2025

Recommendations to the Governor on Accelerating the Adoption of Sustainable Aviation Fuels in Massachusetts and New England

May 2025

May 12, 2025

The Honorable Maura Healey
Governor of Massachusetts

The Honorable Kim Driscoll
Lieutenant Governor of Massachusetts

Massachusetts State House
24 Beacon Street, Room 280
Boston, MA 02133

Subject: MA Interagency Sustainable Aviation Fuel (SAF) Workgroup Recommendations

Aviation is critical to the competitiveness of the Massachusetts economy, which is grounded in travel intensive industries such as high technology, clean technology, biotechnology, higher education, financial services, professional services, and tourism. MassDOT's Statewide Airport Economic Impact Study (2019) concluded that Massachusetts airports contribute $24.7 billion annually to the Commonwealth's economy and support 200,000 jobs in Massachusetts.

At the same time, we must look to reduce the state's aviation-related carbon footprint. The Commonwealth has a legislative mandate to decarbonize and achieve Net Zero by 2050. Aviation is a hard to decarbonize, critical industry whose major source of carbon emissions is jet fuel which is outside of an airport owner's direct control (called Scope 3 emissions), since aircraft operators and fuel providers are responsible for procurement of jet fuel including meeting safety standards and logistics of production, delivery, and use. There will also be an economic cost to the aviation industry from climate change. As identified by the International Civil Aviation Organization (ICAO), economic costs will result from increased weather volatility, the need to reinforce infrastructure, and higher operational costs due to rising temperatures, for example.

Recognizing this challenge, the Office of Climate Innovation and Resilience recommends advancing Sustainable Aviation Fuel (SAF) in Massachusetts by pursuing opportunities to pilot technology and enacting policies and actions to become a leader in supporting SAF energy sources and technologies that have the potential to dramatically reduce life cycle aviation emissions (to near zero by 2050, for example) and avoid indirect impacts on forests and croplands.

To meet this challenge, an interagency workgroup was convened to propose specific recommendations based on research and expertise from industry stakeholders. The Massachusetts SAF Workgroup (SAF Workgroup) is composed of key staff from the Executive Offices of Economic Development (EOED), Energy and Environmental Affairs (EOEEA), Administration and Finance (A&F), the Office of Climate Innovation and Resilience, Massachusetts Clean Energy Center (MassCEC), Massachusetts Department of Transportation Aeronautics Division (MassDOT), and the Massachusetts Port Authority (Massport).

The SAF Workgroup presents the attached report which recommends a series of actions that the Commonwealth can take to incentivize the use of SAF at airports within Massachusetts and regionally. We believe implementing these recommendations will lead to the early delivery of SAF to state airports, lay the groundwork for the development of a SAF eco-system based on the region's technology and academic strengths, incentivize infrastructure investments, and create jobs associated with the production, handling, and delivery of SAF.

Finally, it must be acknowledged that this effort is unfolding in an uncertain federal regulatory environment—major federal funding for clean energy and climate-related initiatives is at risk and longstanding federal environmental regulatory frameworks are under review. Nevertheless, we believe that state and multi-state level efforts to advance SAF are critically important if we are to achieve our sustainability goals related to aviation.

Sincerely,

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Executive Summary

The aviation industry acknowledges the urgent need to address climate change and ensure sustainable flying. At the International Air Transport Association's (IATA) 77th Annual Meeting in Boston, Massachusetts on October 4, 2021, the industry committed to achieving net zero carbon emissions by 2050. This commitment, which is also integrated into the Federal Aviation Administration's (FAA) Climate Action Plan and individual airline environmental sustainability plans, encompasses a range of actions including the development of new propulsion technologies, operational efficiency improvements, and the transition from fossil fuels to sustainable aviation fuels (SAF). Most of the carbon abatement is expected to be achieved by using SAF.

Therefore, immediate action is needed to spur investment in new aviation fuels that are not derived from petroleum-based sources. Instead, sustainable fuels should rely on renewable bio-sources that do not compromise food security or have adverse environmental impacts. Examples include fuels developed from approved waste fats, oils, and greases (known as hydro-processed esters and fatty acids or HEFA), waste bi-products from agricultural and forest residues, and synthetic processes such as one under development by Massachusetts-based Lydian Labs. Massachusetts can show leadership in this area now with a SAF policy that begins to move the Commonwealth away from fossil fuels as the primary energy source for our aviation needs.

SAF is a drop-in fuel produced from renewable feedstocks that offer the same performance and safety as conventional jet fuel, while being fully compatible with the existing fuel supply, infrastructure, and aircraft engines. A crucial element of any future state policy is the inclusion of incentives for using and producing SAF with the highest emission reduction benefits. In line with existing SAF policies, climate benefits should be calculated across the entire lifecycle of the fuel, including production, transportation, combustion, and associated indirect effects. Future Massachusetts policy should recognize ambitious carbon intensity reduction thresholds. Such policies should focus support for SAF on energy sources and technologies that have the potential to dramatically reduce lifecycle aviation emissions (e.g., to near zero by 2050) and avoid indirect impacts on forests and croplands.

Based on research, best practices from other states, and input from experts, the SAF Workgroup identified the following short-term and long-term recommendations.

Recommendation 1.

Undertake a regional planning study to better understand SAF production, transportation, delivery, storage, blending and usage, the current jet fuel supply chain, the potential for future blended SAF delivery, and regional feedstock opportunities.

Expected time frame – Massport has engaged the U.S. Department of Energy's (U.S. DOE) National Renewable Energy Laboratory (NREL) to conduct the study, which is expected to be completed by fall 2025.

Recommendation 2.

Create a Massachusetts and New England Region SAF Hub to include major employers, academic institutions, and key aviation industry groups including airports, airlines, and general aviation users to secure buy-in from key stakeholders, facilitate information sharing, and identify priority short- and long-term initiatives that build SAF momentum.

Expected time frame – consistent with other, similar regional efforts, this effort should be initiated in the near term and include a regional SAF workshop.

Recommendation 3.

Identify and market existing state programs and initiatives targeting greenhouse gas emissions reduction, climatetech, and economic development to support SAF-related production, innovative technology, and job creation. Additionally, explore federal programs that may be available to bolster SAF inclusion in the Commonwealth's climatetech ecosystem.

Expected time frame – as part of this effort, the SAF Workgroup reviewed and identified an initial set of existing programs that can be leveraged. This should be a near-term effort but continue into the medium and long term.

Recommendation 4.

Enact legislation to fund a tax credit for SAF usage, blending, storage, and production infrastructure, as well as new SAF technology testing, adoption, and scale-up to address cost barriers to production and demand and enable market uptake of SAF.

Expected time frame – initial discussions should begin in the near term.

Recommendation 5.

Convene a Regional SAF Alliance, inclusive of the six New England states and New York, which will work to align SAF policies and programs at a regional level and build the scale needed to develop a SAF industry and expand feedstock sources.

Expected time frame – This effort may span the medium to long term but should leverage the SAF Hub process once it is underway and involve the New England states and New York.

The SAF Workgroup believes that implementing these recommendations will enable the Commonwealth and the New England region to achieve early delivery of SAF to our airports and establish a foundation for developing a regional SAF industry. By leveraging the region's high-tech, clean-tech, and academic strengths, sourcing regionally derived feedstocks, and promoting infrastructure development, we can not only help the region achieve its climate goals but also create economic benefits and jobs related to the production, handling, and delivery of SAF.

Background

The U.S. and global aviation industries have set a goal to be net zero by 2050.[1] The FAA has identified SAF as the critical pathway to de-carbonizing aviation. The *Massachusetts Climate Chief Report* emphasizes the importance of SAF as a key component in reducing emissions from long-distance transportation modes and achieving the Commonwealth's climate goals (Figure 1).[2] [3] The report also identifies high speed rail as a strategy to accommodate short haul trips such as Amtrak's Acela service in the Northeast Corridor (Boston-New York-Washington DC).

