

Sustainable Aviation Fuels

Drivers & Federal Perspective

To: SPARC Summit

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Environment & Energy

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FAA Environmental & Energy (E&E) Strategy

E&E Mission: *To understand, manage, and reduce the environmental impacts of global aviation through research, technological innovation, policy, and outreach to benefit the public*

E&E Vision: *Remove environmental constraints on aviation growth by achieving quiet, clean, and efficient air transportation*

E&E Program:

ADVANCE UNDERSTANDING OF NOISE, EMISSIONS, AND THEIR IMPACTS



POLICY MAKING

Domestic Policies

Aircraft and Engine Standards

CORSIA

Long Term Climate Goal Development

Community Engagement

DEVELOP INNOVATIVE SOLUTIONS TO REDUCE NOISE AND EMISSIONS

 Aircraft and Engine Technology

 Sustainable Aviation Fuels

 Optimized Operations and Procedures



Aviation Climate Action Plan

On November 9, 2021, United States Secretary of Transportation Buttigieg released the Aviation Climate Action Plan at COP26 in Glasgow, Scotland.

- International Civil Aviation Organization (ICAO) – “State Action Plans”
- Plan builds on ongoing FAA Environment & Energy Program – long-term focus on reducing climate impacts of aviation
- Administration focus on climate – Achieving net zero emissions economy-wide by 2050
- ***U.S. Aviation Climate Goal: Net-Zero GHG Emissions from U.S. Aviation Sector by 2050***

Climate Action Plan Press Release:

<https://www.faa.gov/newsroom/us-releases-first-ever-comprehensive-aviation-climate-action-plan-achieve-net-zero>

Climate Action Plan Document:

