US SAF demand	✅ Waste oils constrained; soybean oil less constrained	✅ Unlimited theoretical feedstock
	Timing	What are the critical unlocks to scaling, when will they come, and what are the signposts?	✅ Can repurpose falling demand of ethanol	✓ Competition for RD in the near-to mid-term	⊗ Constraint on at-scale renewables deployment in near-term

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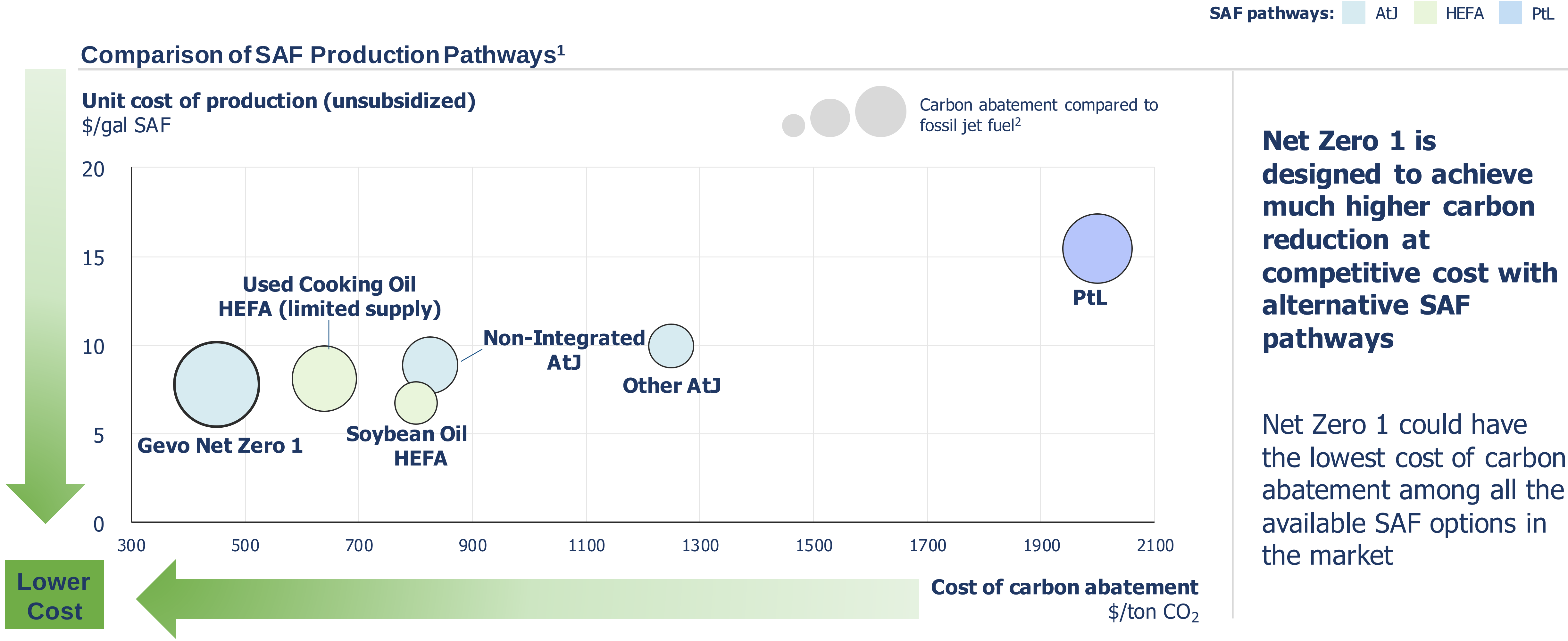
1. Alcohol to Jet
2. Hydroprocessed Esters and Fatty Acids – the process of refining vegetable oils, waste oils, or fats into SAF through a hydrogenation process
3. Power to Liquids – the process of converting renewable electricity and captured carbon dioxide into synthetic fuels and chemicals, such as diesel, methanol, and SAF
4. Renewable energy systems (e.g., wind, solar)

Source: Global consulting firm, Gevo Base Model, Argonne GREET Aviation Model, expert input

Cost Effective: Gevo's Net Zero 1 is Designed to Enable Low-Cost Route to SAF and Low-Cost Route to Carbon Abatement

Comparison of SAF Production Pathways[1]



Net Zero 1 is designed to achieve much higher carbon reduction at competitive cost with alternative SAF pathways

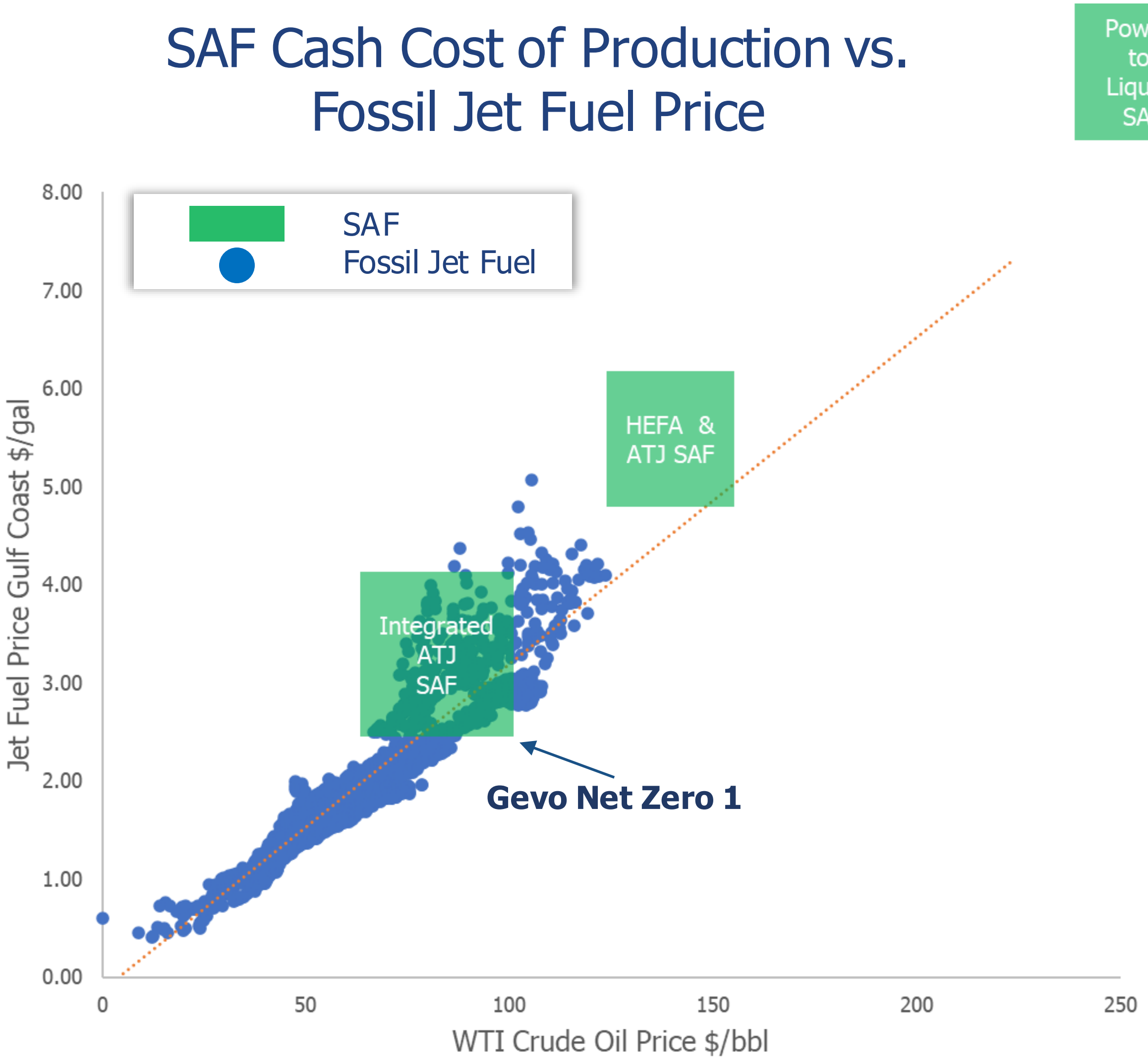
Net Zero 1 could have the lowest cost of carbon abatement among all the available SAF options in the market