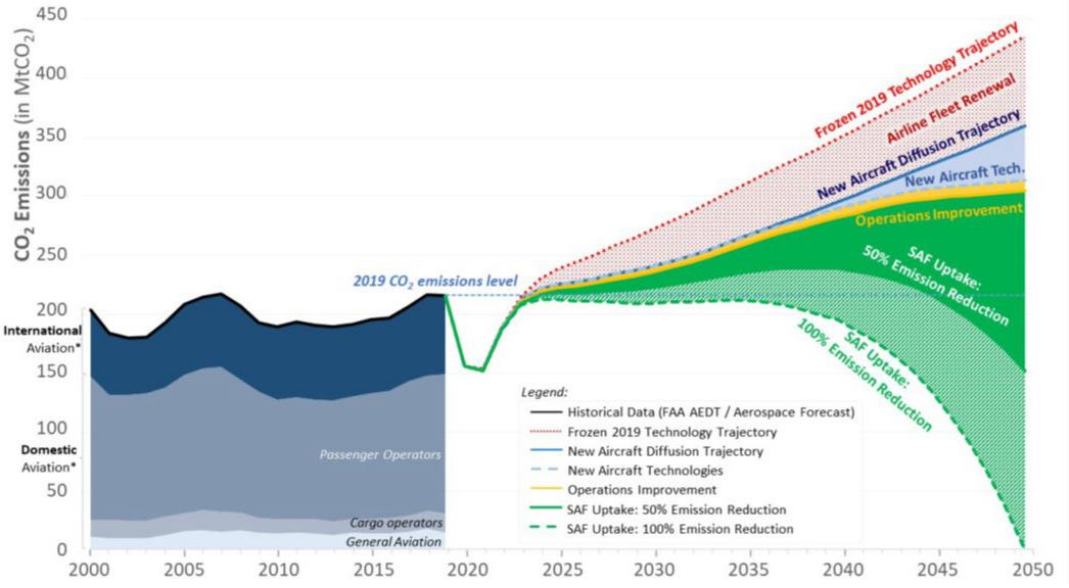
The FAA and major commercial airlines plan to achieve net zero by 2050 through a comprehensive set of actions (Figure 2).[4] These include advancements in aircraft technology and operational efficiency, new engine propulsion technologies such as electric aircraft, the implementation of higher standards for engines, and the adoption of sustainable aviation fuels.

[1] INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA), *Resolution on the Industry's Commitment to reach Net Zero Carbon Emissions by 2050*, (October 2021) https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/iata-agm-resolution-on-net-zero-carbon-emissions.pdf (last visited March 31, 2025).

[2] FEDERAL AVIATION ADMINISTRATION, *United States 2021 Aviation Climate Action Plan*, p. 21, (November 9, 2021) https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf (last visited March 31, 2025).

[3] THE OFFICE OF CLIMATE INNOVATION AND RESILIENCE, *Recommendations of the Climate Chief*, p. 47, (October 25, 2023) https://www.mass.gov/doc/recommendations-of-the-climate-chief-october-25-2023 (last visited March 31, 2025).

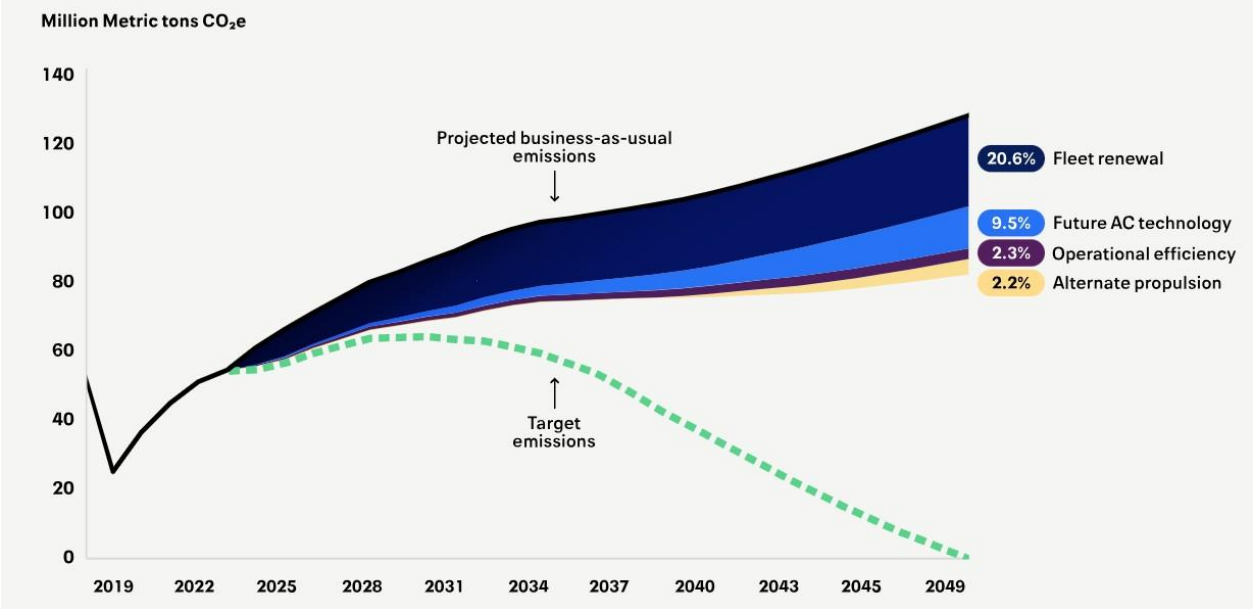
[4] UNITED AIRLINES, *Corporate Impact Report 2024* https://corporateimpact.united.com/environmental-sustainability/our-environmental-strategy/ (last visited May 12, 2025).



Source: FAA, United States 2021 Aviation Climate Action Plan

Figure 1

Analysis of Future Domestic and International Aviation CO_2 Emissions



Source: United States, Corporate Impact Report 2024

Figure 2

United Airlines' Illustrative Decarbonization Roadmap

The Commonwealth, through MassDOT and its airports, is actively engaged with new electric and hydrogen fuel cell aircraft start-ups to advance the industry and prepare our airports with the necessary infrastructure. For example:

- **Beta Technology**, a small electric aircraft manufacturer headquartered in Burlington, VT, is installing charging infrastructure throughout the Northeast including Massachusetts airports - Hanscom Field, Marshfield Municipal Airport, and Westfield-Barnes Regional Airport.[5]
- **Cape Air**, a regional carrier based in Hyannis, MA, is partnering with Eviation for an all-electric 9-seat aircraft.[6]
- **Alaka'i Technologies**, based in Stow, MA, is testing a hydrogen-powered electric vertical and takeoff aircraft (eVTOL).[7]
- MassDOT is also engaged with the **Advanced Air Mobility/Integration Task Force** (AAM/ITF), a collaboration between government, industry, and academia, working together at the forefront of air mobility to support infrastructure and operational needs, aiming for a cleaner, greener and more equitable air transportation future.

Image 1 - Alice Electric Aircraft Prototype

[5] BETA TECHNOLOGIES, Charge network, https://beta.team/charge, (last visited May 12, 2025).

[6] CAPE AIR, *Sustainability: Moving to an electric future*, https://www.capeair.com/about_us/future-of-electric-aviation.html (last visited May 12, 2025).

[7] ALAKA'I TECHNOLOGIES, *Skai*, https://www.alakai.com/skai, (last visited May 12, 2025).

While new aircraft and propulsion systems are crucial for the long-term decarbonization of the aviation industry, they alone will not achieve the industry's decarbonization goals. Factors such as aircraft size, travel distances, the current state of battery and hydrogen technologies, and the lengthy certification process for new engines and systems all contribute to this challenge.[8]

Sustainable Aviation Fuels

The *U.S. Aviation Climate Action Plan* defines SAF as drop-in liquid hydrocarbon fuels produced from renewable feedstocks or bio-waste materials with the same performance and safety as conventional jet fuels. SAF must meet standards developed by the American Society for Testing and Materials (ASTM) to ensure the safe use of fuels in flight operations. To date, the highest blended ratio approved for safe flight operations is 50% SAF with 50% conventional jet fuel. FAA, researchers, and industry are working to achieve 100% SAF for flight operations.

The aviation industry has also recognized that SAF must be produced sustainably. For example, ICAO adopted the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which lists a complete set of sustainability criteria ranging from land/aquatic systems, water quality, land use, to local and social development and food security. There are also state level requirements related to sustainable fuels including California's Low Carbon Fuel Standard and Massachusetts' Alternative Energy Portfolio Standard. The Massachusetts Clean Energy and Climate Plan for 2050 also provides specific guidance on sustainable biofuels.

Although the U.S. produced 26 million gallons of SAF in 2023, about 0.1% of the nation's jet fuel use, SAF production is quickly ramping up as new plants become operational.[9] Today, most of the SAF used in the U.S. is produced in Montana and California and used at airports

[8] FEDERAL AVIATION ADMINISTRATION, United States 2021 Aviation Climate Action Plan, p. 18, (November 9, 2021) https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf (last visited March 31, 2025).

[9] U.S. ENERGY INFORMATION ADMINISTRATION, *U.S. production capacity for sustainable aviation fuel to grow*, (July 17, 2024), https://www.eia.gov/todayinenergy/detail.php?id=62504 (last visited May 12, 2025).

in California, where the regulatory and policy environment subsidizes the current cost premium associated with the production, blending and delivery of SAF.[10]

While SAF's primary advantage is its easy integration into the existing jet fuel supply chain, it comes with higher logistics and cost challenges, making it up to twice as expensive as conventional fuel. This is due to the complex SAF supply chain, which includes feedstock supply, non-feedstock inputs, preprocessing, logistics, pretreatment, conversion, blending, and various regulatory approvals. These factors add to the cost, whereas conventional jet fuel has been optimized over the years to remain cost-effective.[11]

As SAF production increases, several states are implementing measures to help pay for the SAF premium and derive benefits from related economic development. For example, Illinois, Minnesota, and Nebraska offer tax credits to support SAF. There is an opportunity for Massachusetts to engage similarly by implementing a statewide SAF strategy to further the Healey-Driscoll administration's goals of advancing economic development, growing the clean energy and climatetech sectors, and leading the fight against climate change. Economic development opportunities could be wide-ranging from SAF production and supply chain to advancing innovative green technology to produce synthetic SAF. Establishing SAF production facilities creates jobs in manufacturing, engineering, and operations. Investment in SAF technologies stimulates employment in the research, development, and innovation sectors. Developing distribution infrastructure, including transportation and storage, would similarly create new employment opportunities.