https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf

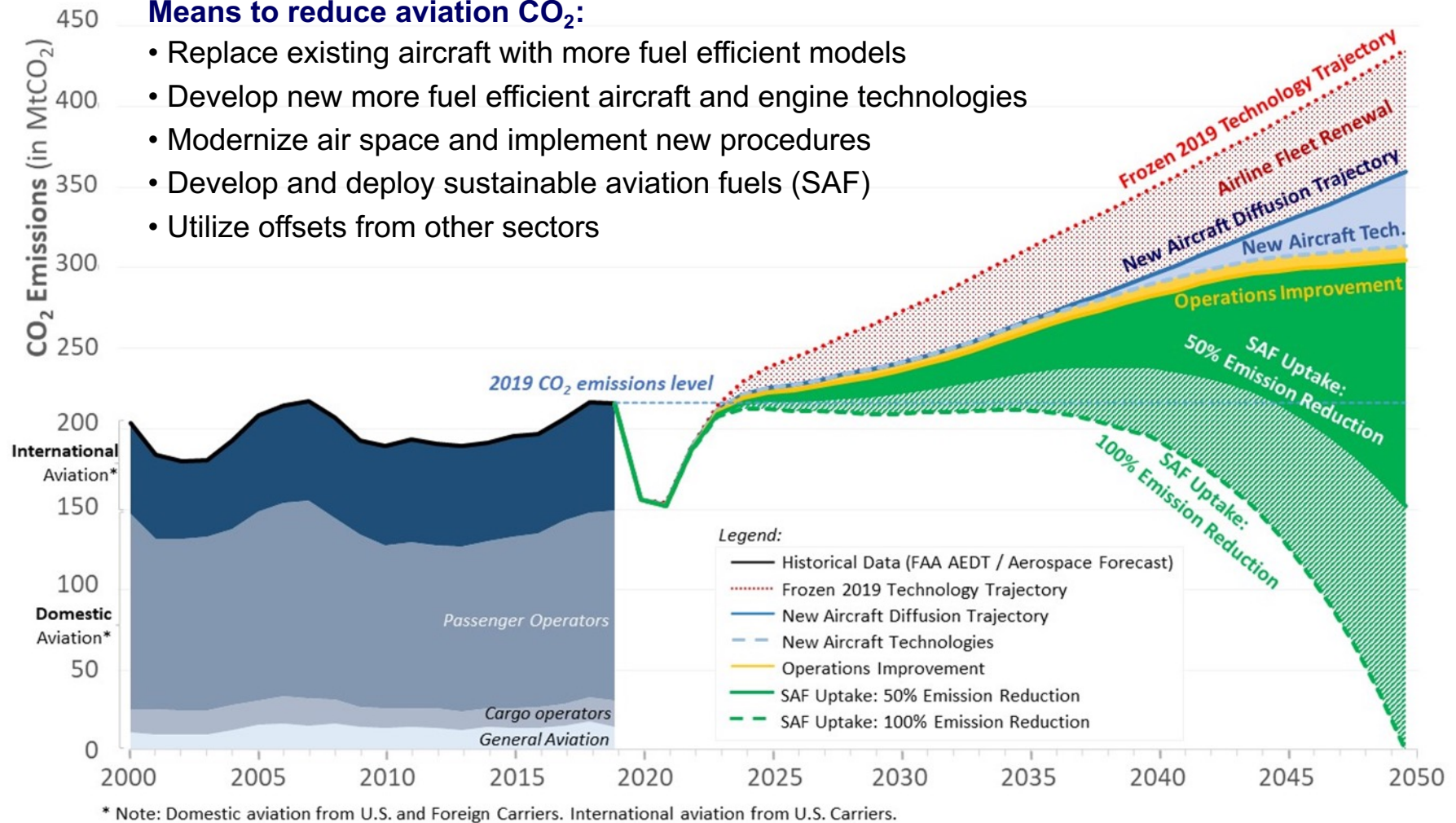


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Analysis of Future Domestic and International Aviation CO₂ Emissions

Means to reduce aviation CO₂:

- Replace existing aircraft with more fuel efficient models
- Develop new more fuel efficient aircraft and engine technologies
- Modernize air space and implement new procedures
- Develop and deploy sustainable aviation fuels (SAF)
- Utilize offsets from other sectors



