Empowering Policy and Progress: How Boeing's Cascade Tool Maps Paths to Aviation's Future

By Boeing

Ensuring responsible growth for aviation, which reduces the impact on our planet, requires a multi-faceted approach — combining the right technologies, operational improvements and energy solutions with policy frameworks, investment and collaboration. It also requires robust, systems-level planning and better tools to plan, measure and manage impact.

In response to aviation's complex challenge to decarbonize, Boeing developed the Cascade Climate Impact Model[1]: A data modeling and visualization tool designed to help decision-makers, and the entire aviation ecosystem explore and compare the most effective strategies for reducing aviation's carbon emissions. Cascade can be used to guide critical decisions towards ICAO's and civil aviation's shared aspiration of net zero emissions by 2050.

Cascade[1] is a publicly available, interactive tool that leverages published flight traffic and energy data to assess aviation's future out to 2050 through assumptions related to five key areas of action: Traffic, Aircraft, Operations, Energy and Carbon Offsets & Removals. The tool helps users understand not just where emissions come from, but how the actions in each of these strategies can help reduce them over time.

Boeing publicly launched Cascade in 2023 and has been evolving[2] the tool together with governments, airlines, academia and industry partners.

Upgrade to 2.0: A Strategic Tool for Decision Making

In early 2025, Boeing unveiled[3] a new version of Cascade – Cascade 2.0, which has evolved the tool into an even more powerful platform capable of offering a more personalized and actionable approach to evaluating aviation's emissions.

Cascade offers real-time modeling for real-world impact – serving as a bridge between complex climate data and actionable insights. It provides users, including states and decision makers, with robust data and modeling to help put facts and evidence front and center in their policy conversations and decisions – whether to operationalize the Long-Term Aspirational Goal (LTAG), shape national commitments, or develop regional partnerships.

There is no one-size-fits-all approach to reducing aviation's emissions and Cascade's new functionalities reflect just that:

- **Enhanced customization for tailored planning:** Acknowledging diverse conditions across the globe, Cascade allows users to analyze the unique conditions

1 https://cascade.boeing.com/
2 https://cascade.boeing.com/perspectives/what-have-we-learned-so-far/
3 https://cascade.boeing.com/perspectives/introducing-cascade/

that apply to specific countries and regions and assess different policy scenarios to understand their potential impact on emissions towards 2050. Users can tailor their analyses by region or aircraft type.

- **Comprehensive analysis with actionable insights:** Enhanced aircraft[4] and energy[5] strategies as well as a selection of new charts provides further insights that enable assessing the impact of technological, investment, and policy decisions over time on a regional scale. Technical Documentation[5] includes information on models, datasets and key assumptions for a deeper understanding of the modeling logic behind the tool.
- **Ease of use driving collaboration and progress:** Through personalized dashboards, Cascade allows users to create, save and share scenarios with their stakeholders, as well as export data when needed – further enhancing collaboration across sectors to advance a responsible and resilient aviation system.

The Perspectives[6] page on Cascade website serves as a supportive platform to the app – offering valuable industry insights and articles on aviation's future.

Enhancing Regional Energy Production

Cascade's ability to simulate emissions pathways under varying conditions makes it a valuable tool especially for governments as they develop long-term climate strategies and monitor progress against ambitions, and advance energy transition and economic prosperity.

For example, Boeing is partnering with ICAO Member State delegations across the Middle East to bring Cascade to their State Action Plan workshops, where delegates use the tool to explore their national baseline scenarios, evaluate mitigation options available and model expected outcomes aligned with their ambitions.

Through the latest updates to functionalities, the user has granular control over data through modifying the decarbonization strategies by specific parameters such as Sustainable Aviation Fuel (SAF) feedstock types, electric aircraft introductions, and renewable energy availability. Cascade allows users to modify different energy carriers for aviation such as SAF, hydrogen, and electricity, explore the benefits and tradeoffs of each for a particular region or nation, and assess different scenarios to determine the production levels required towards 2050. Then, users can evaluate progress and see where more action is needed to further strengthen energy resilience.

Cascade empowers aviation stakeholders — from governments to airlines, to energy players — to test "what if" scenarios. For example, in the scenario shown here[7], by 2050:

- Two thirds of the total energy used by aircraft globally will come from SAF.
- 110 billion gallons (416 billion liters) of SAF will be required.
- 2.77 trillion kWh (2,770 TWh) of renewable electricity will be required to produce the necessary amount of e-fuels. This is equal to 33% of the total renewable energy that was produced globally in 2023.

Looking Ahead

Boeing continues to develop Cascade adding new capabilities and features in incremental steps, reflecting the latest climate conversations, technology developments, and policy updates.

There is no single solution for achieving aviation climate goals, and no one organization can do it alone. Cascade supports governments, airlines and the aviation industry in navigating tailored, integrated strategies, prioritizing impactful actions and crafting data-driven pathways for a resilient and responsible aviation future, together.

4 https://cascade.boeing.com/perspectives/introduction-to-aircraft-strategy/
5 https://docs.cascade.boeing.com/
6 https://cascade.boeing.com/perspectives/
7 https://cascade.boeing.com/perspectives/introduction-to-energy-strategy/