The clean energy and clean technology sectors (along with "blue tech") have been identified as drivers of future employment and economic growth.[12] Massachusetts has a rich innovation ecosystem that can be leveraged to develop a statewide SAF strategy. For example, MIT is currently undertaking FAA-funded research on the SAF supply chain and

[10] OFFICE OF GOVERNOR GAVIN NEWSON, *Governor Newsom announces first-of-its-kind partnership with airlines on sustainable aviation fuel*, news release, (October 30, 2024), https://www.gov.ca.gov/2024/10/30/governor-newsom-announces-first-of-its-kind-partnership-with-airlines-on-sustainable-aviation-fuel/#:~:text=Oct%2030%2C%202024-,Governor%20Newsom%20announces%20first%2Dof%2Dits%2Dkind%20partnership%20with,tenfold%20increase%20from%20current%20levels (last visited May 12, 2025).

[11] NATIONAL RENEWABLE ENERGY LABORATORY, Calderon, O. R.; Tao, Ling; Abdullah, Z.; Moriarty, K.; Smolinski, S.; Milbrandt, A.; Talmadge, M.; Bhatt, A.; Zhang, Y,; Ravi, V.; Skangos, C.; Tan, E.; and Payne, C., *Sustainable Aviation Fuel (SAF) State-of-Industry Report: State of SAF Production Process* (July 2024), https://docs.nrel.gov/docs/fy24osti/87802.pdf (last visited May 12, 2025).

[12] MASSACHUSETTS HIGH TECHNOLOGY COUNCIL, *MassVision2050: Massachusetts Innovation Sectors*, https://www.mhtc.org/massvision2050/innovation-sectors/(last visited March 31, 2025).

leads the Zero Impact Aviation Alliance (ZIAA), a group that includes Delta Air Lines, the Boeing Company, Pratt & Whitney, World Energy and Massport - representing the full aviation value chain. World Energy, the world's first commercial-scale producer of SAF, is headquartered in Boston. The Commonwealth and the SAF Workgroup can draw on the knowledge of local strategic management consultants and technology innovators that possess expertise on SAF economics, technology, and logistics. In 2025, Lydian Laboratory, a local MIT spin off company, will be producing synthetic [13]sustainable aviation fuel in its Charlestown R&D facility and plans to scale up production at a pilot plant located in North Carolina. In addition to its Massachusetts connections, Lydian's technology is of particular interest because it has the potential to reduce aviation emissions to near zero by 2050 and is not dependent on bio-based feedstock.

State Interagency SAF Workgroup

States have a critical role to play in incentivizing the use of SAF as well as identifying opportunities to promote economic development through production, delivery, handling, blending and storage of SAF. Recognizing this opportunity, an interagency SAF Workgroup was formed to:

1. Research best practices and current models of SAF adoption at the state level.
2. Identify existing federal and state programs that could be leveraged to support SAF use and development.
3. Identify areas of opportunity for economic development within existing offerings and explore new ones.
4. Identify stakeholder engagement needs to build an ecosystem for SAF advocacy and support.

Based on these objectives, the SAF Workgroup identified a series of recommendations that will align Massachusetts with the best practices of other successful states and position the Commonwealth to be a leader in SAF adoption in the near term and, in the longer term, incentivize an ecosystem of R&D activity, infrastructure deployment, and advocacy/support for a SAF economy.

[13] Synthetic SAF, also known as power-to-liquid, is made through carbon capture and green hydrogen (i.e., hydrogen produced from water). This is a technically challenging pathway both on the production side and the need for green electricity. However, innovative start-ups are successfully producing SAF at smaller scale today including Twelve from Berkley, CA, and Lydian Labs from Boston.

Members of the SAF Workgroup included staff from:

- Executive Office of Energy and Environmental Affairs (EOEEA)
- Executive Office of Economic Development (EOED)
- Executive Office of Administration & Finance (A&F)
- Department of Transportation/Aeronautics (MassDOT)
- Office of Climate Innovation and Resilience
- Massachusetts Clean Energy Center (MassCEC)
- Massachusetts Port Authority (Massport)

The SAF Workgroup met bi-weekly beginning in December 2024 and concluded its work in May 2025. They engaged with outside experts and compiled a library of background materials to support the recommendations and serve as a reference for future work on SAF.

The team engaged with the following outside experts and organizations:

- Airports, Airlines and Fixed Base Operators
    - Delta Air Lines
    - JetBlue
    - Jet Aviation
    - Signature Aviation
    - Westfield-Barnes Regional Airport
- Federal and State Government Entities
    - Minnesota SAF Hub
    - National Renewable Energy Laboratory (NREL)
    - United States Department of Energy (U.S. DOE)
- Non-profits
    - Massachusetts Airport Managers Association (MAMA)
    - Mass Mobility Hub
- Start-ups and SAF Manufacturers
    - Lydian Labs
    - World Energy
- Universities
    - Massachusetts Institute of Technology/Zero Impact Aviation Alliance

Observations and Findings

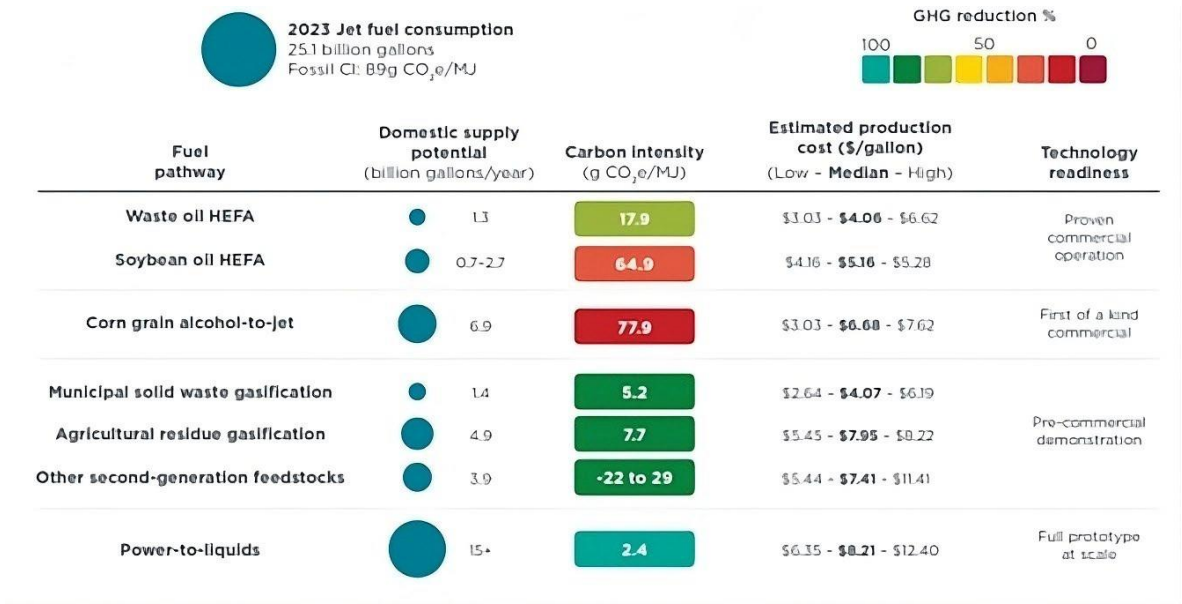
Through research and engagement with experts, the SAF Workgroup identified the following key observations and findings related to aviation and SAF, which informed the recommendations.

SAF Industry Context

Production

- SAF is a "drop-in" jet fuel, which means it can be mixed with or used as a direct replacement for conventional jet fuel without any modifications to aircraft engines or fuel infrastructure.
- Based on current safety standards, neat SAF (i.e., 100% SAF) must be blended with jet fuel up to a maximum ratio of 50%. Today, the most common blend ratio is 30% SAF. The FAA and the aviation industry are working towards permitting commercial aircraft to use 100% SAF.
- SAF can be produced from a variety of non-petroleum-based renewable feedstocks approved by the FAA including waste fats, oils and greases, agricultural and forestry residues, and municipal waste, as well as fuels produced synthetically.
- Neat SAF must be produced using feedstocks, methods, and delivery channels such that greenhouse gas emissions over the life cycle of the fuel are reduced, and the production is sustainable. Research in this area points to pathways, shown in Figure 3, that present the right combination of reducing greenhouse gases while using sustainable sources such as converting waste fat, oil, and grease stocks (i.e., the hydrogenated esters and fatty acids, or HEFA, production pathway).[14]

[14] INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION, Andy Navarette, Nikita Pavlenko, and Jane O'Malley, *SAF policy scorecard: Evaluating state-level sustainable aviation fuel policies in the United States*, pp. 3-4, (November 2024), https://theicct.org/wp-content/uploads/2024/11/ID-225-%E2%80%93-SAF-scorecard_final.pdf (last visited March 31, 2025).