1. Cost of carbon abatement = (SAF production cost – fossil jet production cost $2.08/gal jet) / (fossil jet CI 89 gCO2e/MJ – SAF CI); does not include incentives for SAF; 2. CI reduction potential = fossil jet CI – SAF CI; assume fossil jet has 90 gCO2/MJ based on ANL GREET CI.

Source: Global consulting firm, Gevo Base Model, Argonne GREET Aviation Model, expert input

Cost Effective: Most Competitive Cash Cost of Production

SAF Cash Cost of Production vs. Fossil Jet Fuel Price



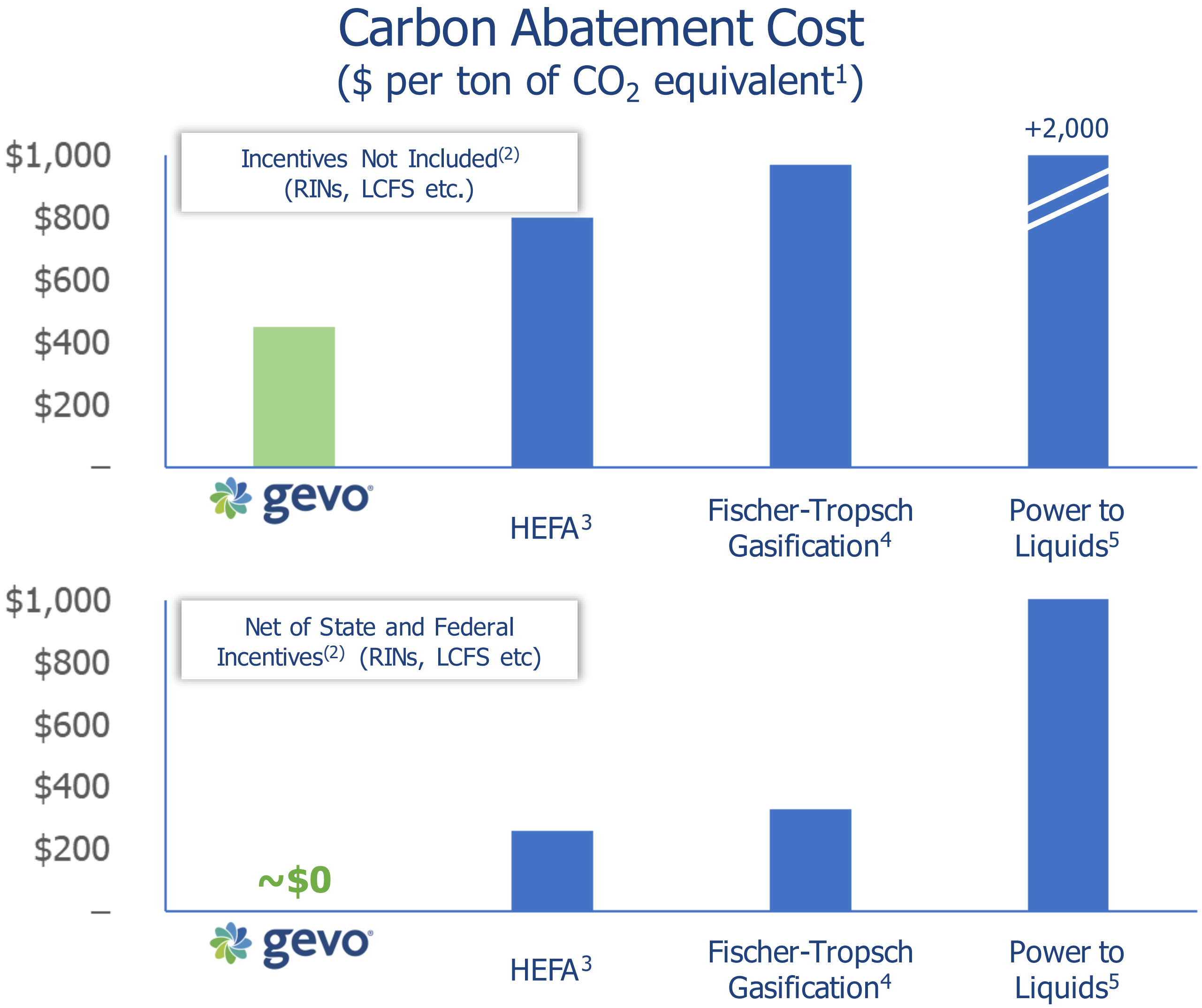
AtJ SAF cash cost of production is expected to be competitive with fossil jet fuel prices, even though AtJ SAF can deliver 100% or more carbon abatement per gallon

Gevo's proprietary integrated process design and technologies lead to most favored competitive position

The future of aviation is **Alcohol-to-Jet**; it's the most competitive on a cash cost of production basis

Cash cost of production represents total economic cost of production before capital cost. Does not include federal and state incentives.
Based on work done by an independent global consulting firm, Nexant, Cancawe-Aramco, and Gevo analysis. SAF production cash cost shown before Federal and state incentives such as RINs, LCFS, 45Z and other state SAF tax credits, and before new capital cost. AtJ SAF cost assumes approximately $5.00/bu corn for illustrative purposes; estimates dependent on feedstock prices and other assumptions.

Cost Effective: Most Competitive SAF Carbon Abatement



Cost of Carbon Abatement is low enough that the carbon value from environmental incentives (RINs, Federal, State level) can make the SAF affordable to airlines

Based work done by an independent global consulting firm which includes on external market data and internal estimates. (1) Carbon abatement cost = (Cost of SAF production + Cost of capital – Fossil jet price of $2.08/gal) / (Fossil jet Carbon Intensity 89 gCO2e/MJ – SAF Carbon Intensity) x Conversion Factor. Conversion Factor = 1,000,000 gCO2e per ton / 119,777 BTU per gal jet x 948 Btu per MJ. (2) State and Federal incentives include incentives such as the 45Z, California LCFS, RINs and state SAF tax credits, as applicable. Based on internal estimates for Gevo Net-Zero 1 greenfield SAF plant. (3) Soybean oil (43 CI), assumes brownfield HEFA facility $6.80-7.01/gallon production and capital cost. (4) Forestry residues (4 CI). (5) Combustion point source CO2 (12 CI).

