

Frontiers in Energy Research Special Topic: Sustainable Aviation Fuels

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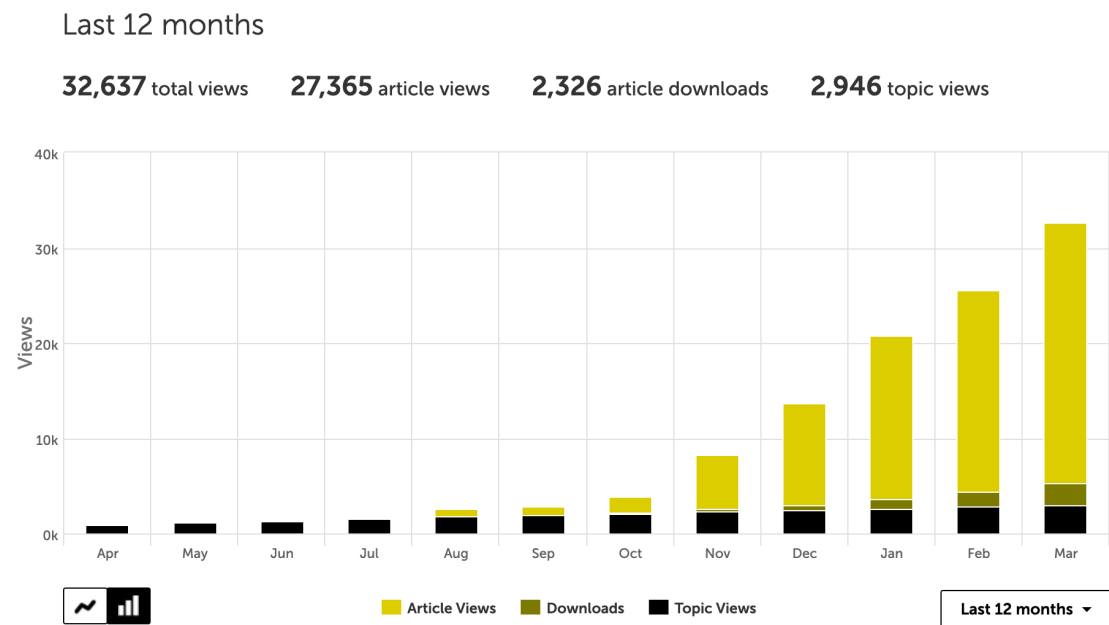
ASCENT Semi-annual Meeting April 2022

Motivation

- To explore the state of knowledge on SAF development, performance, and deployment to inform researchers, industry, and policy makers.
- To provide open access resources with a comprehensive overview of critical SAF topics.

Current Status

- Submissions completed in December 2021.
- 23 papers published thus far; 1 remaining in review.
 - 15 included ASCENT Project 001 or NJFCP authors
 - 3 included FAA and/or CAAFI authors
- Contributions made by 102 authors.
- Already ranked in the upper 85th percentile of research topics.



Paper Highlights – Fuel Qualification

- ASTM approval is a key requirement for new SAF to enter the marketplace. These papers provide an overview of the current process for qualifying new synthesized jet fuel blendstocks under ASTM and discuss the challenges of qualifying 100% synthesized fuels and the proposed direction for near term qualification under ASTM.
- **Rumizen** - [Qualification of Alternative Jet Fuels](#) - 10.3389/fenrg.2021.760713
- **Kramer et al.** [Perspectives on Fully Synthesized Sustainable Aviation Fuels: Direction and Opportunities](#) - 10.3389/fenrg.2021.782823

Paper Highlights – Policy & Policy Impacts

- Policy choices are a critical enabler of SAF development and deployment. These papers summarize current policy and policy options and their impacts on SAF deployment and selling price.
1. **Brandt et al.** Cumulative Impact of Federal and State Policy on Minimum Selling Price of Sustainable Aviation Fuel - 10.3389/fenrg.2022.828789
 2. **Korkut and Fowler** - Regulatory and Policy Analysis of Production, Development and Use of Sustainable Aviation Fuels in the United States - 10.3389/fenrg.2021.750514
 3. **Wang et al.** Quantitative Policy Analysis for Sustainable Aviation Fuel Production Technologies - 10.3389/fenrg.2021.751722
 4. **Taheripour et al.** Economic Impacts of the U.S. Renewable Fuel Standard: An Ex-Post Evaluation - 10.3389/fenrg.2022.749738