Source: International Council on Clean Transportation, 2024

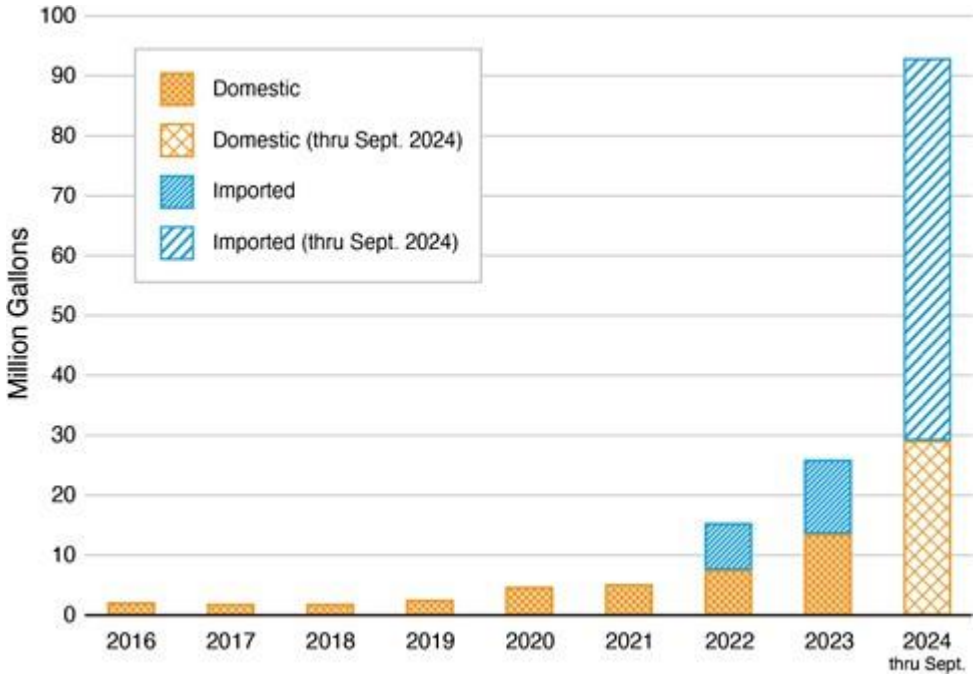
Figure 3

Key Characteristics of Relevant SAF Pathways in the United States

Demand

- In the U.S., the aviation industry uses about 29 billion gallons of jet fuel annually. SAF production is in its infancy with current production at 93 million gallons through September 2024 (Figure 4). However, SAF production is ramping up and is expected to reach billions of gallons by 2030 and beyond. [15]

[15] U.S. DEPARTMENT OF ENERGY, U.S. DEPARTMENT OF TRANSPORTATION, U.S. DEPARTMENT OF AGRICULTURE, U.S. ENVIRONMENTAL PROTECTION AGENCY, *Sustainable Aviation Fuel Grand Challenge October 2021 – September 2024 Progress Report*, pp. 3-5, (December 2024), https://www.energy.gov/sites/default/files/2025-01/saf-progress-report-2024.pdf (last visited March 31, 2025).



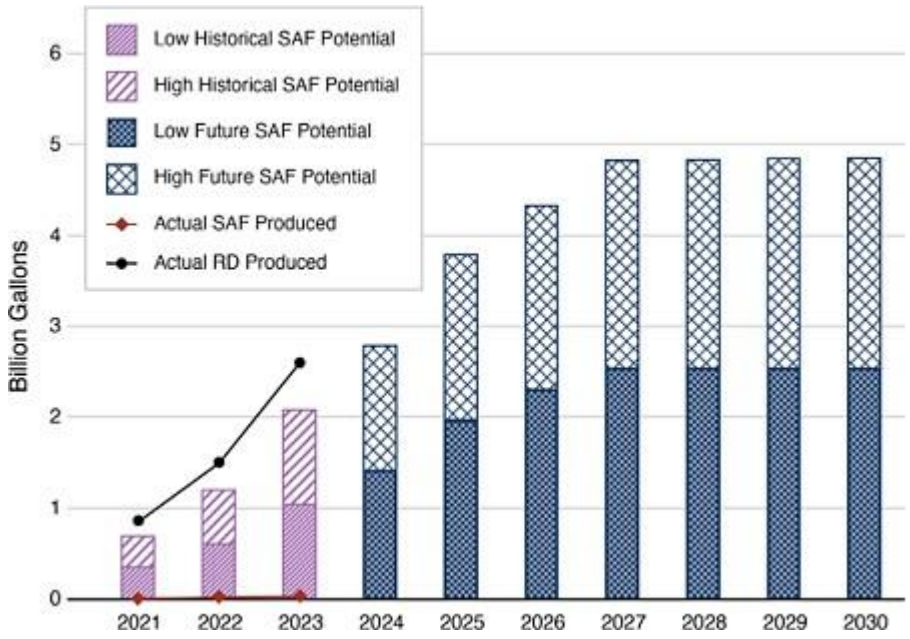
Source: USDOE, USDOT, USDA, USEPA, Sustainable Aviation Fuel Grand Challenge October 2021-September 2024 Progress Report

Figure 4
U.S. SAF Production

- Industry projections shown in Figure 5 indicate that the U.S. could surpass its SAF target of three billion gallons a year by 2030.[16] Projects in various stages of development and backed by an estimated $44 billion of investment already represent more than the annual three-billion-gallon target. [17]

[16] Ibid., p. 16.

[17] Sofia Cabrera, *DOE Report Says US Domestic SAF Use Grew Significantly Under Biden*, S&P GLOBAL (January 14, 2025), https://www.spglobal.com/commodity-insights/en/news-research/latest-news/agriculture/011425-doe-report-says-us-domestic-saf-use-grew-significantly-under-biden (last visited March 31, 2025).



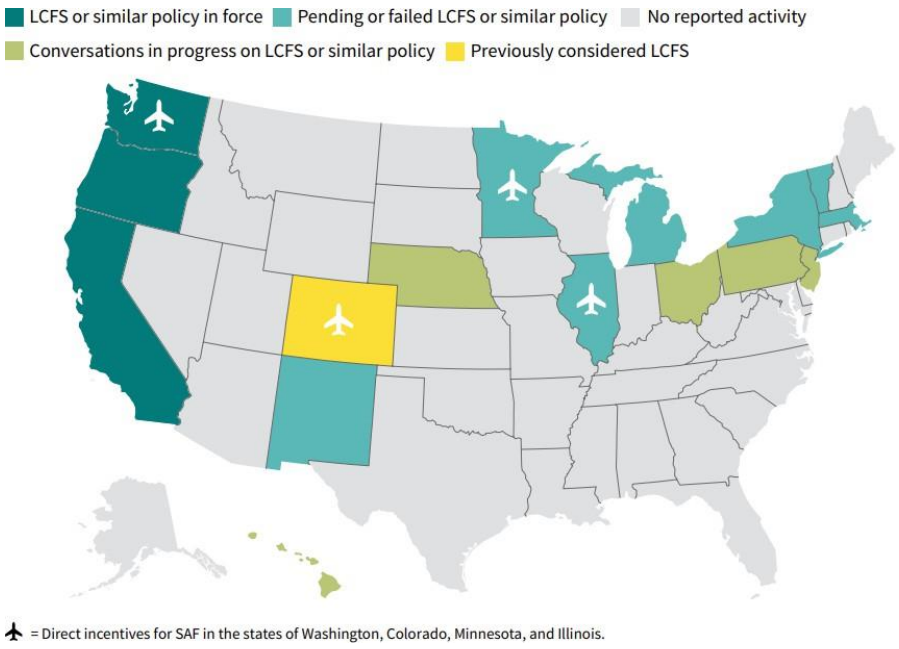
Source: USDOE, USDOT, USDA, USEPA, Sustainable Aviation Fuel Grand Challenge October 2021-September 2024 Progress Report

Figure 5

U.S. SAF Production Potential

Policy Landscape

- States are successfully utilizing incentives and subsidies to help pay for the SAF cost premium and the development of related production/blending/storage/delivery infrastructure (Figure 6).[18]