Cost Effective: Gevo's ETO (ethanol-to-olefins) Technology Could Further Reduce Future SAF Cost of Production

Gevo's ETO technology generates C3+ olefins directly from ethanol, making it more efficient than current dehydration + oligomerization processes. Reduced unit operations > less capital > lower energy footprint > more carbon abatement per dollar.

Amount of Potential Cost Reduction (2030+)

Cost of Carbon Abatement

40%, or $175/ton CO_2 Cost Reduction

Cost of SAF Production

25%, or $2/gal SAF Cost Reduction

Gevo has the potential to achieve tech-driven cost reductions and lower cost of carbon through ETO

ETO could lower capex by ~25% by generating C3+ olefins directly from ethanol, reducing the scale of the AtJ process, and **lower opex by ~15% by** increasing yield and reducing the energy input required

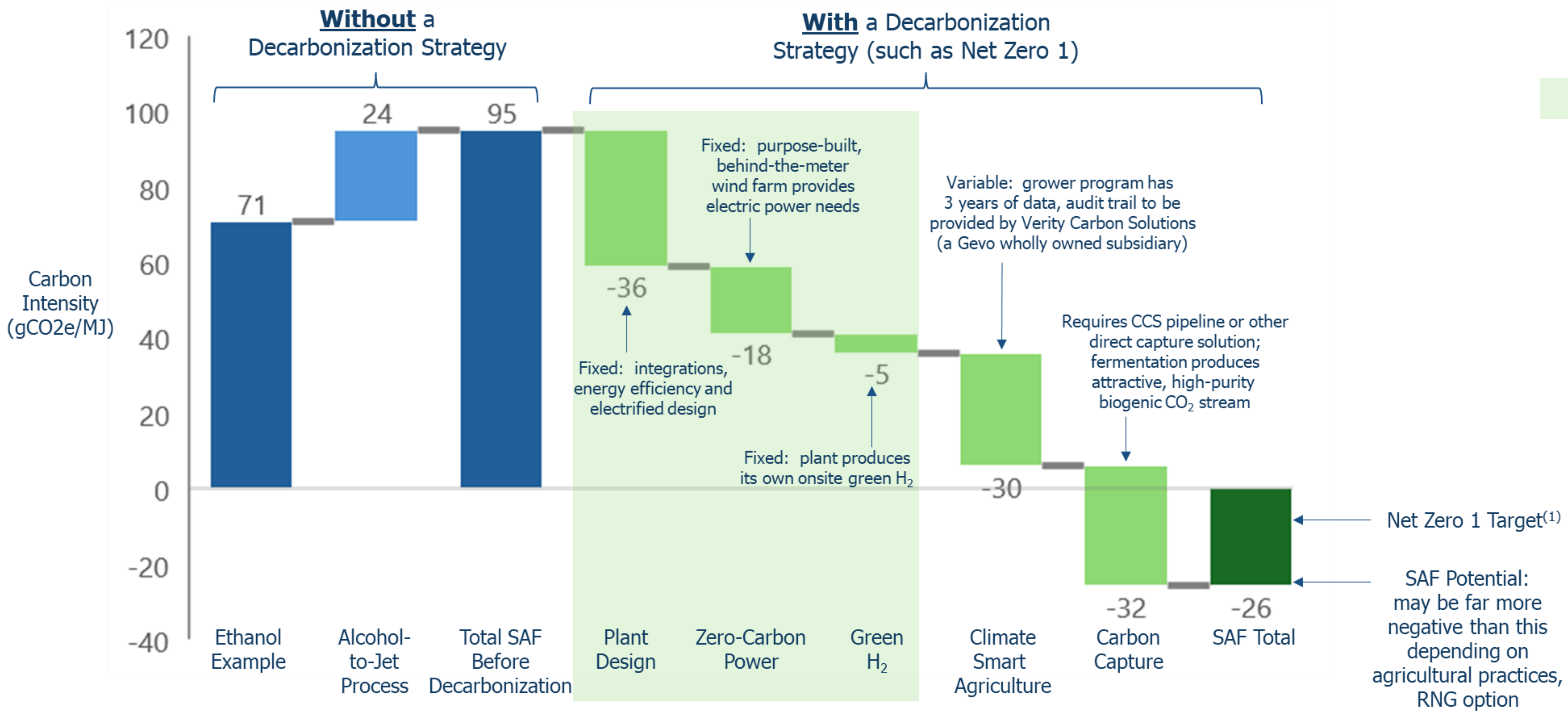
LG Chem

Gevo is jointly developing the ETO process with LG Chem for chemical use and retains certain rights to the technology

Can also be used to produce carbon-negative materials

Source: Gevo Base Model, Gevo ETO model

Sustainable: Net Zero 1 SAF is Designed to Achieve Zero or Negative Carbon Intensity



Without a Decarbonization Strategy

With a Decarbonization Strategy (such as Net Zero 1)

Fixed: purpose-built, behind-the-meter wind farm provides electric power needs

Fixed: integrations, energy efficiency and electrified design

Fixed: plant produces its own onsite green H_2

Variable: grower program has 3 years of data, audit trail to be provided by Verity Carbon Solutions (a Gevo wholly owned subsidiary)

Requires CCS pipeline or other direct capture solution; fermentation produces attractive, high-purity biogenic CO_2 stream

Net Zero 1 Target[(1)]

SAF Potential: may be far more negative than this depending on agricultural practices, RNG option