Paper Highlights – Feedstocks

- Feedstock availability can limit SAF potential. These papers address cover crops, feedstock processing and resulting characteristics of raw material and fuel, and technoeconomics.
1. **Bach et al.** - Construction and Demolition Waste-Derived Feedstock: Fuel Characterization of a Potential Resource for Sustainable Aviation Fuels Production - 10.3389/fenrg. 2021.711808
 2. Field et al. Modeling yield, biogenic emissions, and carbon sequestration in southeastern cropping systems with winter carinata - 10.3389/fenrg.2022.837883
 3. **Taheripour et al.** Oilseed Cover Crops for Sustainable Aviation Fuels Production and Reduction in Greenhouse Gas Emissions Through Land Use Savings - 10.3389/fenrg. 2021.790421
 4. **Trejo-Pech et al.** Biofuel Discount Rates and Stochastic Techno-Economic Analysis for a Prospective Pennycress (*Thlaspi arvense* L.) Sustainable Aviation Fuel Supply Chain - 10.3389/fenrg. 2021.770479
 5. **Tumuluru et al.** Pilot-Scale Pelleting Tests on High-Moisture Pine, Switchgrass, and Their Blends: Impact on Pellet Physical Properties, Chemical Composition, and Heating Values - 10.3389/fenrg. 2021.788284

Paper Highlights – Fuels Chemistry and Production

- Additional research is being performed to better understand both the potential for conversion pathway optimization and the chemical characteristics of the products of various pathways. These papers address chemical processes, refinement, and data sharing.

1. [Blakey et al. Advanced Fuel Property Data Platform: Overview and Potential Applications](#) - 10.3389/fenrg.2022.830236
2. [Boehm et al. Comparing Alternative Jet Fuel Dependencies Between Combustors of Different Size and Mixing Approaches](#) - 10.3389/fenrg.2021.701901
3. Landera et al. [Building Structure-Property Relationships of Cycloalkanes in Support of Their Use in Sustainable Aviation Fuels](#) - 10.3389/fenrg.2021.771697
4. Mehl et al. [Understanding the Compositional Effects of SAFs on Combustion Intermediates](#) - 10.3389/fenrg.2022.830236
5. Moore et al. [Determining the Adsorption Energetics of 2,3-Butanediol on RuO₂\(110\): Coupling First-Principles Calculations With Global Optimizers](#) - 10.3389/fenrg.2021.781001
6. [Tanzil et al. - Production of Sustainable Aviation Fuels in Petroleum Refineries: Evaluation of New Bio-Refinery Concepts](#) - 10.3389/fenrg.2021.735661

Paper Highlights – Social Sciences

- Social or cultural capitals are another type of criteria that should be considered when identifying the potential suitability of biorefinery candidate locations. These papers address social science considerations for SAF supply chains.

1. **Anderson et al.** - Social Science Applications in Sustainable Aviation Biofuels Research: Opportunities, Challenges, and Advancements - 10.3389/fenrg. 2021.771849
 - Provides
2. **Boglioli et al.** - Searching for Culture in “Cultural Capital”: The Case for a Mixed Methods Approach to Production Facility Siting - 10.3389/fenrg. 2021.772316
 - Provides...

Paper Highlights – Overall SAF Potential

- With the SAF Grand Challenge and other global targets, the scale of SAF deployment will be very large. These papers address opportunities and challenges for massive SAF deployment.

1. Jain et al.- Estimating the Reduction in Future Fleet-Level CO2 Emissions From Sustainable Aviation Fuel - 10.3389/fenrg.2021.771705
2. Male et al. The U.S. Energy System and the Production of Sustainable Aviation Fuel From Clean Electricity - 10.3389/fenrg. 2021.765360

Paper Highlights – Supply Chain Analyses

- A key area of ASCENT I focus has been on the development of regional supply chains. These papers address potential opportunities for supply chain development.

1. **English et al.** The Economic Impacts of a Renewable Biofuels/Energy Industry Supply Chain using the Renewable Energy Economic Analysis Layers (REEAL) Modeling System - 10.3389/fenrg. 2022.780795
2. **Sharma et al.** Economic Analysis of Developing a Sustainable Aviation Fuel Supply Chain Incorporating With Carbon Credits: A Case Study of the Memphis International Airport - 10.3389/fenrg. 2021.775389

Conclusion

- First output of the SAF Interagency Working Group in conjunction with ASCENT.
- Already showing its value as a popular and impactful research topic.
- Large number of ASCENT and CAAFI articles demonstrates the impact of our work on this space.
- Open-source nature of this work will facilitate wide distribution.
- High potential to be selected by the journal for compiling into an e-book.