Source: RMI analysis of state policy offices

Figure 6
SAF Policy Landscape and Exiting SAF Projects

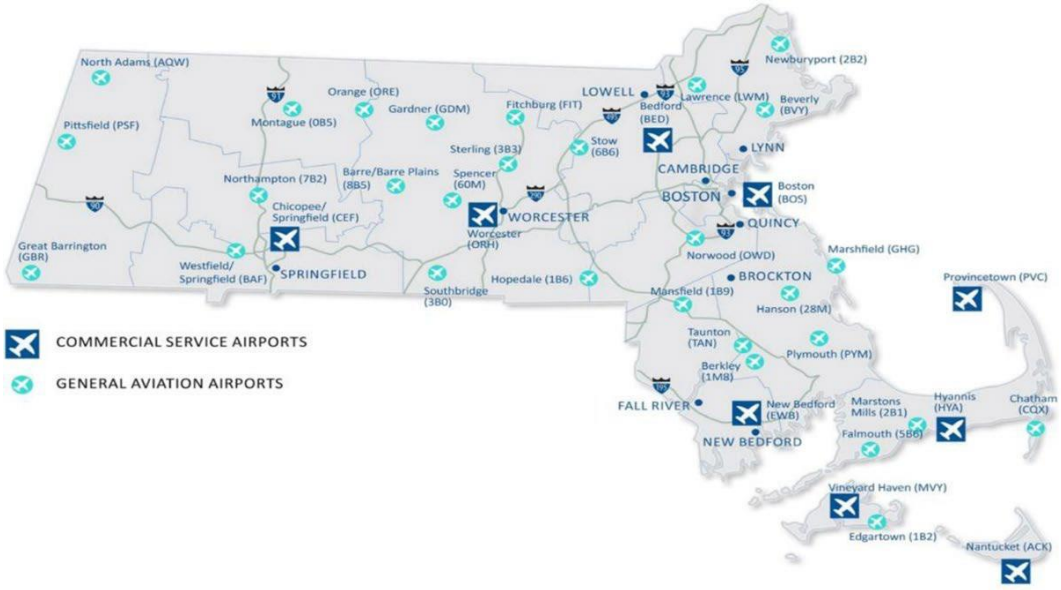
- Today, most of the SAF produced is shipped to locations where the regulatory and policy environments support SAF use by providing subsidies to help offset the SAF cost premium.
- Successful states have taken the initiatives through regulatory, tax, and targeted investments to develop a SAF economy that incentivizes the local use of SAF and aligns strategic economic development initiatives to include SAF.

[18] Andrew Chen et al., *Refueling Aviation in the United States: Evolution of US Sustainable Aviation Fuel Policy*, RMI, 2024, https://rmi.org/insight/refueling-aviation-in-the-us-evolution-of-us-sustainable-aviationfuel-policy/ (last visited May 12, 2025).

Massachusetts Aviation Context

Infrastructure

- The Massachusetts airport system, as shown in Figure 7, consists of 38 airports including commercial air service airports, general aviation airports, and facilities with shared public and military use. MassDOT Aeronautics oversees 35 airports and Massport owns and operates three including Boston Logan International Airport, New England's largest commercial airport and international gateway with services from more than 50 airlines, including major carriers that have committed to reaching net zero emissions by 2050 and 2040, respectively.



Source: MassDOT Aeronautics Division

Figure 7
Massachusetts Airport System

- Other major airports outside of Massachusetts that are important to the regional airport system and future SAF use include Portland International Jetport (ME), Manchester-Boston Regional Airport (NH), Rhode Island T.F. Green International Airport (RI), Hartford Bradley International Airport (CT), and Patrick Leahy Burlington International Airport (VT).

- The New England states used about 674 million gallons of jet fuel in 2023 according to the U.S. Energy Information Administration.[19] Massachusetts accounts for about 90% of the region's consumption, or about 494 million gallons.

Economy

- The U.S. and the world economies are highly dependent on civil aviation for connecting communities, facilitating business interactions, and supporting demand for goods and services. U.S. civil aviation directly or indirectly supports $1.8 trillion in total economic activity and 9.4 million jobs.[20]

- Aviation is also critical to the competitiveness of the Massachusetts economy with travel intensive industries such as high tech, biotechnology, higher education, financial services, and tourism. Massachusetts airports contribute over $24 billion to the Commonwealth's economy annually and support 200,000 jobs in the state.[21]

- Massachusetts is the headquarters for 16 Fortune 500 companies (e.g., Liberty Mutual, TJX, State Street, Biogen, Vertex Pharmaceuticals, etc.) and diverse businesses and entities including renowned health care institutions, high technology and biotechnology companies, specialized manufacturing, financial services, management consultancies, and top-ranked institutions of higher education. These prominent businesses and institutions that rely on air travel and have their own decarbonization goals can bring meaningful corporate leadership and resources to ensure SAF adoption.

- Massachusetts has a proven record in state programs and initiatives that support clean energy and climate technology, manufacturing, R&D and commercialization, infrastructure, and economic development to potentially support the development of a SAF economy.

- Massachusetts is also home to significant university and private-sector research entities that are well situated to help address potential scientific and technical hurdles to SAF production and delivery.

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[19] U.S. ENERGY INFORMATION ADMINISTRATION, Table F2: Jet fuel consumption, price, and expenditure estimates, 2023, https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_fuel/html/fuel_jf.html (last visited March 31, 2025).

[20] FEDERAL AVIATION ADMINISTRATION, *The Economic Impact of U.S. Civil Aviation*, September 2024, https://www.faa.gov/2024-economic-impact-report (last visited May 12, 2025).

[21] MASSACHUSETTS DEPARTMENT OF TRANSPORTATION AERONAUTICS DIVISION, *Statewide Airport Economic Impact Study Update*, p. 2, (January 2019), https://www.mass.gov/doc/aeronautics-economic-impact-study-2019/download (last visited March 31, 2025).

- Massachusetts' economic strengths in R&D, innovation, venture capital, and high tech are a natural fit for innovative technology and processes related to synthetic SAF.

Climate and Emissions

- According to a survey conducted by ICAO among aviation industry stakeholders, climate change presents specific business risks to aviation. These risks include physical threats such as rising sea levels and storm surges, which can affect access, infrastructure, and operations at coastal airports. Extreme weather events, higher temperatures, and changes in wind patterns may lead to increased flight cancellations and delays, infrastructure damage, and payload restrictions, meaning flights would need to carry fewer passengers and cargo in hotter temperatures. The combined effect of these risks can lead to significant financial losses for airlines.[22] For example, a study from the University of Illinois and University of Michigan estimates that climate change can significantly impact the ability of airlines to recover from operational disruptions, concluding that estimated daily recovery costs can increase by 15.7% to 49.4%, on average.[23]

- The FAA identified SAF as critical pathway to de-carbonizing aviation. Neat SAF (i.e., 100% SAF) can reduce greenhouse gases by over 90% depending on the feedstock and production process.[24] While the U.S. produced 26 million gallons of SAF in 2023, which amounts to approximately 0.1% of the nation's jet fuel use, SAF production is quickly ramping up as new plants come online.

- Tackling the Commonwealth's (and the region's) aviation-related carbon footprint is consistent with the Commonwealth's legislative mandate to achieve net zero by 2050.

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[22] INTERNATIONAL CIVIL AVIATION ORGANIZATION COMMITTEE ON AVIATION ENVIRONMENTAL PROTECTION, *Aviation and Climate Change Factsheet,* 2020 https://www.icao.int/environmental-protection/Documents/Factsheet Business and Economics Final.pdf (last visited April 16, 2025).

[23] Jane Lee, Lavanya Marla, and Parth Vaishnav, *The impact of climate change on recoverability of airline networks,* Transportation Research Part D: Transport and Environment, Volume 95 (June 2021) https://www.sciencedirect.com/science/article/abs/pii/S136192092100105X (last visited May 12, 2025).

[24] Prussi, M.; Lee, U.; Wang, M.; Malina, R.; Valin, H.; Taheripour, F.; Velarde, C.; Staples, M. D.; Lonza, L.; Hileman, J. I., *CORSIA: The first internationally adopted approach to calculate life-cycle GHG emissions for aviation fuels,* RENEWABLE SUSTAINABLE ENERGY REVIEW, p. 7, (June 2021), https://www.sciencedirect.com/science/article/pii/S1364032121006833#section-cited-by (last visited March 31, 2025).

- One of the recommendations from the Massachusetts Climate Chief is for Massport and MassDOT to develop a plan to reduce aviation emissions including consideration of alternative fuels. The Report also recommends advancing SAF in Massachusetts. [25]

SAF Considerations

- If the region sets an initial target of 2% blended SAF, the total neat SAF needed would be about 13.5 million gallons for New England and 10 million gallons for Massachusetts.[26] The target percentage and fuel standards could be raised over time as SAF options become more available. For example, the European Union has set SAF adoption goals with a minimum 2% target in 2025 ramping up to 6% by 2030 and 70% by 2050, with explicit exclusions for crop-based fuels and increasing percentage standards for synthetic fuels that utilize clean electricity as the primary energy source.[27]

- Existing Massachusetts, California and international policies and recommendations, and industry research and standards will inform the appropriate policies the Commonwealth should pursue related to approved feedstocks and a net greenhouse gas emissions reduction target. For example, some midwestern agricultural states follow U.S. EPA guidelines and set a minimum net greenhouse gas emissions reduction standard of 50% when compared to fossil-based jet fuel on a life cycle emissions basis. Massachusetts has historically exceeded minimum recommended guideline, for example by limiting eligible feedstocks to wastes such as used cooking oil and forestry residues.