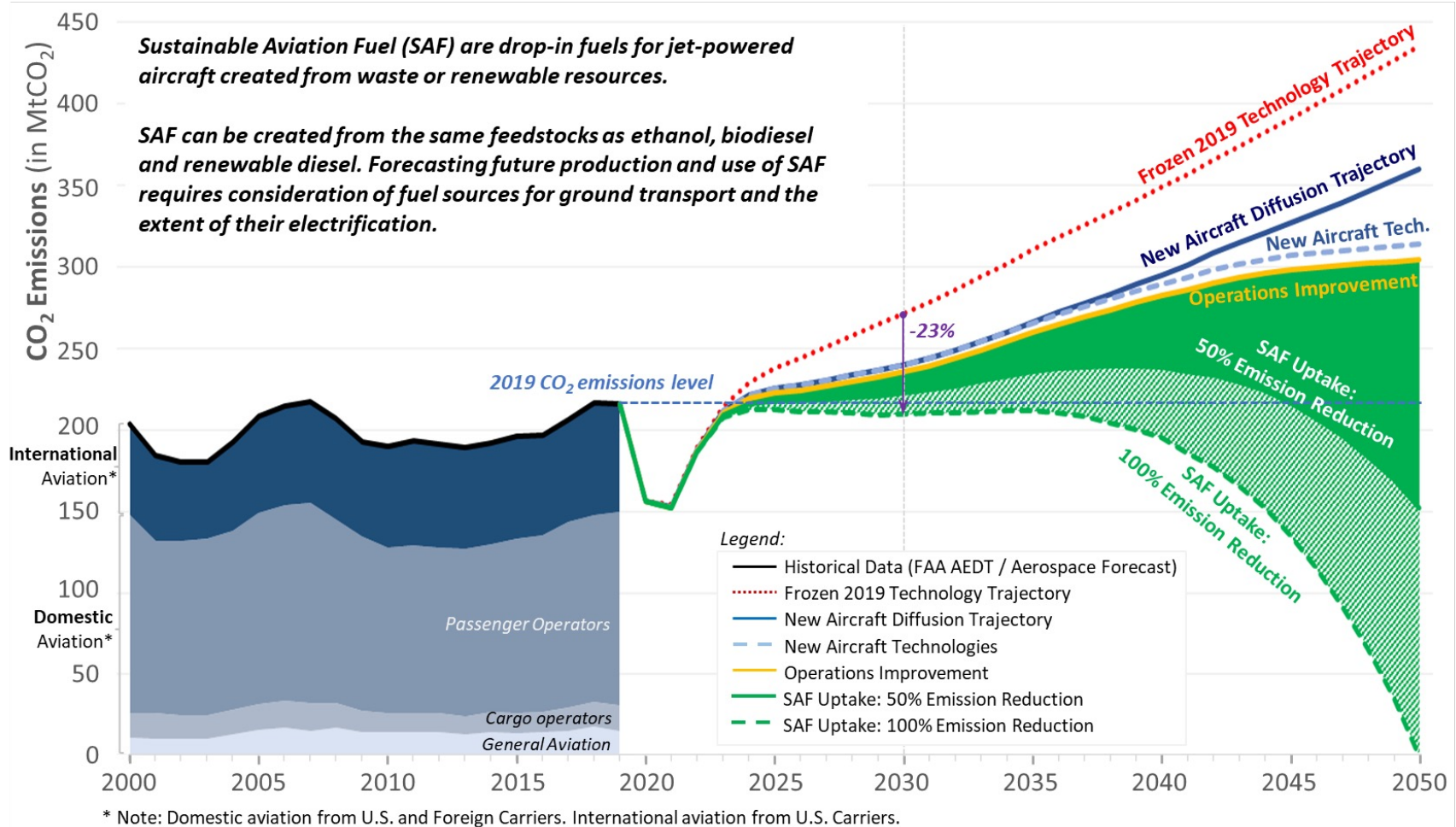
NOTE: Analysis conducted by BlueSky leveraging R&D efforts from the FAA Office of Environment & Energy (AEE) regarding CO₂ emissions contributions from aircraft technology, operational improvements, and SAF



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Sustainable Aviation Fuels

Sustainable Aviation Fuels (SAF) will be critical to the long-term decarbonization of aviation. Through a range of policy instruments, including the SAF Grand Challenge, the USG will work with industry to rapidly scale up SAF production with the goal of meeting the fuel needs of U.S. aviation by 2050.



SAF: Opportunities & Challenges

- ✓ **Drop-in** – same infrastructure, engines & aircraft
 - ✓ **Reduce lifecycle emissions** – critical to aviation de-carbonization
 - ✓ **Viable tech** – seven approved pathways, two co-processing
 - ✓ **Scalable feedstocks** – wastes & residues, biomass, sugars, oils
 - ✓ **Widely accepted** by airlines, business, and general aviation
 - ✓ **Broadly supported** by governments to meet climate, energy security, rural economic development goals
-
- **Production costs** – conversion infrastructure, feedstock availability
 - **Incentives** – lack production support
 - **Certification** – time and resource intensive
 - **Blend limits** – capped at 50%
 - **Sustainability** – ensure credibility of GHG reductions



SAF Grand Challenge

THE WHITE HOUSE



BRIEFING ROOM

FACT SHEET: Biden Administration Advances the Future of Sustainable Fuels in American Aviation

SEPTEMBER 09, 2021 • STATEMENTS AND RELEASES

White House Sustainable Aviation Fact Sheet:

<https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/09/fact-sheet-biden-administration-advances-the-future-of-sustainable-fuels-in-american-aviation/>



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SAF Grand Challenge Roles (in MOU)

DOE

- Continue investments and develop expertise in sustainable technologies to develop cost effective low carbon liquid fuels and enabling coproducts from renewable biomass and waste feedstocks
- Continue a significant multi-year SAF scale-up strategy committed to in FY21
- R&D aimed at creating new pathways toward higher SAF production
- Advance environmental analysis of SAF
- Collaborate with EPA to expedite regulatory approvals of SAF with significant life-cycle GHG reductions

