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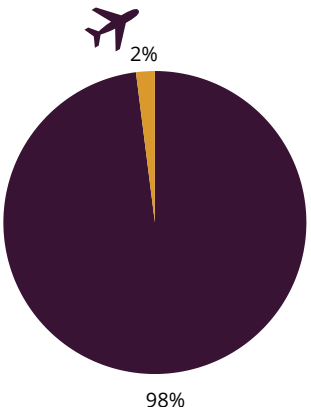
Alternative Aviation Fuel (AAF)

What Communities Need to Know

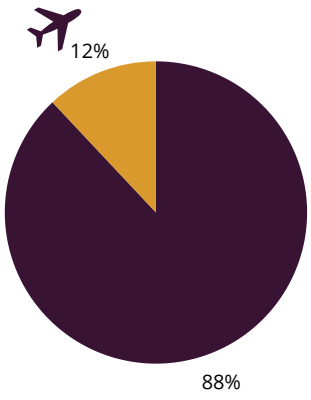
In theory, Alternative Aviation Fuel (AAF)* could provide an answer to the aviation industry's climate problems, and the Minnesota Sustainable Aviation Fuel Hub is already taking action. However, early attempts to scale up AAF haven't addressed concerns regarding environmental degradation and the exclusion of rural communities. For AAF to be successful in reducing emissions and supporting a just energy transition, it's essential to prioritize sustainable feedstocks, strict policy enforcement, and environmental justice, learning from the mistakes of earlier biofuel efforts.

What is Alternative Aviation Fuel?

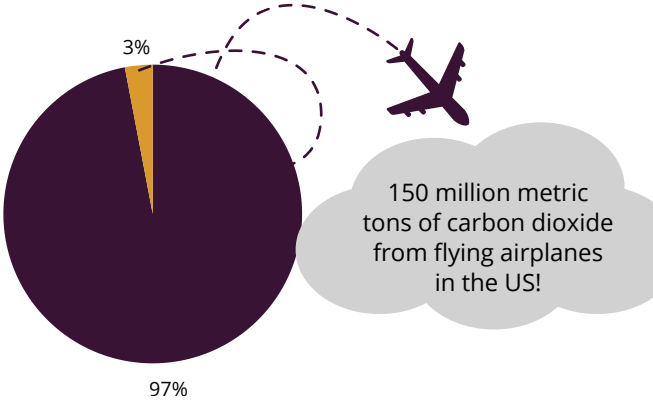
AAF is a fuel made from feedstock that aims to cut emissions from air travel. Aviation produces a significant share of the world's carbon dioxide emissions. So, the intention of AAF is to support the aviation industry's goal of achieving zero carbon emissions by 2050.



TOTAL GLOBAL EMISSIONS



GLOBAL TRANSPORT EMISSIONS



USA TOTAL EMISSIONS, 2019

Aviation emissions will likely double by 2050 without any action. This is true for both the U.S. and the world.

AAF's Potential for Emissions Reductions in Aviation

This technology is still new, but **in theory** it already shows potential for major emissions cuts (up to 80%) - depending on the amount of AAF used in a blended fuel, and how the feedstocks that create AAF are grown and processed.

How It's Produced

AAF is a type of biofuel made from plant-based feedstocks. It powers airplanes through various production methods. The main methods are:

- **HEFA (Hydrotreated Esters and Fatty Acids)**: This method refines vegetable oils, waste oils, or fats into AAF.
- **Alcohol to Jet (AtJ)**: This process converts alcohols like ethanol and iso-butanol into AAF. It removes oxygen and links the molecules together.
- **eFuels**: AAF can be made with green hydrogen, capturing carbon dioxide, and renewable electricity to create synthetic fuels. This type is known as eFuel or Power-to-Liquid (PtL).

Currently, AAF still has to be blended with regular aviation fuel, and it can only make up a maximum of 50% of the mixture. The aviation industry's goal is for airlines to use 100% AAF by 2030. **Even if they meet this goal, environmental benefits are not guaranteed. In the short term, much of the AAF may come from ethanol (Alcohol to Jet). This could boost emissions due to deforestation, which would negate its climate benefits.**

*AAF is also sometimes referred to as sustainable aviation fuel (SAF) or synthetic aviation fuel. We use the term AAF because attempts to ramp up AAF so far have not necessarily been sustainable.