- Feedstock options that may be advantageous for Massachusetts and the New England region include municipal waste, waste oils, wood wastes and residues, and synthetic fuel technologies that draw carbon directly from the atmosphere. A proposed state and regional planning study (see Recommendation 1 below) will provide guidance to inform policy related to feedstock options.

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[25] THE OFFICE OF CLIMATE INNOVATION AND RESILIENCE, *Recommendations of the Climate Chief*, p. 47 Recommendation 18, (October 25, 2023), https://www.mass.gov/doc/recommendations-of-the-climate-chief-october-25-2023 (last visited March 31, 2025).

[26] This corresponds to approximately 100,000 metric tons of carbon dioxide emissions or, using a recent U.S. EPA value of $190 per ton, $19 million dollars of potential avoided damage from climate impacts of the combustion of fossil jet fuel.

[27] EUROPEAN COMMISSION, *European Green Deal: new law agreed to cut aviation emissions by promoting sustainable aviation fuels*, press release, (April 15, 2023), https://ec.europa.eu/commission/presscorner/detail/en/ip_23_2389 (last visited May 12, 2025).

Recommendations

Based on research and discussions with various experts, the SAF Workgroup identified five recommendations that cover a range of actions to achieve successful implementation of SAF including: baseline logistics planning, stakeholder, and multi-state/regional engagement, leveraging existing resources and programs, and state policy and legislation.

By enacting these short-term and long-term recommendations, Massachusetts, in collaboration with industry, neighboring states, and other critical partners, can pursue opportunities to pilot technology and implement meaningful policies and actions. This approach aims to position Massachusetts as a leader in the early adoption of SAF, potentially reducing life cycle aviation emissions dramatically (e.g., to near zero by 2050). As discussed in this report, a key aspect of any implementation plan will be to establish policies that support sustainable aviation fuels that do not compromise food security or have adverse environmental outcomes.

Short-Term Recommendations

Recommendation 1.

> Undertake a regional planning study to better understand SAF production, transportation, delivery, storage, blending and usage, the current jet-fuel supply chain, potential for future blended SAF delivery, and regional feedstock opportunities.

A critical first step in the adoption of SAF and laying the groundwork for future infrastructure development is a baseline study of the current supply chain that delivers jet fuel to Massachusetts and the New England region, from production to delivery, storage, and usage. The study should also assess the supply chain for the delivery of SAF to the region in the short term as well as the regional production, handling, blending and delivery of SAF in the long term. The logistics and planning study should take a regional approach that includes all the New England states and New York.

Therefore, the SAF Workgroup recommends engaging with national experts as soon as possible. The SAF Workgroup identified the U.S. DOE - NREL as a potential partner. NREL has conducted similar studies around the country including a recent report for the Port Authority of New Yok and New Jersey (Figure 5). In addition, scientists at MIT are currently working on behalf of the FAA on sustainable aviation fuel and should be considered as advisors to the study.

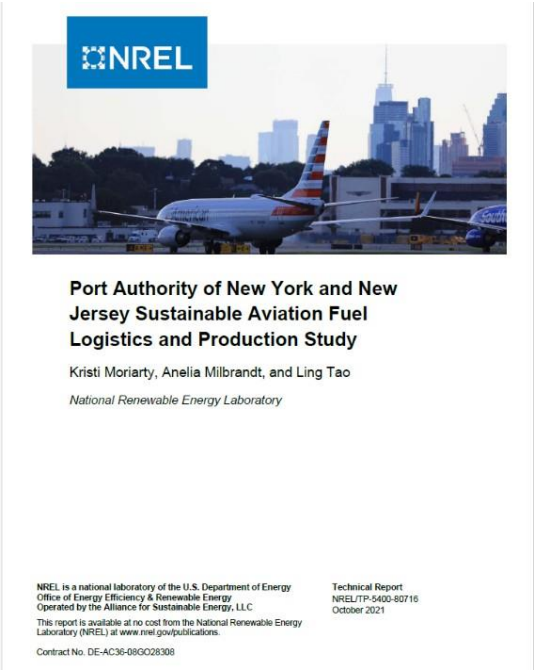

Image 2 – U.S. DOE NREL Study for Port Authority of New York and New Jersey

To complement Massport's efforts, MassCEC plans to undertake a sector mapping study of sectors with low-replacement rate infrastructure and complex decarbonization challenges, such as marine and aviation. The study is intended to identify key industry decision makers, levers for change, geographic distribution of infrastructure, and short-term vs. long-term implementation recommendations. In addition to SAF, the study will also explore electrification and hydrogen feasibility and recommendations for aviation.

Recommendation 2.

Create a Massachusetts and New England Region SAF Hub to include major employers, academic institutions, and key aviation industry groups including airports, airlines, and general aviation users to secure buy-in from key stakeholders, facilitate information sharing, and identify priority short- and long-term initiatives that build SAF momentum.

A best practice the SAF Workgroup identified is the creation of a SAF Hub, a partnership that includes a range of businesses and other stakeholders working with the state to: 1) advocate for and support the delivery of SAF at regional airports; 2) create state policies to support SAF production and use; 3) bring together innovators, producers, suppliers, and transportation companies to coordinate SAF logistics; 4) identify and take action on short-term initiatives that support the long-term commercialization of SAF; and 5) share reliable and reputable information across key public and private stakeholders.

This successful model is being used in Minnesota (the Minnesota SAF Hub) and includes major local employers across different industries, Delta Air Lines (Minneapolis-St. Paul is a Delta connecting hub airport), academia, and nonprofit organizations (Figure 8).

Source: Minneapolis Saint Paul Regional Economic Development Partnership

Figure 8
Minnesota SAF Hub

Massachusetts participates in successful national, regional, and state consortium models, particularly in the Offshore Wind sector, which can be emulated. MassCEC currently participates in and/or leads:

- *National Offshore Wind Research and Development Consortium* (NOWRDC) (Figure 9), convened by U.S. DOE and New York State Energy Research and Development Authority (NYSERDA) is a "nationally focused, not-for-profit organization collaborating with industry to accelerate the deployment of offshore wind energy in the U.S., address challenges and obstacles facing the offshore wind industry and

maximize economic and social benefits, and reduce the levelized cost of energy of offshore wind in the U.S." [28]

Figure 9

MassCEC Offshore Wind Partnership in Research and Innovation

- *Regional Wildlife Science Collaborative for Offshore Wind* (RWSC), sponsored by NYSERDA and led by federal and state government, offshore wind companies, and environmental non-government organizations. "RWSC collaboratively and effectively conducts and coordinates relevant, credible, and efficient regional monitoring and research of wildlife and marine ecosystems that supports the advancement of environmentally responsible and cost-efficient offshore wind power development activities in U.S. Atlantic waters." [29]
- *Massachusetts Fisheries Working Group on Offshore Wind Energy* and *Massachusetts Habitat Working Group on Offshore Wind Energy,* both convened and led by MassCEC. "While the working groups are voluntary and informal, each provide a critically important forum for maintaining a dialogue with key stakeholders, getting feedback and guidance, and identifying issues and concerns.

[28] National Offshore Wind Research and Development Consortium https://nationaloffshorewind.org/ (last visited April 30, 2025)

[29] Regional Wildlife Science Collaborative for Offshore Wind https://rwsc.org/rwse-is-now-rwsc/ (last visited April 30, 2025)

> Input from the working groups has directly resulted in accommodations to avoid important marine habitat, fishing grounds, and marine commerce routes in the designation of the wind energy lease areas."[30] [31]

While each consortium or working group has a different directive, goal, membership makeup, and funding mechanism, all include public and private stakeholder convening and public information sharing to advance industry goals cost effectively and sustainably. Best practices from the structure of each group can be used to inform the creation and direction of the regional SAF Hub.

Recommendation 3.

> Identify and market existing state programs and initiatives, and explore new opportunities for targeting greenhouse gas emissions reduction, climatetech, and economic development to support SAF-related production, innovative technology, and job creation. Additionally, explore federal programs that may be available to bolster SAF inclusion in the Commonwealth's climatetech ecosystem.

There are a range of federal programs that offer incentives for SAF production and usage including tax credits, grants, and loans. These programs were created to incentivize SAF usage, production, and investment in related infrastructure and innovative technologies. However, the uncertain federal environment places these potential sources of funding at risk. For this reason, the SAF Workgroup recommends that the Commonwealth focus its efforts on leveraging existing state initiatives that target climate-related investments, while monitoring potential federal opportunities. As shown in Figure 10, EOED identified approximately 25 programs administered by various state agencies that have the potential to support SAF based on an initial review. Ultimate eligibility determination depends on program-specific criteria.

EOED developed this set of programs based on existing resources available to climatetech, startups, manufacturing, and other ecosystem support organizations (e.g., hubs, accelerators, etc.). The analysis considers both the relevant uses of funds for SAF companies throughout their commercialization phases (e.g., R&D activities and facility construction), and the typical needs of growing businesses (e.g., workforce training and equipment). This list is tailored to scaling SAF businesses and includes manufacturing and selected sector-agnostic programs, rather than being limited to climatetech programs.