🟩 Highlights carbon reduction fixed from proprietary plant design

Takeaways

Most of the NZ1 carbon reduction is fixed from proprietary plant design

Existing levers do not depend on future technologies

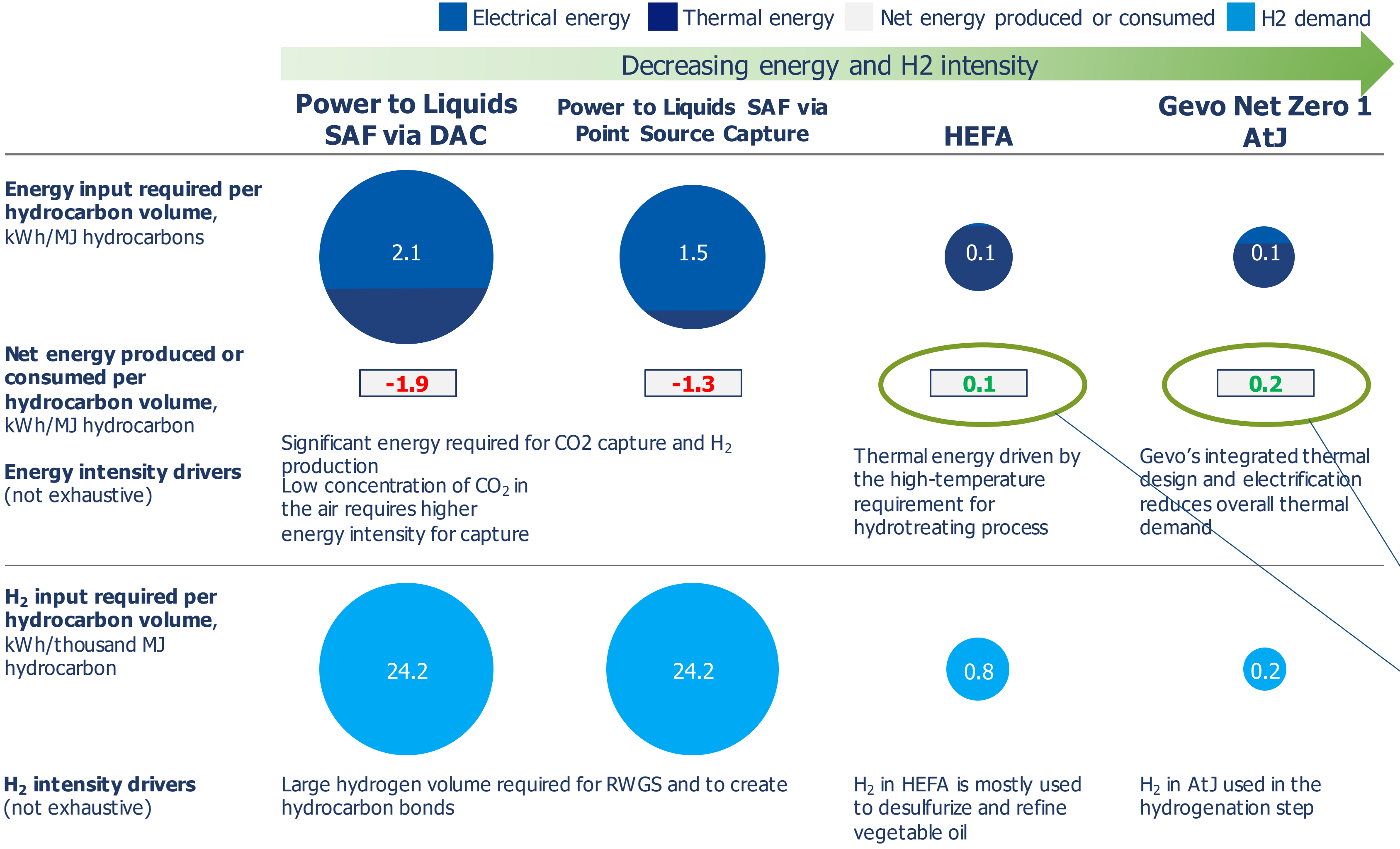
Additional option to use biogas from Gevo's Iowa RNG (not shown)

ILUC – Indirect Land Use. CCS – Carbon Capture and Sequestration. CI – Carbon Intensity.

1. Based on internal estimates. Net Zero 1 is targeting zero or negative CI; final CI result may vary from what is estimated. Based on Argonne GREET model including internal estimates of agricultural practices and CCS impacts potential.

Sustainable: Photosynthesis and Fermentation Provides Most of the Energy for SAF Production via AtJ and HEFA

Comparative analysis of SAF pathways



	Power to Liquids SAF via DAC	Power to Liquids SAF via Point Source Capture	HEFA	Gevo Net Zero 1 AtJ
Energy input required per hydrocarbon volume, kWh/MJ hydrocarbons	2.1	1.5	0.1	0.1
Net energy produced or consumed per hydrocarbon volume, kWh/MJ hydrocarbon	**-1.9**	**-1.3**	**0.1**	**0.2**
Energy intensity drivers (not exhaustive)	Significant energy required for CO2 capture and H_2 production Low concentration of CO_2 in the air requires higher energy intensity for capture		Thermal energy driven by the high-temperature requirement for hydrotreating process	Gevo's integrated thermal design and electrification reduces overall thermal demand
H_2 input required per hydrocarbon volume, kWh/thousand MJ hydrocarbon	24.2	24.2	0.8	0.2
H_2 intensity drivers (not exhaustive)	Large hydrogen volume required for RWGS and to create hydrocarbon bonds		H_2 in HEFA is mostly used to desulfurize and refine vegetable oil	H_2 in AtJ used in the hydrogenation step

Source: Gevo management, The Status of CCS 2020, global consulting firm.

Key insights

Gevo's NZ1 and existing HEFA processes require significantly less thermal and electrical energy than Direct Air Capture; HEFA and AtJ leverage photosynthesis to supply most of the energy required to produce SAF

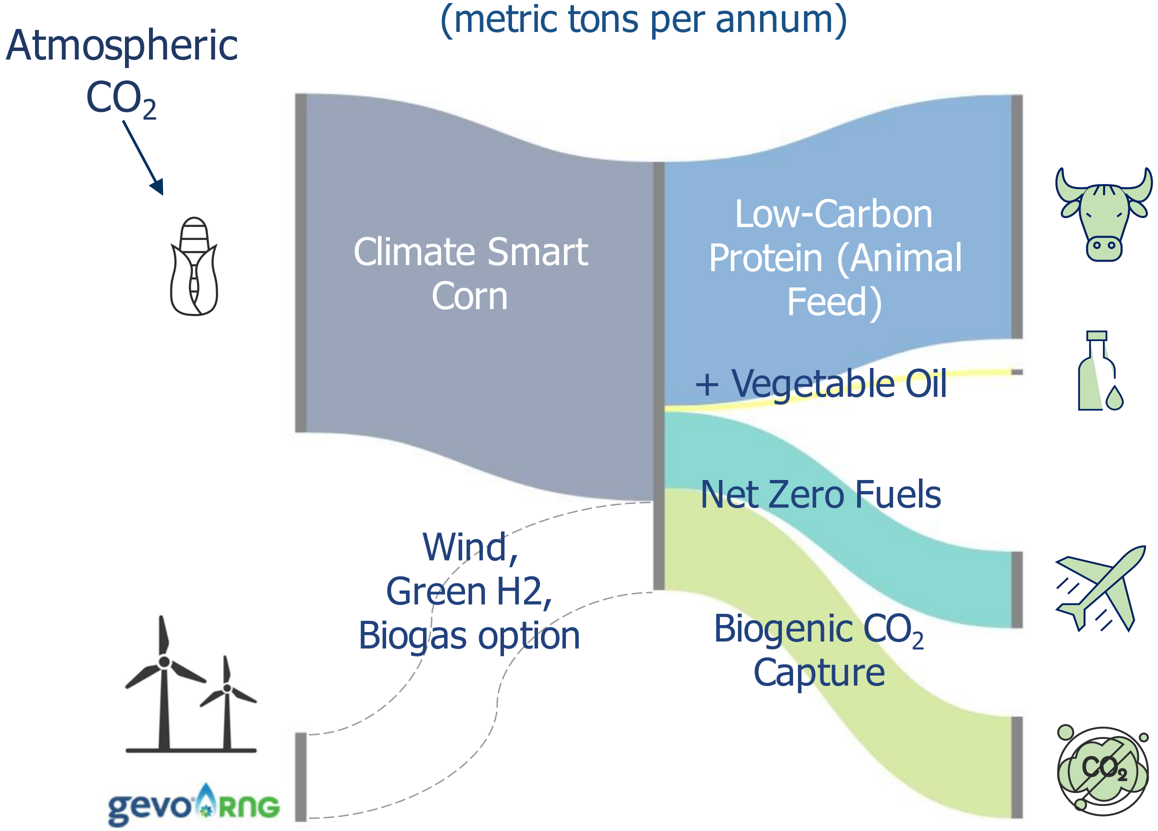
HEFA and AtJ create more energy via SAF output than is required for production input; PtL requires more energy than it produces

These pathways produce more energy than they consume, require fewer inputs

Sustainable: We Make Food First

Mass Flow Diagram

(metric tons per annum)



Carbon abatement per annum =3,000 flights from NYC to London

Approximate quantities (in metric tons per annum): corn 965,000 or 220k equivalent acres; protein 695,000 based on 36% dry matter for wet basis; corn oil 15,420; biogenic CO2 295,000 (does not include additional potential sequestration from soil organic carbon / climate smart ag practices); net zero fuels 218,400 or 65 million gallons (60 SAF and 5 renewable diesel and bio-naphtha). Carbon abatement based on ~800ktpa and negative emissions (less than zero Carbon Intensity) using Argonne GREET method including expected climate smart agriculture benefits. Comparison assumes B747-Long-Range (262 seat) with an efficiency of 1.8 MJ per seat-km.