DOT/FAA

- Develop overall strategy to decarbonize aviation
- Coordinate ongoing SAF testing and analysis
- Work with standards organizations to ensure safety and sustainability of SAF
- Continue International technical leadership
- Promote end use of SAF
- Support infrastructure and transportation systems that connect SAF feedstock producers, SAF refiners, and aviation end users.
- Collaborate with EPA to expedite regulatory approvals of SAF with significant life-cycle GHG reductions

USDA

- Continue investments and build expertise in sustainable biomass production systems
- Decarbonize supply chains
- Invest in bio-manufacturing capability & workforce development
- Community and individual education
- Provide outreach & technology transfer to producers, processors and communities to accelerate adoption and participation
- Commercialization support
- Collaborate with EPA to expedite regulatory approvals of SAF with significant life-cycle GHG reductions

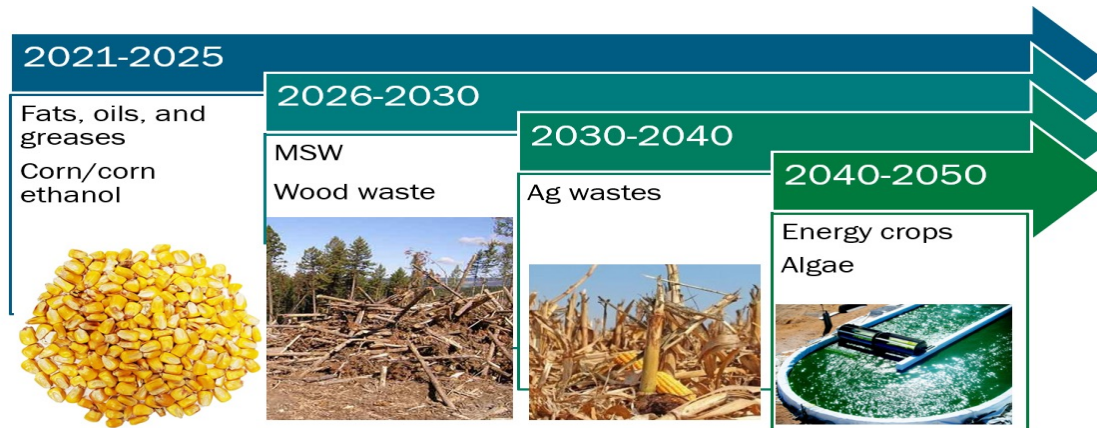
Next Step: Develop SAF Grand Challenge Roadmap

SAF Grand Challenge Roadmap

Objective: Create a multi-agency plan of federal actions that will support stakeholders to build the SAF supply

Derisk technology, supply chains and markets and reduce barriers;

- Leverage existing government research, development, demonstration, and deployment support;
- Accelerate new research, development, demonstration, and deployment support; and,
- Implement a supporting policy framework



SAF GC Roadmap – Proposed Action Areas

- 1. Feedstock Innovation** - *R&D on sustainable feedstock supply system innovations across the range of SAF relevant feedstocks and identify optimization to reduce cost, reduce technology uncertainty and risk, increase yield and sustainability, and optimize SAF precursors.*
- 2. Conversion Technology Innovation** - *Focus ongoing and future R&D on a multi-generational pipeline of conversion technologies and process improvements to reduce cost of production while increasing conversion efficiency, sustainability, and volume of fuels produced.*
- 3. Building Regional SAF Fuel production Supply Chains** – *Support SAF production expansion through regional supply chains ensuring R&D transitions, field validation, demonstration projects, supply chain logistics, public-private partnerships, bankable business model development, and collaboration with regional, state and local stakeholders.*
- 4. Policy and Valuation Analysis** - *Provide data, tools, and analysis to support policy decisions and maximize social, economic, and environmental value of SAF including alignment of existing and new policies.*
- 5. Enabling End Use** - *Facilitate the end use of SAF by civil and military users by addressing critical barriers including: efficient evaluation of fuel engine performance and safety, advancement of certification and qualification processes, expansion of existing blend limits, and integration of SAF into fuel distribution infrastructure. .*
- 6. Communicating Progress & Building Support** – *Monitor and measure progress against SAF GC goals and communicate the public benefits of the SAF GC to critical stakeholders.*