[30] Fisheries Working Group on Offshore Wind Energy https://www.mass.gov/info-details/fisheries-working-group-on-offshore-wind-energy (last visited April 30, 2025)

[31] Habitat Working Group on Offshore Wind Energy https://www.mass.gov/info-details/habitat-working-group-on-offshore-wind-energy (last visited April 30, 2025)

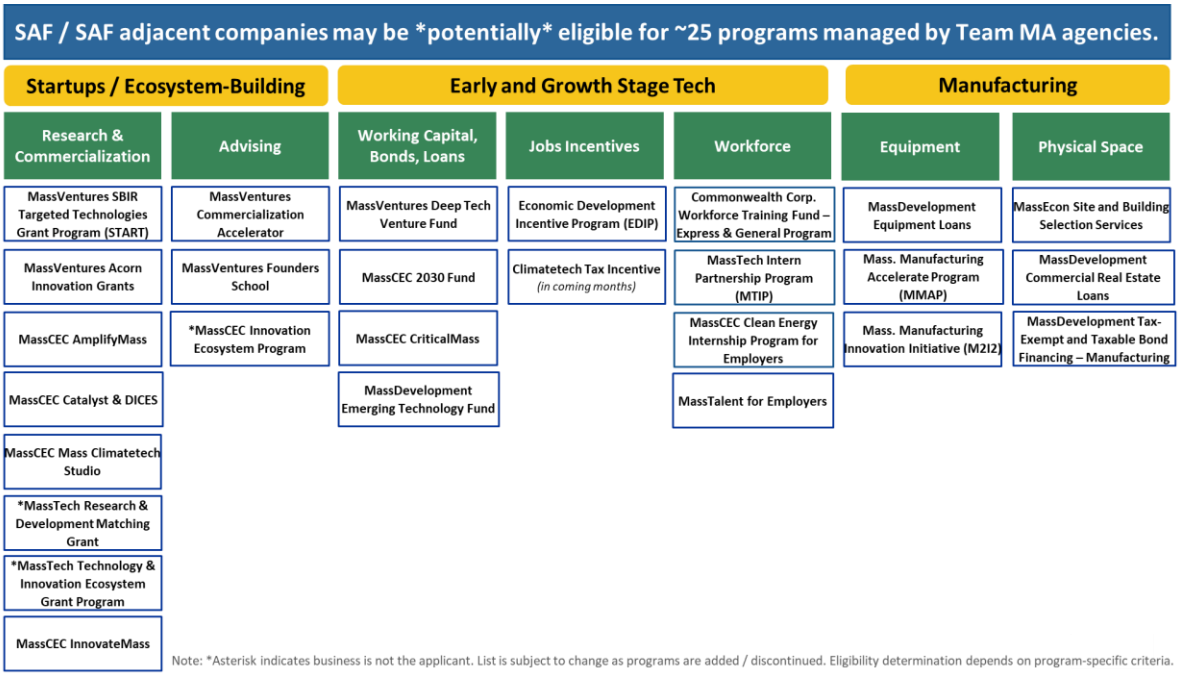

Figure 10

Potential SAF-Eligible Programs Administered by State Agencies

Illustrative examples of how SAF companies may utilize these programs include:

- **MassDevelopment Emerging Tech Fund** – This program provides loans to technology companies for expansion, working capital, or equipment purchases. This could help a growth-stage SAF technology business interested in setting up manufacturing operations in Massachusetts.
- **MassCEC Innovation Ecosystem Program** – This program provides grants to Massachusetts ecosystem support organizations (ESOs) for activities to grow a climate tech innovation ecosystem and commercialize early-stage technology. A SAF hub (see Recommendation 2) could apply for this program.
- **MassCEC Critical Mass Program** – This program provides grants to eligible climatetech startup companies undertaking deployment-scale projects to support the transition from development and demonstration of technical prototype solutions to sustainable commercial operations. A SAF manufacturer startup could apply for this program.

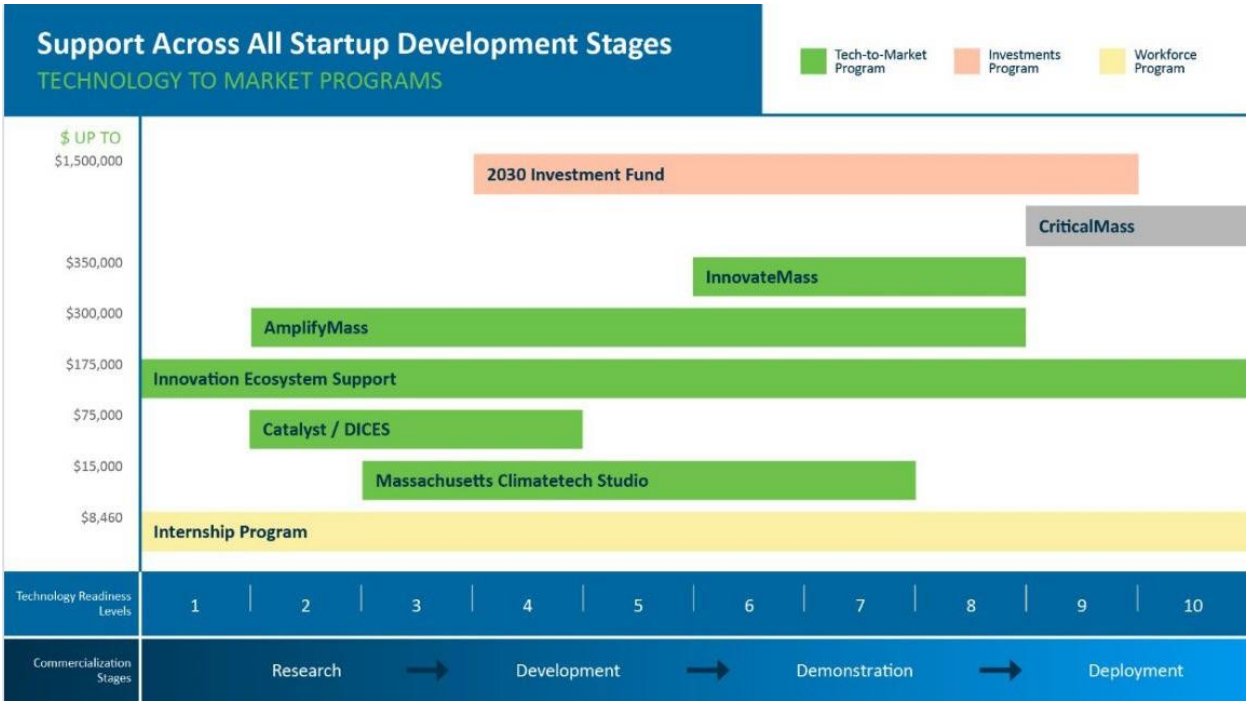

Figure 11
MassCEC Technology-to-Market Programs

In addition to these programs, MassCEC has a Climatetech Funding portfolio to support research, development, demonstration, and deployment of innovative technologies. As shown in Figure 12, MassCEC's 2030 Fund strategically invests in MA-based climate-focused startup businesses targeting clean transportation technology.

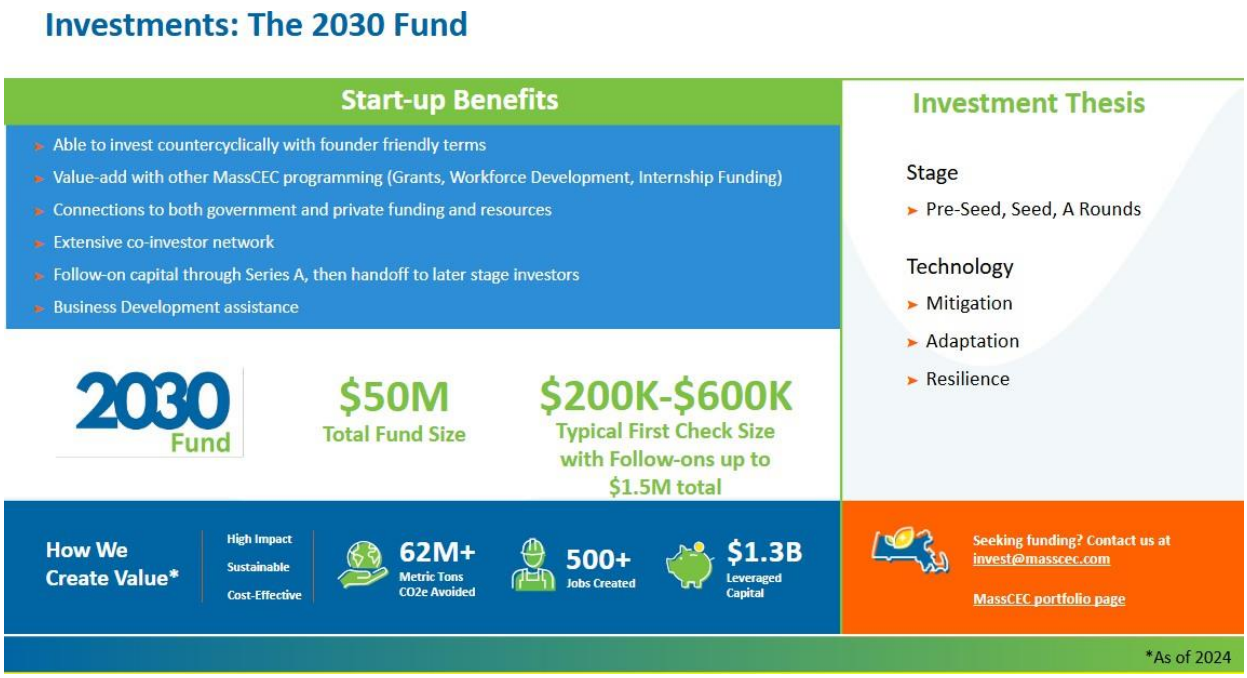

Figure 12
MassCEC 2030 Fund

There are also clean energy and climate workforce development programs that could be leveraged to support the workforce and infrastructure related to the SAF supply chain, including MassCEC's Clean Energy Internship Program for Employers, which facilitates the placement of college students and recent graduates into paid internships with verified clean energy companies across Massachusetts by providing stipends for interns. Any company working on SAF could apply for this program.