Sustainable: We Make SAF From Plant Sugars

Feedstock

- **Any fermentable sugar** (from corn, bagasse, wood waste, etc.)
- US is the world's largest corn market
- Primary nutritional components are separated, sold as low-carbon food products

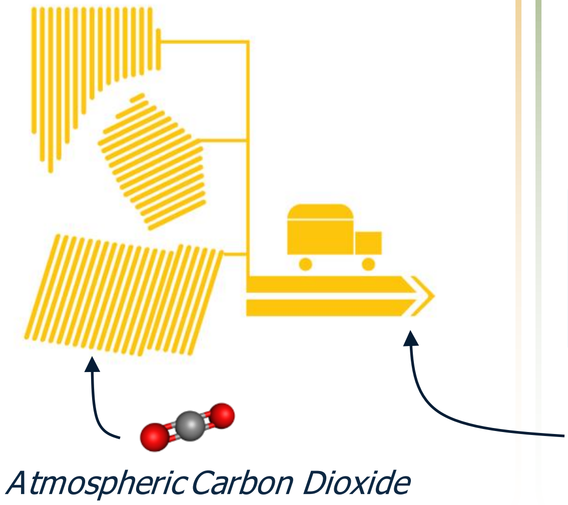
Fermentation

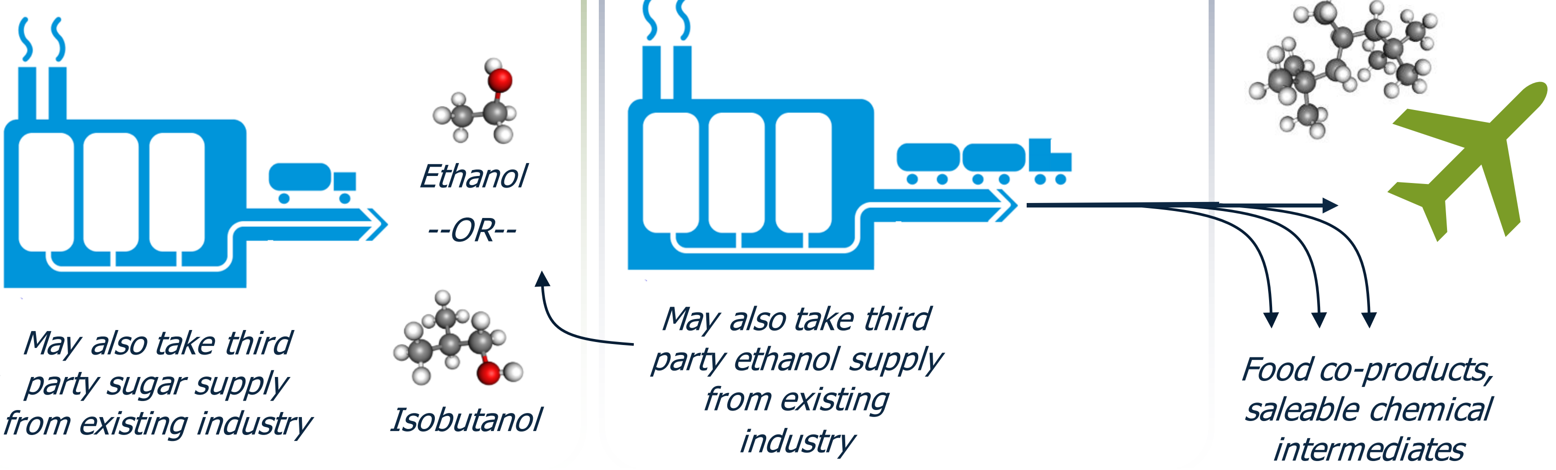
- **Sugar converted to alcohol** (ethanol or isobutanol) by microorganisms through fermentation
- US is the world's largest ethanol producer
- Humans have made alcohol from fermentation for millennia

Alcohol-to-Jet

- **Alcohol converted to chains of hydrocarbons** through dehydration, oligomerization
- Relies upon existing catalytic chemistry used today in the petrochemicals industry

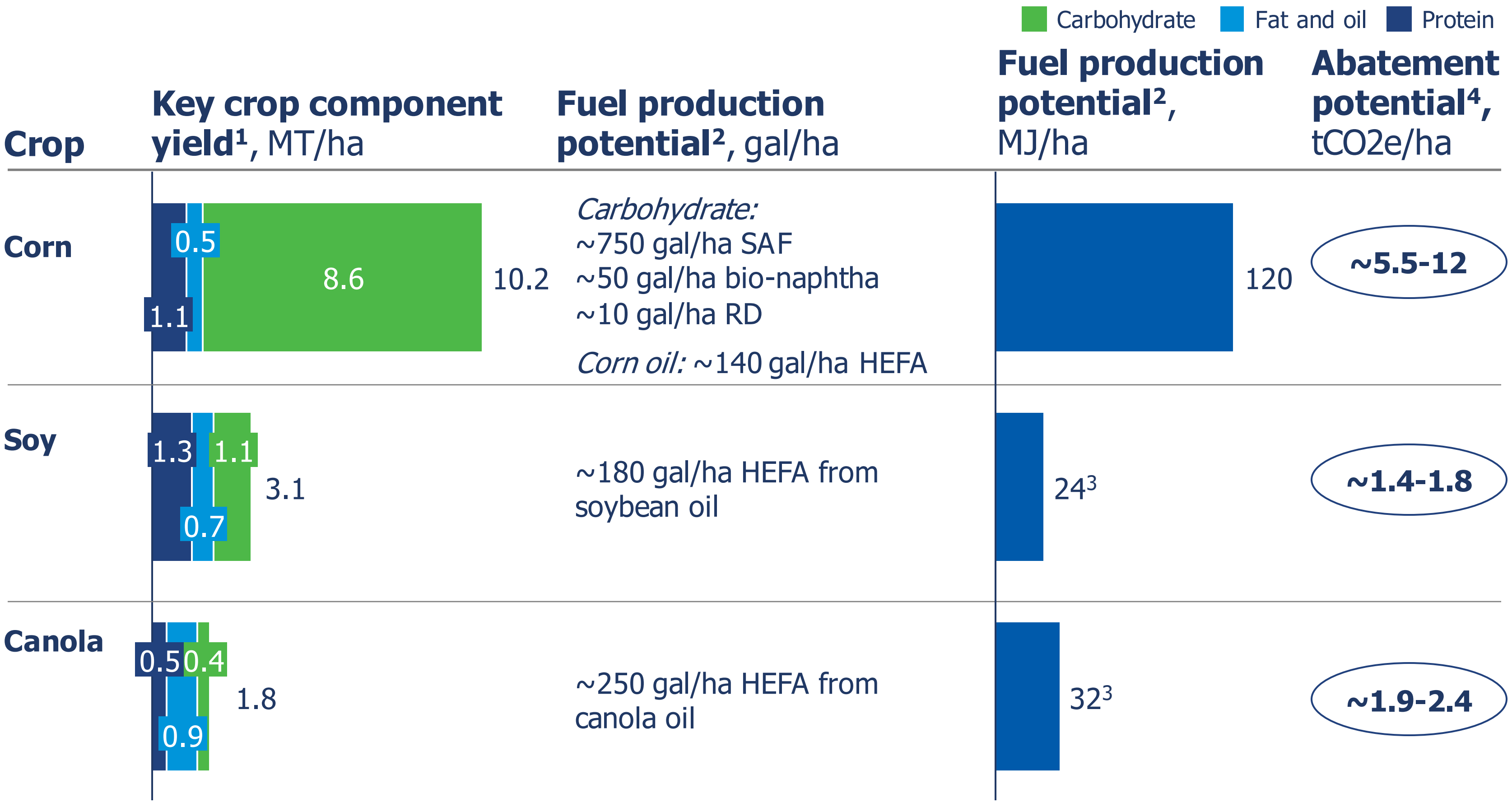
● *Carbon atom*
● *Oxygen atom*
○ *Hydrogen atom*