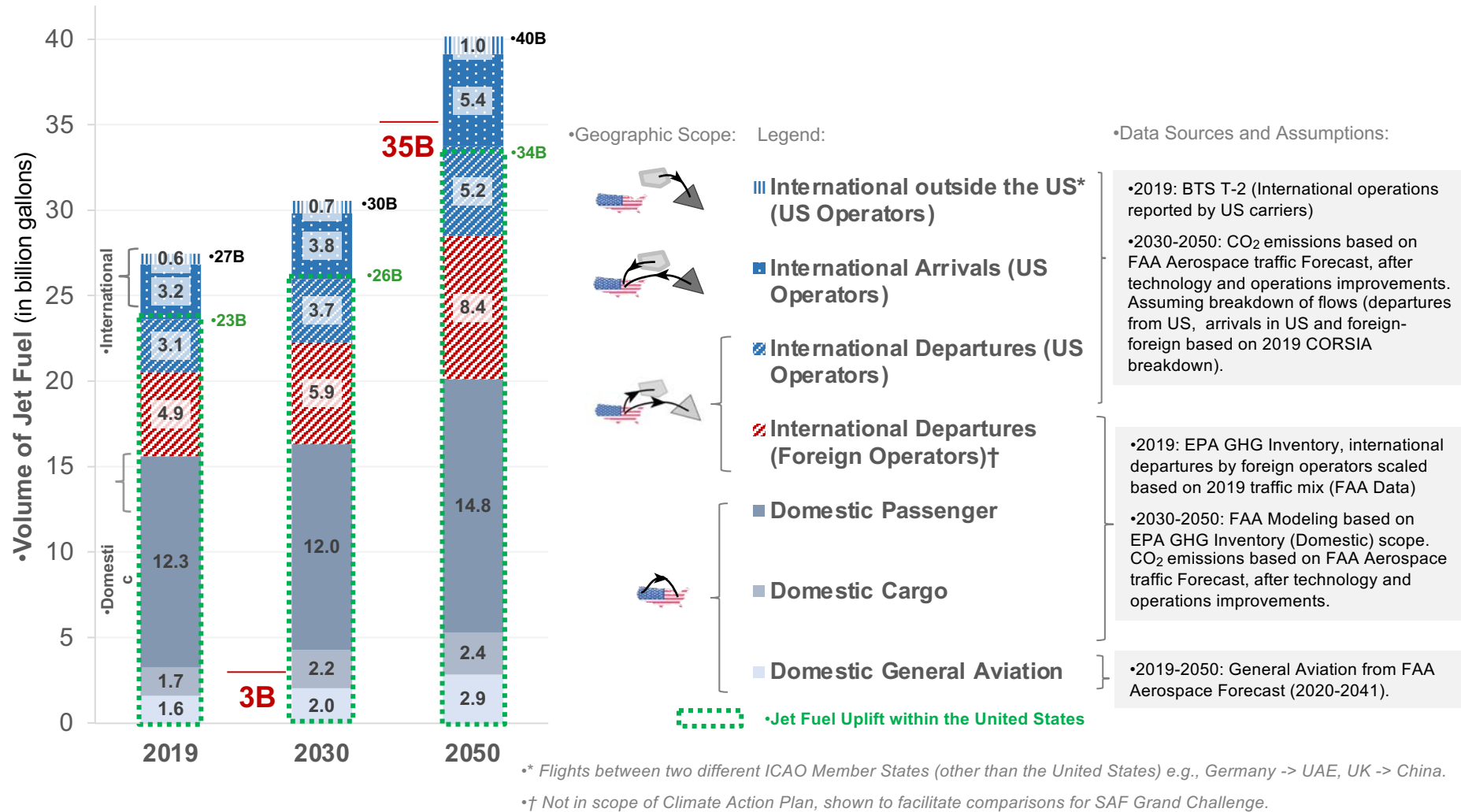


SAF Grand Challenge Roadmap Next steps

- **DOT/FAA, DOE and USDA leading process**
- **Biomass Board SAF Interagency Working Group**
- **Status**
 - Two brainstorming sessions held with federal experts
 - One session held with DOE national labs, ASCENT and USDA researchers
 - Industry/NGO/Regional stakeholder session April 15
 - Writing/development underway