While the Commonwealth's current climatetech program ecosystem has available opportunities to support early-stage research, development, and demonstration of SAF production and technologies, there is a gap in programs and funding once companies move into the deployment stage. The SAF Workgroup recommends that once existing programs have been identified and marketed, the state should begin to explore potential program structures and funding sources to develop new programming aimed at supporting companies through deployment and commercialization. This will ensure that production and technology growth do not stall and that programs are available to encourage companies to continue deployment in Massachusetts.

Long-Term Recommendations

Recommendation 4.

Enact legislation to fund a tax credit for SAF usage, blending, storage, and production infrastructure, as well as new SAF technology testing, adoption, and scale-up to address cost barriers to production and demand and enable market uptake of SAF.

Like all new technology, the production of SAF results in a premium price when compared to conventional jet fuel. The price of SAF per gallon can be up to two times or more than the price of conventional jet fuel. As a result, subsidies to help pay for this "green premium" are critical in the short to medium term to support the scale-up of SAF production and delivery. Such subsidies can also be justified on an economic basis because they help avoid the economic costs of climate change, such as adapting airports to sea level rise or reducing impacts to airline operations from increased severe weather events. There are federal incentives in place that support the production, blending and related infrastructure as well as grants that target innovative technology.[32] [33]

Also, the Commonwealth has policies and programs in place that could help to incentivize and pay for SAF infrastructure development (see Recommendation 3).

Today, SAF use is concentrated in states that have adopted tax credits and incentives. Incentives range from broader, regulatory measures (e.g., a low carbon fuel standard for the transportation sector) to targeted tax credits (Figure 13).

[32] INTERNAL REVENUE SERVICE, *Sustainable Aviation Fuel Credit*, (September 30, 2024), https://www.irs.gov/credits-deductions/businesses/sustainable-aviation-fuel-credit (last visited March 28, 2025).

[33] U.S. DEPARTMENT OF ENERGY, U.S. DEPARTMENT OF TRANSPORTATION, U.S. DEPARTMENT OF AGRICULTURE, AND U.S. ENVIRONMENTAL PROTECTION AGENCY, *SAF Grand Challenge Roadmap Flight Plan for Sustainable Aviation Fuel*, (September 2022), https://www.energy.gov/sites/default/files/2022-09/beto-saf-gc-roadmap-report-sept-2022.pdf (last visited March 31, 2025).

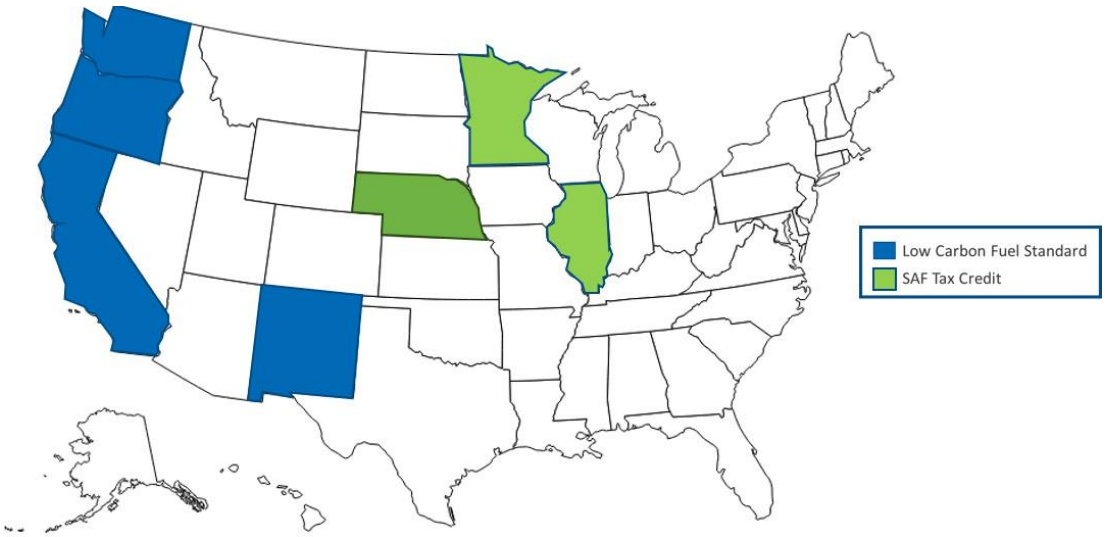

Figure 13

Example of States That Have Implemented Measures to Support SAF Production and Use

Adopting a targeted SAF tax credit will expedite implementation. The tax credit can also be phased in or out, limited to specific policy goals (e.g., to increase the use of SAF within Massachusetts or establish clear eligibility criteria on GHG reduction), and constructed to complement other state grant programs that may be better suited for manufacturing or other infrastructure and technology testing and adoption.

Four state tax credit schemes were reviewed for informational purposes. Three are currently in place in Illinois, Minnesota and Nebraska, and the Michigan tax credit is pending.

- Illinois, Minnesota, Nebraska, and Michigan tax credits are funded through a tax on jet fuel.
- Credits provided for neat SAF range from $0.75 to $1.50 per gallon.
- Michigan, Minnesota and Nebraska have an annual cap on the credit: (1) Michigan's cap is $4.5 million in 2025-26 and increases to $9 million in future fiscal years; (2) Minnesota has a current cap of $7 million which will increase to $10 million in FY2027, and $2.1 million in future years; and (3) Nebraska's cap is $0.5 million per fiscal year. Illinois does not appear to have a limit other than the credit is applied to the tax liability on fuel.
- Illinois, Minnesota, and Nebraska have sunset provisions- ranging from 2033 to 2035. The Michigan proposal requires domestic sources of feedstock by 2030 and, as drafted, does not have a sunset provision.

In Massachusetts, the jet fuel tax is a local option.[34] One strategy is to explore a tax credit at the municipal level. Another strategy is to use existing state funds designated for addressing climate change. Since the goal is to support initial start-up and transition, like other states, the amount and timeframe of the credit can be phased out overtime.

Recommendation 5.
Convene a Regional SAF alliance, inclusive of the six New England states and New York, which will work to align SAF policies and programs at a regional level and build the scale needed to develop a SAF industry and expand feedstock sources.

Image 3 - New England Governors & Eastern Canadian Premiers, 9/10/2024

An important consideration when thinking about developing a SAF industry is scale on the demand side, to increase the potential volume of neat SAF that would be purchased and blended, as well as scale on the supply side to provide enough regional feedstock sources to make it economically feasible to construct local refineries and ancillary infrastructure. States that have implemented policies to stimulate SAF use and production like Illinois, Minnesota and California are geographically large and include a variety of potential options for SAF feedstock.

Massachusetts is already successfully collaborating with New England states (and Canadian provinces) on energy and clean energy transition through the New England Governors and Eastern Canadian Premiers (NEG-ECP) Conference. We recommend building-on this model

[34] MASSACHUSETTS DEPARTMENT OF REVENUE, Administrative Procedure AP 113:Jet Fuel Tax https://www.mass.gov/administrative-procedure/ap-113-jet-fuel-tax (last visited March 28, 2025).

to include SAF.[35] One approach is to use the SAF Hub (see Recommendation 4) to identify and recommend specific policies at the multi-state level that would support the scale-up of SAF in terms of both demand and supply. For example, aligning tax policies to ensure a consistent credit scheme across participating states, or establishing common SAF standards so that the entire region benefits from a unified, acceptable SAF fuel base.

[35] OFFICE OF THE GOVERNOR, *Governor Healey to Host New England Governors and Eastern Canadian Premiers (NEG-ECP) Conference*, news release, (August 14, 2024), https://www.mass.gov/news/governor-healey-to-host-new-england-governors-and-eastern-canadian-premiers-neg-ecp-conference (last visited March 31, 2025).

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