SAF

Sustainable: Corn Yields More SAF & Abates More Carbon Per Acre Than Soy Or Canola While Producing Similar Volumes Of Protein



🟩 Carbohydrate 🟦 Fat and oil ■ Protein

Crop	Key crop component yield[1], MT/ha	Fuel production potential[2], gal/ha	Fuel production potential[2], MJ/ha	Abatement potential[4], tCO2e/ha
Corn	1.1 / 0.5 / 8.6 — 10.2	*Carbohydrate:* ~750 gal/ha SAF ~50 gal/ha bio-naphtha ~10 gal/ha RD *Corn oil:* ~140 gal/ha HEFA	120	**~5.5-12**
Soy	1.3 / 0.7 / 1.1 — 3.1	~180 gal/ha HEFA from soybean oil	24[3]	**~1.4-1.8**
Canola	0.5 / 0.9 / 0.4 — 1.8	~250 gal/ha HEFA from canola oil	32[3]	**~1.9-2.4**

Key insights

Corn has a higher abatement potential than soy (4-6.5x) or canola (3-4.5x) per acre of land, depending on agriculture practices. Current analysis excludes lignocellulosic residues (e.g., corn stover), but if additional crop feedstocks is taken into account, the gap between corn and soy / canola could further widen

Corn is a more efficient use of land than is soy or canola, driven by **higher carbohydrate content per hectare from corn** and the fact that **corn is a C4 photosynthesis plant**

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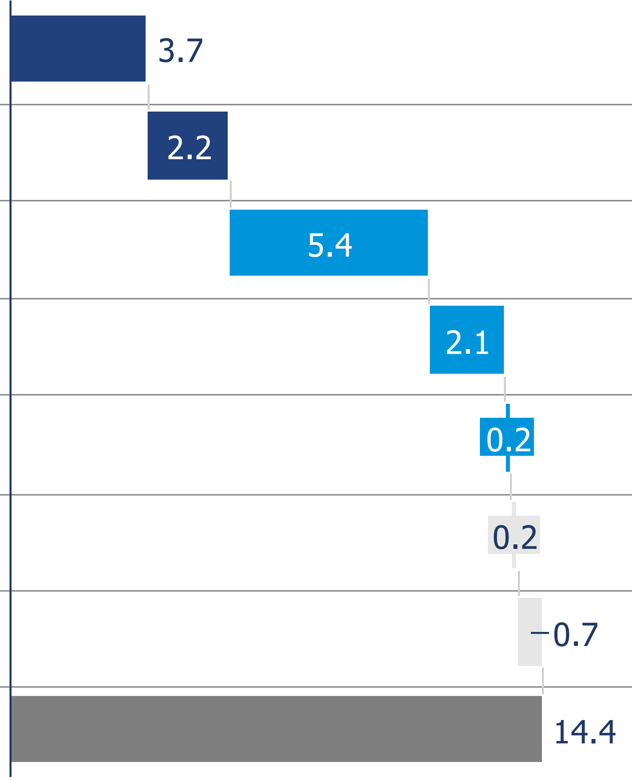
1. Assumes 11.9MT/ha corn (8-10% protein, 4-5% fat and oil, 70-75% carbohydrate); 3.5 MT/ha soy (35-45% protein, 15-25% fat and oil, 33% carbohydrate); 2 MT/ha rapeseed (20-25% protein, 45% fat and oil, 15-20% carbohydrate)
2. Assuming all potential feedstock used for fuel production
3. Theoretically, carbohydrate portion of soybean crush or rapeseed meal could be fermented to be used as AtJ feedstock (producing SAF, RD, and bio-naphtha). Including carbohydrate portion could add ~13 MJ/ha (0.5-1 tCO2e/ha) or ~4.5 MJ/ha (0.2-0.4 tCO2e/ha) of abatement potential for soy and canola, respectively. However, such AtJ pathways are not a focus area because economically infeasible to separate carbohydrate portion from protein
4. Abatement potential dependent on agriculture practices; lower end of range assumes no sustainable agriculture practices, higher end of range assumes sustainable agriculture practices consistent with low CI corn feedstock for NZ1; CCS assumed in ethanol fermentation step of AtJ, but in no other production steps

Source: USDA; FAOSTAT; Journal of Food Science and Technology; Global Consulting Firm.

Sustainable: Corn Feedstocks Grown in US Could Produce ~10Bn GPY of SAF (>3x Projected 2030 Demand) Without Disrupting the Food System

■ Available for food and fuels use ■ Available for food only ■ Not available for food or fuels use



	Use	**Fractional US Bushels grown**, Billion Bushels	**SAF**, Billion GPY	**Food/Feed** Million Tons
Fuels & Industrials	Ethanol and biofuels	3.7	6.4	29[3]
	Other industrial[1]	2.2	3.9[2]	17[3]
Food/ feed	Animal feed	5.4		149
	Exports	2.1		57[4]
	Food	0.2		4
Other uses	Seed	0.2	Unavailable for food/ fuels	
	Losses	−0.7		
	Total	14.4	10.3	256

🇺🇸 United States Example

Key insights

SAF can be produced from corn without affecting current food / feed supply; corn used to produce ethanol and other industrial uses could be further processed to SAF, **supplying more than the expected 2030 US demand of ~3Bn GPY with no changes to total land use**

Corn used in fuels and industrials can supply **46 million tons of animal feed and corn oil to the US food/ feed system**

1 Industrial applications include e.g., fermentation, modified starch, paper, textiles; 2. Corn for industrial uses is repurposed for SAF production 3. Includes DDGS for animal feed and corn oil, assuming a bushel of corn produces 16.4 pounds of DDGS, and 0.7 pounds of corn oil; 4. Assumes all exports are food/feed

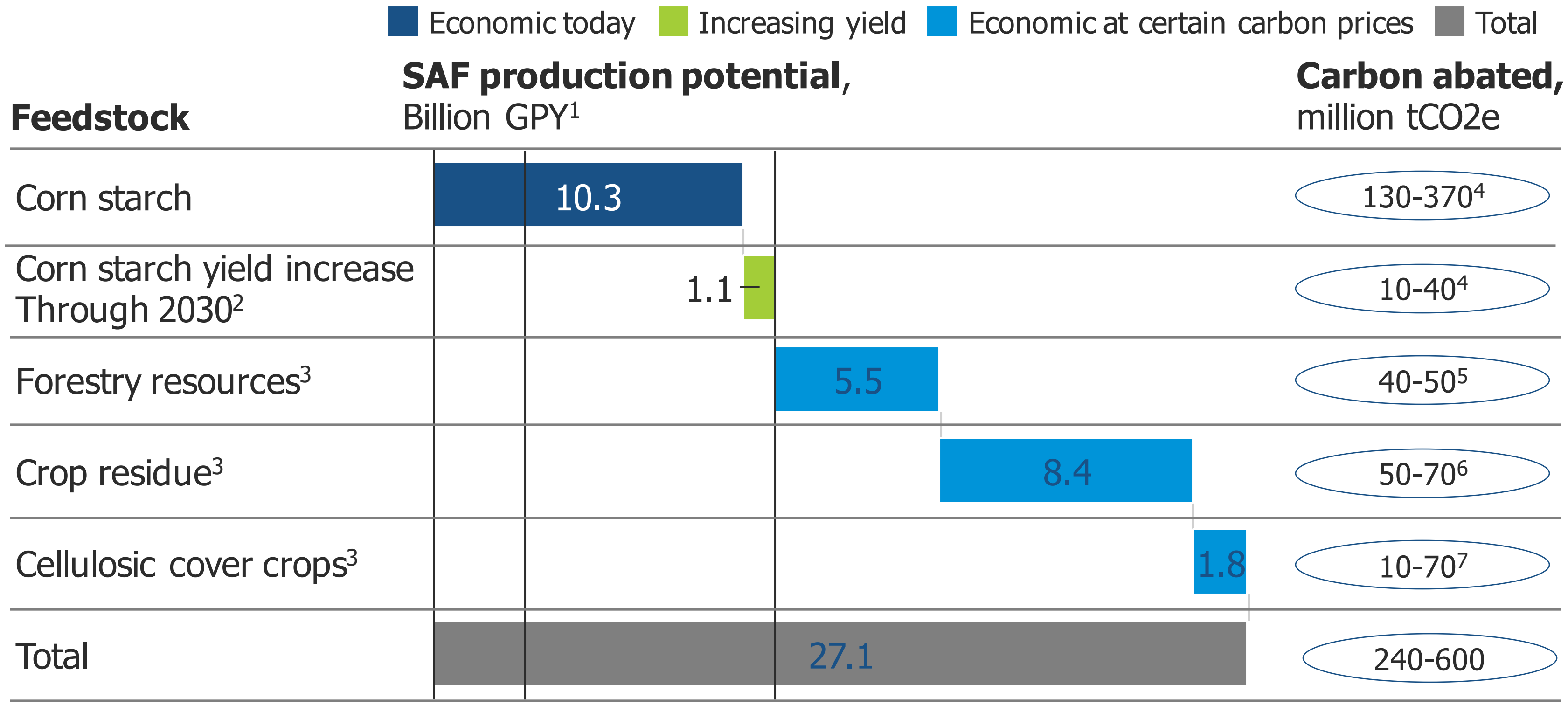
Source: USDA NASS, FAOSTAT, Our World in Data, Iowa State University ethanol profitability model

Scalable: Lower Carbon Intensity of SAF > More Carbon Abatement > Less SAF is Needed to Achieve Carbon Abatement Goals

CI Score of Blended Barrel of Jet Fuel (gCO_2e/MJ)	**90**	**56**	**45**	**45**	**0**
Percent CI Reduction Overall		**38%**	**50%**	**50%**	**100%**
SAF Gallons Needed to achieve CI Reduction in US Market (assuming 20BGPY total)		**15B**	**10B**	**5B**	**15B**

Note: current blending limit is 50% SAF and 50% fossil jet fuel.

Scalable: AtJ Platform is Scalable and Could Supply Nearly the Entire Jet Fuel Demand of the US Without Affecting Current Food/Feed Supply



US SAF Demand in 2030:
~3B Gallons

Total US jet demand in 2030 could be ~30 BGY[8],
corn AtJ alone could satisfy a 38% SAF blend

1. Assumes all potential HC are converted to SAF; 2. Assuming a crop yield growth of ~1.1% yoy average of 2000-2021; 3. Assumes ~17% HC yield from cellulosic feedstocks; 4. Low abatement case assumes Gevo's CI of -8 gCO2e/MJ, high abatement case assumes carbon capture on managed land can achieve CI of -190 gCO2e/MJ for corn starch based on an LCA report from Locus (scientific consensus still outstanding on potential impact and not yet approved in all credit schemes); 5. Low abatement case assumes a standalone AtJ facility resulting in a CI of 40.0 gCO2e/MJ, high abatement case assumes an integrated ethanol + AtJ facility resulting in a CI of 24.9 gCO2e/MJ; 6. Low abatement case assumes a standalone AtJ facility resulting in a CI of 39.7 gCO2e/MJ, high abatement case assumes an integrated ethanol + AtJ facility resulting in a CI of 24.6 gCO2e/MJ; 7. Low abatement case assumes miscanthus feedstock and a standalone AtJ facility resulting in a CI of 43.3 gCO2e/MJ, high abatement case assumes carbon capture on managed land can achieve CI of -190 gCO2e/MJ for cellulosic cover crops based on an LCA report from Locus; 8. Based on 3.63 quads (10^15 BTU) jet fuel demand from 2023 EIA Annual Energy Outlook

Source: Global Consulting Firm, USDA NASS, FAOSTAT, Our World in Data USDA, World Bank, Environmental Protection Agency, ICAO, DOE Billion-Ton Report
https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_Eligible_Fuels/CORSIA_Supporting_Document_CORSIA%20Eligible%20Fuels_LCA_Methodology_V5.pdf
https://ag.purdue.edu/commercialag/home/resource/2021/06/opportunities-and-challenges-associated-with-carbon-farming-for-u-s-row-crop-producers/

United States Example

Key insights

Corn alone can provide enough SAF to fulfill 2030 demand three times over without additional land use; including increases in yield through 2030 and the potential for cellulosic feedstocks for AtJ increases the potential SAF production from ~10B GPY to over 27B GPY

AtJ could abate nearly 600M tons CO_2e if including cellulosic feedstocks

What is SAF?

Why SAF?