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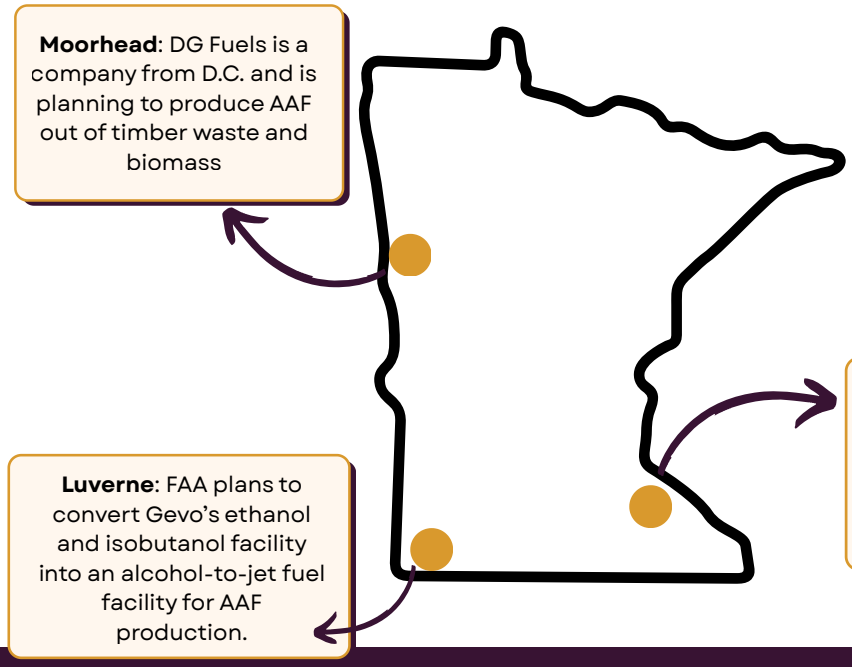
AAF facilities are already being promoted and built in Minnesota



Moorhead: DG Fuels is a company from D.C. and is planning to produce AAF out of timber waste and biomass

Luverne: FAA plans to convert Gevo's ethanol and isobutanol facility into an alcohol-to-jet fuel facility for AAF production.

Rosemount: Delta Air Lines, in collaboration with Flint Hills Resources, is developing a facility to blend AAF with conventional fuel and ship through a pipeline to MSP.

Minnesota SAF Hub

The "GREATER MSP Partnership" includes Bank of America, Delta Air Lines, Ecolab, Xcel Energy, and the State of Minnesota. Together, they have formed the Minnesota SAF Hub. This group is working on strategies to decarbonize the airline industry. They aim to increase the supply of AAF in Minnesota.

Environmental Justice Considerations

Crop-based biofuels (e.g. corn ethanol) increase net emissions through deforestation

Cutting down forests for AAF feedstock defeats its purpose.

To hit U.S. AAF goals, we would need to convert 114 million acres of corn into SAF. That's 20% more than the current U.S. corn production. If we use vegetable oils instead, we would need to double global production, leading to more tropical deforestation.

Unregulated Book and Claim systems can harm air quality at AAF production sites.

Book and Claim systems let airlines and companies claim AAF's environmental benefits without using it directly. They do this by purchasing AAF certificates. If these certificates lack trustworthiness, the producer may cause environmental and social harm.

Low Carbon Fuel Standard (LCFS) programs risk burdening low-income communities if the programs are poorly designed

Critics say Minnesota's AAF proposal supports old fuel technologies, like ethanol and carbon capture for oil recovery. This approach may slow the shift to clean energy. It could also increase dependence on carbon-heavy infrastructure, like pipelines. These pipelines often run through low-income and rural areas. Communities in these regions face health, safety, and environmental risks while seeing few direct benefits.

To avoid negative impacts, it's necessary to:

- Define "sustainable" to include air, water, biodiversity, and clean energy — not just a carbon intensity score.
- Prioritize and invest in AAF only if it leans into regenerative agriculture, including an emphasis on lower-carbon, innovative feedstocks such as winter oilseeds, which also have huge benefits for water quality and biodiversity.
- Leverage AAF's role in the energy transition to bolster rural communities, while addressing the persistent environmental, economic, and racial inequity in our agriculture and energy systems.