- **Roadmap discussion at the CAAFI General Meeting**
 - June 1-3, 2022.

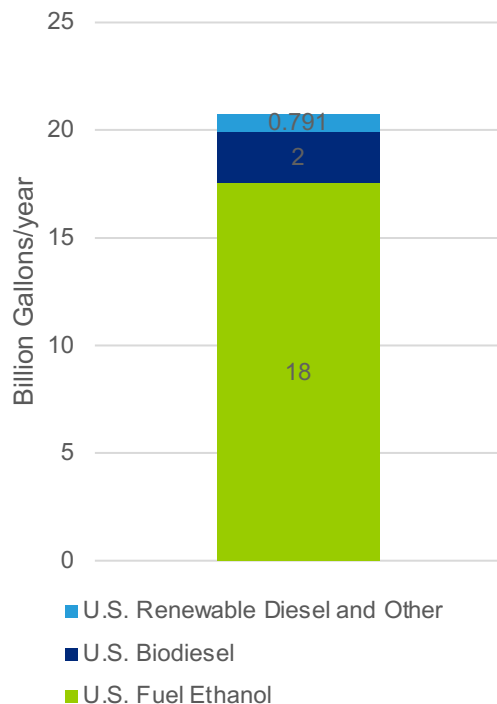


SAF Grand Challenge Goals Relative to Projected Demand

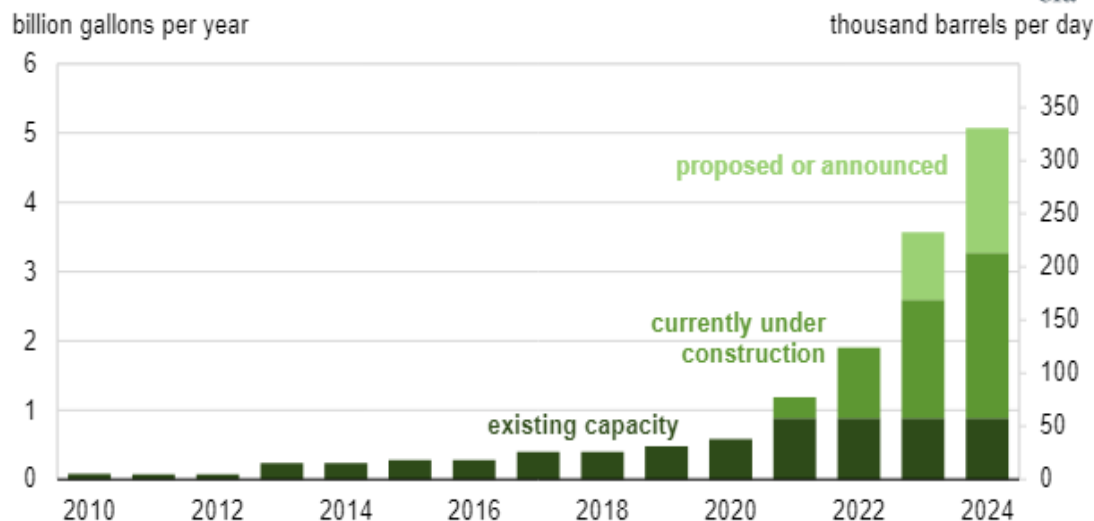


Existing & expected U.S. renewable fuel production

2021 U.S. Renewable Fuel Production Plant Capacity



Existing and expected U.S. renewable diesel production capacity (2010–2024)

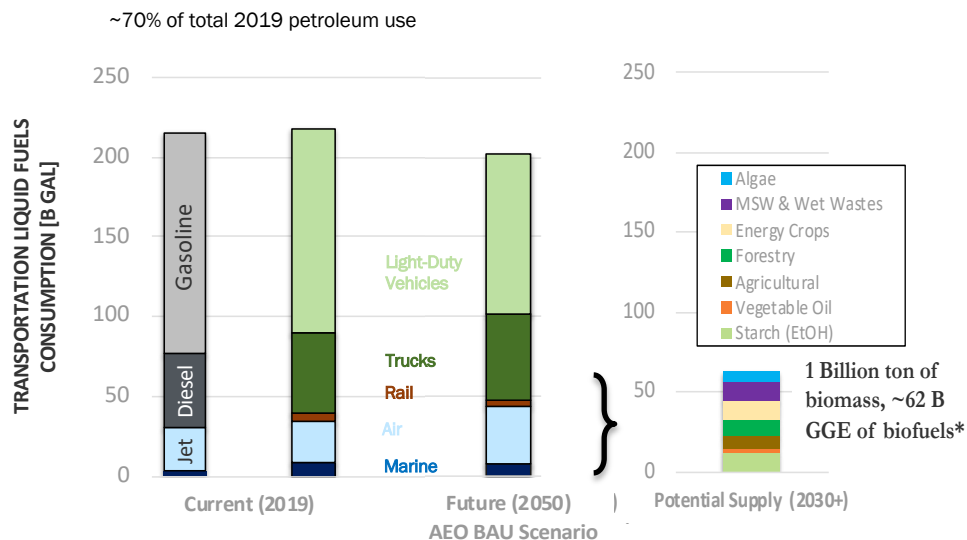


•Source: U.S. Energy Information Administration (EIA)
<https://www.eia.gov/todayinenergy/detail.php?id=48916>

- Source: U.S. Energy Information Administration (EIA)
<https://www.eia.gov/biofuels/biodiesel/capacity/>
- <https://www.eia.gov/biofuels/renewable/capacity/>
- <https://www.eia.gov/petroleum/ethanolcapacity/>



Total Available Biomass for Renewable Fuels



- Biomass can fully **supply future Aviation/ Maritime/Rail** (requires 75% of all feedstocks)
- Biggest market pull is in **sustainable aviation fuels (SAF)**
- Provides market for **current ethanol** (~17B gal, ~40% of corn production)
- Supports decarbonization of chemicals via **bioproducts**, and decarbonization of agriculture through healthy forests and sustainable agriculture
- **CO₂-to-fuels** remains to be explored





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FAA SAF Program Focus



Testing

accelerate SAF development

- Test fuels
- Improve testing methods
- Conduct evaluation
- Streamline approval

Analysis

environmental and economic sustainability

- Lifecycle emissions
- Cost reduction
- Supply potential
- Supply chain opportunities

Coordination

support SAF integration

- Public-private partnership – CAAfi
- U.S. interagency cooperation
- International cooperation – ICAO



U.S. Aviation Climate Goal

To be effective, a goal should be clear, achievable, and ambitious with specific actions that can be taken to achieve it. The goal outlined below contributes to the broader objective to achieve net-zero GHG emissions economy-wide by 2050.

U.S. Aviation Climate Goal: Net-Zero GHG Emissions* from U.S. Aviation Sector** by 2050

* Aviation GHG emissions include life cycle carbon dioxide (CO₂), nitrous oxide (N₂O), and methane (CH₄) emissions. Aircraft engines produce negligible amounts of nitrous oxides and methane, so this plan has a focus on aviation combustion CO₂ emissions and well-to-tank life cycle GHG emissions (CO₂, N₂O, and CH₄). The U.S. Aviation 2050 Goal is based on emissions that are measurable and currently monitored. Research is ongoing into the climate impacts of aviation-induced cloudiness and the indirect climate impacts of aviation combustion emissions (see section 7 for details on the climate impacts of aviation non-CO₂ combustion emissions).

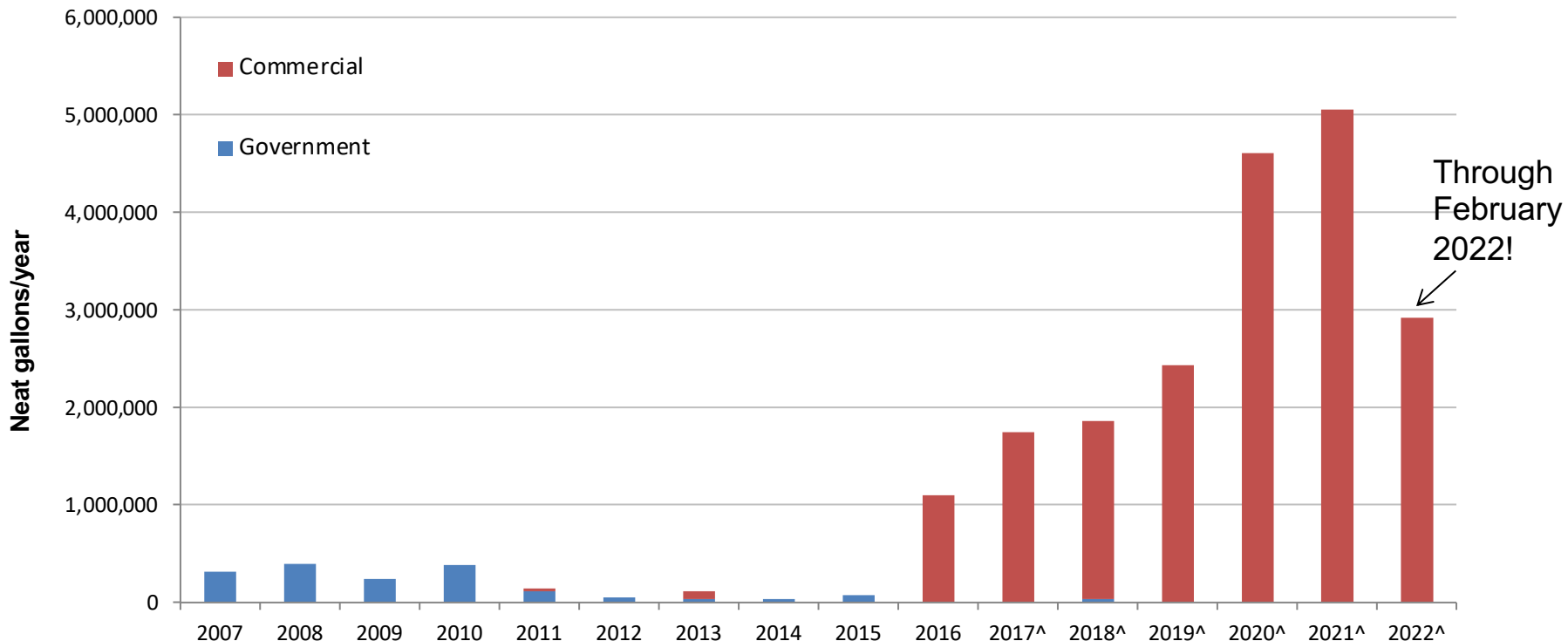
** This U.S. aviation goal encompasses CO₂ emissions from (1) domestic aviation (i.e., flights departing and arriving within the United States and its territories) from U.S. and foreign operators, (2) international aviation (i.e., flights between two different ICAO Member States) from U.S. operators, and (3) airports located in the United States.



Where we stand on U.S. SAF commercialization

Slow initiation, but gaining momentum

U.S. Annual SAF Procurements*



*Reflects voluntarily reported data on use by U.S. airlines, U.S. government, manufacturers, other fuel users, and foreign carriers uplifting at U.S. airports.

^ 2017-2021 calculation incorporates data reported by EPA for RFS2 RINs for renewable jet fuel.



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