Gevo’s competitive position

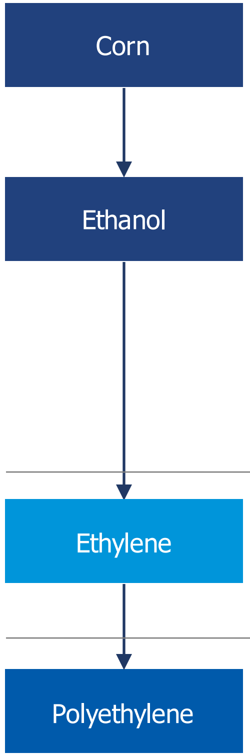
Additional opportunities in bio-chemicals

The Same Process that Makes Our SAF Can Also Make Non-Fossil Derived, Carbon-Negative Materials

Example: Carbon Intensity of polyethylene using part of the Alcohol-to-Jet SAF process

⬚ Biologic sequestration ■ Ethylene ■ Ethylene ■ Polyethylene (xx) Cost in typical units

Production route



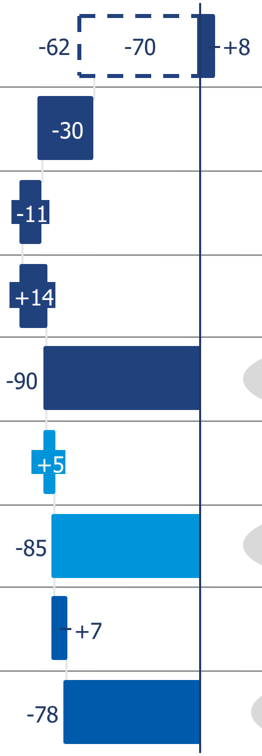
Corn → Ethanol: Low CI production includes CCS

DDGS by-product: 1.1 tonne DDGS per tonne ethanol produced

Ethanol → Ethylene: Energy-intensive dehydration

Ethylene → Polyethylene: Polymerization

Carbon intensity of production[2]



Component	CI, gCO2e / MJ		Assumptions
Corn	-62 (-70, +8)		~6,450 gCO2e/bushel CI of corn farming; credits for precision farming, yield increase, and sustainable farming (5.5, 3.8, and 13.1 gCO2e/MJ respectively); -70 gCO2e/MJ from CO2 absorbed from atmosphere that is later sequestered in plastics
CCS during fermentation	-30		~6.2 lbs CO2/gal ethanol produced during fermentation
By-product credit	-11		~0.3 lb corn oil/gal EtOH and ~4.7 lb DDGS/gal EtOH; carbon intensity of 180 gCO2e/lb, removed from attribution to ethanol
Utilities, other materials, iLUC	+14		Assume wind power (0 CI) and fossil natural gas (1.6 gCO2e/MJ); iLUC 7.6 gCO2e/MJ; other materials include chemicals / denaturants (2.5 gCO2e/MJ)
Ultra-Low CI Ethanol	-90	**(7.3)kgCO2e /gal EtOH**	**Traditional[1] ethanol: -10 gCO2e/MJ or -0.3 gCO2e/gal EtOH**
Dehydration	+5		Assume fossil natural gas and grid electricity
Ethylene	-85	**(3.9)tCO2e/t ethylene**	**Traditional ethanol: -4.5 gCO2e/MJ or -0.2 tCO2e/t ethylene**
Polymerization	+7		This step consistent between PE produced via fossil and via bio routes, so does not contribute to abatement potential; assumes fossil natural gas, grid electricity, and grey H2
Polyethylene	-78	**(3.6) tCO2e/t PE**	**Traditional ethanol: 2.7 gCO2e/MJ or 0.1 tCO2e/t PE**

A **negative-carbon** polyethylene; polyethylene is used to make many household products; other drop-in chemicals are possible too

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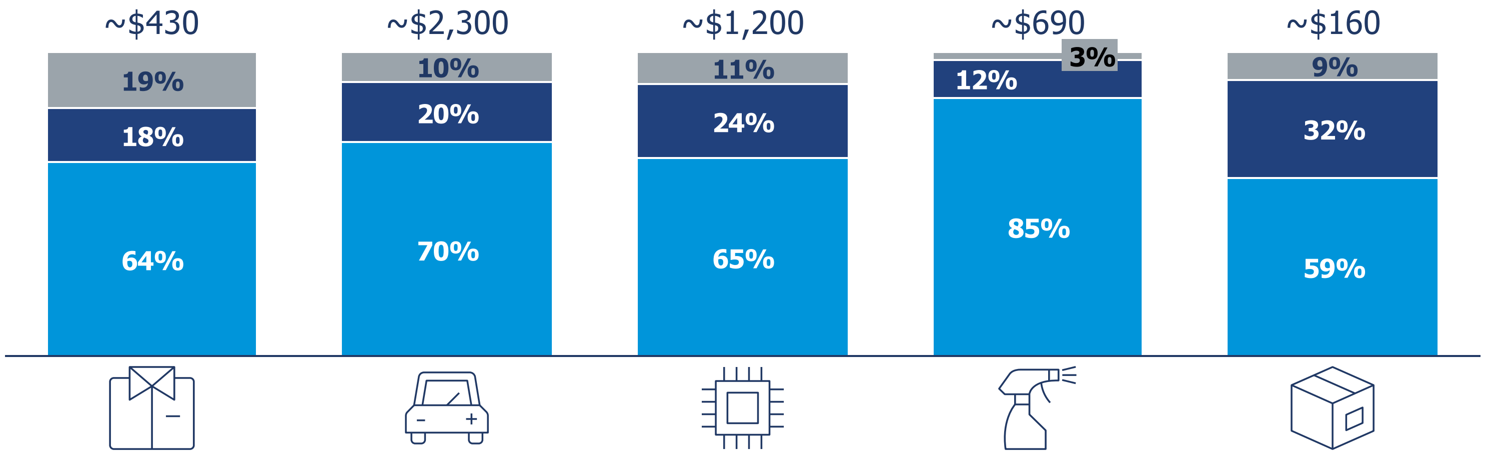
1. Assumes no CCS, no sustainable agriculture practices, fossil grid electricity and no integrated plant design to reduce heating/natural gas demand
2. Assumes no incineration at end-of-life

Source: Internal estimates, IHS PEP, expert interviews, web search, Global Consulting Firm

The Market Opportunity for Low-Carbon, Drop-in Chemicals is ~$400-500 Billion

Across end markets with significant chemical consumption, hundreds of billions in chemicals spend is under scrutiny given Scope 3 emission reduction commitments

Share of revenue with associated commitments by Top 20 companies, B USD 2020



	Apparel	Automotive	Electronics	FMCG	Packaging
Associated chemicals value pool, B USD 2020	**~$70B**	**~$110B**	**~$70B**	**~$90B**	**~$160B**
	e.g., Polyesters, Nylons, Pigments, Textile processing chemicals	e.g., Elastomers, Fibers, Thermoplastics, Foams, Coatings	e.g., Electronics chemicals, Plastics, Thermoset plastics	e.g., Surfactants, Flavors and fragrances, Emollients, Actives	e.g., Films & Membranes, Plastics, Polymers, Thermoplastics

Majority of players across the top end markets have made scope 3 commitments, many with **target dates of 2030-2040**

End market players have started to recognize that achieving these targets often requires **significant lead time to source and secure supply of sustainable chemicals**

Globally, **$400-500B chemicals value pool will be scrutinized for substitution and / or replacement with sustainable chemicals** by players in top 5 end markets

Similarly, **potential US sustainable chemicals opportunity ranges from $100-150B** based on chemicals and end product consumption

1. Sum of 2020 revenue generated by top 20 companies in each end market - apparel, automotive, electronics, fast moving consumer goods (top 20 companies across food, home, and personal care sectors), packaging

Source: CapIQ, Science-Based Targets Initiative, CDP Worldwide, expert interviews, IHSM, market reports
McKinsey "How corporate sustainability commitments could catalyze the next generation of bio-based chemicals and materials."
https://www.mckinsey.com/industries/chemicals/our-insights/the-third-wave-of-biomaterials-when-innovation-meets-demand

A Carbon Abatement Company

Thank You

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