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Influential Policies

Federal Level

Sustainable Aviation Grand Challenge

- A 2021 federal plan to help produce SAF (AAF) on a commercial scale. This plan aims to expand U.S. consumption of SAF to **3 billion gallons in 2030** and **35 billion gallons in 2050**, to satisfy 100% of demand.
- To do so, federal incentives were created for the production of SAF
  - (2023->2024) **40B: Sustainable Aviation Fuel Credit**
  - (2025->2027) **45Z: New Clean Fuel Production Credit**

Changing Federal Landscape

While the Trump administration has tried to roll back much federal funding under the Inflation Reduction Act, for now the Department of Energy website maintains the information and steps for the Sustainable Aviation Fuel Grand Challenge.

The recent "One Big Beautiful Bill" has extended tax credits under 45Z until 2027, though it has lowered how much SAF (AAF) producers can receive per gallon, and put other restrictions in place.

State Level

Tax credits

In May 2023, Minnesota approved a tax credit for SAF blenders and producers. The incentive offers $1.50/kg for SAF made or blended in the state. It also exempts SAF biofuel construction from state sales tax.

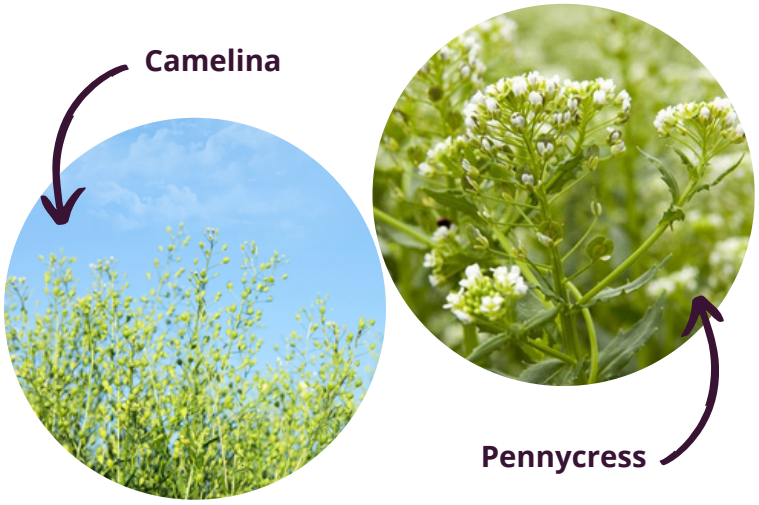
Low-Carbon Fuel Standards | Minnesota's Clean Transportation Standard Act (Pending)

A Low Carbon Fuel Standard (LCFS) aims to reduce pollution from transportation fuels. It sets a limit on carbon pollution for each unit of energy used. The intention is to encourage companies to lower their emissions over time.

The **Clean Transportation Standard Act (CTSA) is Minnesota's version of an LCFS**. The CTSA aims to promote lower-carbon fuels like electricity, hydrogen, and biofuels. This would also support AAF producers. **However, the bill has not yet passed.** Minnesota leads in biofuel production and has many interest groups involved. Some environmental groups oppose the bill, saying it won't do enough to cut emissions.

Promising Methods

SAF can come from alternative crops such as **camelina and pennycress**. These crops are much lower in carbon than biofuels made from ethanol. They also support farm income and ecosystem health. The **Forever Green Initiative** at the University of Minnesota drives research and commercialization of these continuous living cover (CLC) crops. With support from Cargill, the University of Minnesota helped Delta complete the first flight using camelina-blended SAF in 2024.



Cargill has a program to encourage farmers to grow camelina and other winter oilseeds. They sell farmers the seeds and guarantee to purchase the crops. Additionally, they offer cost-sharing programs like the Forever Green EECO Implementation Program.

However, in reality these promising methods are not scaling up fast enough to challenge industries like ethanol (corn). Companies that are highly invested in ethanol production still occupy more of the market and are obtaining funding at a much faster rate.

This fact sheet was developed as part of the Emerging Climate Technologies in Greater Minnesota Pilot Project. For more information, visit **waxwingllc.com/ruralejproject**

For a list of resources that contributed to this brief, scan this QR code: