IE Sustainability Datathon October 2025

IE–IATA Datathon 2025: SAF Uptake and Decarbonization Pathways

1. Introduction to the challenge

Aviation plays a vital role in connecting people, goods, and economies across the globe. However, it also represents one of the most challenging sectors to decarbonize, due to its dependence on high energy-density fuels and the long operational lifespan of aircraft.

The European Union has committed to ambitious climate objectives under the European Green Deal and the Fit for 55 package, which aim to reduce net greenhouse gas emissions by at least 55% by 2030 and achieve climate neutrality by 2050. Within this framework, specific initiatives such as ReFuelEU Aviation and the inclusion of aviation in the EU Emissions Trading System (ETS) establish clear policy milestones for reducing emissions in air transport.

Sustainable Aviation Fuels (SAF) are at the core of this transition. SAF refers to non-conventional aviation fuels derived from renewable or waste-based sources that can significantly reduce life-cycle CO_2 emissions compared to fossil jet fuel. According to IATA, SAF is expected to deliver the largest share of CO_2 reductions needed by aviation to meet net-zero targets by 2050.

The ReFuelEU Aviation Regulation, adopted in 2023, sets minimum blending mandates for SAF across the EU: 2% by 2025, 6% by 2030, 20% by 2035, and up to 70% by 2050, alongside sub-targets for synthetic e-fuels. These targets aim to provide a predictable market signal for producers and investors, while enhancing the competitiveness and resilience of European air transport.

This datathon challenges participants to use publicly available datasets to explore how the aviation sector can realistically achieve these SAF uptake targets. Teams are invited to model plausible SAF adoption scenarios for European aviation (EU27) from 2025 to 2050, quantifying their potential impacts on CO_2 emissions, total fuel demand, and associated costs. Analyses may incorporate elements such as traffic growth, technological improvements in aircraft efficiency, fuel price differentials, and policy incentives. Participants may also assess trade-offs between different policy pathways—balancing environmental ambition, economic feasibility, and energy security.

Yet, this is not a conventional datathon. It is not only about programming or coding models; it is about research, strategy, and innovation. Participants are expected to think critically, combine data-driven evidence with policy insight, and apply both human intelligence and artificial intelligence to tackle one of the most complex real-world challenges of our time.

The ability to ask the right questions, identify appropriate data sources, justify assumptions, and communicate actionable insights will be as valuable as any line of code.

The work may combine quantitative modelling, policy analysis, or strategic recommendations, encouraging interdisciplinary collaboration between data scientists, economists, and sustainability experts. By building evidence-based projections, participants will contribute to a deeper understanding of how data-driven insights can inform aviation's route toward net-zero emissions and inspire the next generation of sustainable innovation.

2. Scope of Analysis

The analysis should focus on the European Union as a whole (EU27), aligning with the geographical scope of the ReFuelEU Aviation Regulation. Teams should model fuel consumption, SAF blending, and emission reductions for flights departing from airports located within the EU27, aggregated at the European level.

National-level disaggregation (e.g., France, Germany, Spain) is optional but not required. However, teams are encouraged to apply creativity and analytical depth in how they structure their models and datasets, provided that the final results deliver a coherent EU27 picture. Different approaches—ranging from country-level modelling to regional clustering or policy scenario segmentation—are welcome, as long as they remain methodologically transparent and lead to comparable aggregate outcomes.

The United Kingdom and Switzerland fall outside the regulatory scope and should not be included.

3. Datathon objectives

You're not just asked to code, you're asked to think like a researcher, analyze like a data scientist, and propose like a strategist.

Teams are encouraged to make any reasonable assumptions necessary to complete the challenge, as long as these are **clearly documented** both in the **code** and in the **written report**, including the **rationale** and any **limitations**. Transparency, consistency, and sound reasoning will be valued as much as technical precision.

The winning teams will combine **solid quantitative evidence**, **policy awareness**, and a **visionary perspective** on how Europe's aviation sector can decarbonize responsibly and effectively — demonstrating that true innovation arises from the intersection of data, insight, and imagination.

1. Objective 1: Quantify the impact of SAF adoption on aviation emissions

Use data to estimate how **Sustainable Aviation Fuels (SAF)** could help reduce CO_2 emissions in the European aviation sector between 2025 and 2050.

Teams will model different **SAF uptake scenarios** (e.g., Business as Usual and Baseline) and calculate their effect on:

- Total fuel demand (Jet + SAF) (Mt)
- SAF blending share (%)
- CO_2 emissions generated and avoided (Mt)

Description of the Objective 1:

The first goal of this challenge is to quantify how the progressive adoption of SAF can contribute to reducing CO_2 emissions in the European aviation sector between 2025 and 2050. Participants should use publicly available data to build simple but consistent models that estimate the evolution of fuel consumption and emissions under different SAF uptake scenarios. To establish a consistent starting point, teams should reference total EU27 aviation fuel demand for 2024/2025. A figure of ~38–39 million metric tonnes (Mt) of fuel is a recommended baseline for total annual demand (EASA/ReFuelEU Aviation technical reports).

Teams should define and compare **two possible trajectories:**

- **Market-Driven BAU Pathway (without Mandates) (S0):** SAF blending evolves without the minimum mandates established by the ReFuelEU Aviation Regulation.
- **Policy-Accelerated Pathway (High Ambition) (S1):** SAF blending follows the minimum mandates established by the *ReFuelEU Aviation Regulation* (2 % in 2025, 6 % in 2030, 20 % in 2035, 70 % in 2050).

Description of the two Scenarios:

The following two scenarios outline contrasting pathways for SAF adoption in the EU aviation sector. The **Market-Driven BAU Pathway (without Mandates) (S0)** scenario represents a market-driven evolution without regulatory enforcement, while the **Policy-Accelerated Pathway (High Ambition) (S1)** scenario reflects a proactive, high-ambition trajectory supported by stronger policies, technological progress, and coordinated market action.

- **Market-Driven BAU Pathway (without Mandates) (S0):**

This scenario represents the Business-as-Usual (BAU) pathway, in which the aviation sector continues its current trajectory without the enforcement of the minimum SAF blending mandates established by the ReFuelEU Aviation Regulation.
In this case, the adoption of Sustainable Aviation Fuels (SAF) evolves naturally, driven by voluntary market initiatives, limited national incentives, and early-stage investments in production capacity, but without a coordinated EU-level regulatory push.
The scenario provides a reference point against which the effects of policy-driven or accelerated deployment pathways can be compared in terms of fuel demand, emissions reductions, and economic implications. It reflects the pace of SAF adoption that could be expected in the absence of mandatory blending requirements or significant additional policy measures.

- **Policy-Accelerated Pathway (High Ambition) (S1)**

This scenario assumes a faster deployment of SAF than the regulatory baseline, driven by stronger policy support, technological innovation, and coordinated market action across the aviation ecosystem.
The SAF blending trajectory follows the minimum mandates of the ReFuelEU Aviation Regulation until 2025, and then exceeds them progressively from 2030 onwards by approximately 5–10 percentage points, reflecting accelerated investment and scaling-up of SAF production capacity.
Indicatively, the SAF share could reach around 2% in 2025, 10–12% by 2030, 30% by 2035, and 70% by 2050 (ReFuelEU Aviation; EUR-Lex) These figures remain within the plausible range identified by IATA (2023) and EASA (2024) for a high-ambition policy scenario, consistent with Europe's net-zero aviation objectives.
This pathway represents a proactive transition scenario, in which governments, airlines, and fuel producers work in alignment to close the cost gap between SAF and fossil jet fuel, stimulate technological learning, and accelerate the decarbonization of European aviation while fostering industrial competitiveness and innovation.

For each scenario, teams should calculate and report the following four metrics for each year (from 2025 to 2050):

1. **Total fuel demand (Mt)** (Jet A-1 + SAF) for each year between 2025 and 2050, considering plausible traffic growth in the EU (27) aviation sector.

2. **SAF blending share (%)** in the total fuel mix for each year.

3. **CO_2 emissions (Mt)** generated under each scenario, for each year.

4. **CO_2 emissions avoided (Mt)** compared with a fossil-only baseline (no SAF adoption), for each year.

To complete these calculations, participants must make reasonable assumptions for certain key metrics, including the annual growth rate of aviation fuel demand, the emission factor for conventional jet fuel, and the relative emission reduction of SAF, among others.

These assumptions must be clearly documented and justified in both the code and the final written report, including the rationale behind each assumption, to ensure transparency and comparability across all scenarios and teams.

To ensure consistency, teams should assume an average SAF life-cycle CO_2 emissions reduction value. A reference value—such as 70% or 80% reduction compared to fossil jet fuel—is suggested. This figure must be clearly documented, justified, and properly cited (e.g., from IATA or EASA) in the final report.

Teams are free to refine parameters or include additional variables (e.g., aircraft efficiency, carbon pricing, or synthetic-fuel sub-targets), provided that the results remain transparent and comparable.

⚠️ **Important: Teams that fail to clearly document and justify all assumptions made in the model, or that submit a final output that deviates from the specified table format and structure, will be disqualified from the final evaluation.**

Expected output:

The expected output is a concise dataset showing the four key metrics aggregated at the EU27 level for the two scenarios, for each year from 2025 to 2050.

Illustrative structure of the dataset. Values are placeholders; participants must calculate the evolution of each variable annually for each scenario (2025–2050):

Year	Scenario	Total fuel (Mt)	SAF share (%)	CO_2 emissions (Mt)	Avoided CO_2 (Mt)
2025	0	39.0	1.0	150.2	0.0
2025	1	39.0	2.0	150.2	0.0
2026	0	39.4	1.0	121.5	3.0
2026	1	39.4	3.0	120.5	4.0
...	...	...	...	...	...

Note: Figures are illustrative and expressed in million tonnes (Mt).

2. Objective 2: Evaluate the economic and policy implications of SAF deployment

Assess the **costs, trade-offs, and feasibility** of the transition toward Sustainable Aviation Fuels (SAF) under the **EU regulatory framework** (e.g., *ReFuelEU Aviation Regulation*, *EU ETS*).
Teams are invited to complement their quantitative modelling with an **economic and policy analysis** that connects data-driven results with real-world decision-making.

Participants may explore questions such as:

- How do fuel costs evolve under different SAF uptake scenarios? **Current mandates, which offer no subsidies, may have distorted SAF price markets. How does this affect future SAF scenarios and fuel price costs for the industry going forward?**

- What policy mechanisms (mandates, incentives, carbon pricing) could accelerate adoption?

- What are the main barriers or risks (feedstock availability, infrastructure, competition) affecting the feasibility of the transition?

Teams are encouraged to be as creative as possible in showcasing the potential of their models and estimations, enriching their Executive Summary with valuable insights that differentiate their proposal from other teams.

Description of the Objective 2:

The second goal of this challenge is to evaluate how the two SAF scenarios (S0 – Market Driven BAU, S1 – Policy-Accelerated Pathway) translate into economic and policy implications for the European aviation sector.

This analysis must be directly grounded in the results generated under Objective 1. Teams are expected to use the outputs of their quantitative model, such as total fuel demand, SAF shares, and CO_2 emissions and reductions, as the foundation for assessing how different SAF trajectories would influence the sector's economic landscape and regulatory needs.

Participants should use these results to estimate how fuel expenditure, marginal abatement costs, and financial impacts may vary across scenarios. To complete this task, each team must define its own economic assumptions, such as indicative fuel prices, SAF cost differentials, or expected carbon prices. While publicly available studies (e.g., IATA, EASA, European Commission) can serve as useful references, the specific values adopted must be clearly explained, justified, and supported by credible sources in the final report.

Beyond the numerical assessment, teams should interpret the broader economic and policy consequences of their findings. This includes discussing how the evolution of SAF uptake could affect airline operating costs, ticket prices, or investment requirements in production and distribution infrastructure, as well as analyzing the potential trade-offs between environmental ambition, economic feasibility, and energy security.

Finally, participants are encouraged to reflect on the policy environment required to make these trajectories viable. Their discussion may consider the role of EU instruments such as blending mandates, e-fuel sub-targets, and carbon pricing mechanisms under the ETS, as well as potential incentives to bridge the cost gap between SAF and fossil jet fuel. Key barriers and risks—including feedstock availability, technological readiness, or regulatory uncertainty—should also be examined in light of their quantitative results.

Ultimately, this objective seeks to integrate data-driven evidence from Objective 1 with economic reasoning and policy insight, enabling teams to propose coherent, realistic, and actionable pathways for SAF deployment in Europe.

⚠️ Important: Teams that fail to clearly document and justify their assumptions will not be eligible for final evaluation.

Expected output:

Teams must present their findings through an Executive Summary. The Executive Summary (3–5 pages) should provide a comprehensive synthesis of the team's work across both objectives. It must clearly explain how the economic and policy analysis (Objective 2) builds upon, interprets, and extends the quantitative results developed in Objective 1.

The document should integrate the key findings from the modelling exercise with the team's assumptions, reasoning, and policy insights—demonstrating how data-driven evidence can inform strategic and regulatory decisions for SAF deployment in Europe. All parameters, data sources, and assumptions must be explicitly documented, justified, and properly cited to ensure transparency and comparability across teams.

3. Objective 3: Communicate a clear, evidence-based vision for sustainable aviation

Translate your findings into an insightful, evidence-based narrative that can inform decision-makers and stakeholders about how data and innovation can guide the aviation sector toward net-zero emissions.
This objective focuses on the communication and synthesis of all previous work — bringing together the quantitative modelling (Objective 1) and the economic and policy analysis (Objective 2) into a single, coherent story.

Description of the Objective 3:

The third goal of this challenge is to transform the results and insights developed throughout Objectives 1 and 2 into a concise, impactful, and professional presentation. Teams should demonstrate their ability to connect technical analysis with strategic thinking, showing not only what their models reveal, but also what those results mean for the future of aviation in Europe.
The presentation should integrate the data-driven evidence from Objective 1 with the economic reasoning and policy perspective from Objective 2. It should highlight the most relevant findings regarding SAF deployment pathways, emission reductions, cost implications, and policy trade-offs, while translating these into actionable insights for industry and policymakers.
In doing so, teams are encouraged to balance analytical rigor with clarity and persuasion, framing their conclusions in a way that bridges the gap between data analysis and strategic decision-making. The best presentations will not only summarize results but will also communicate a vision for sustainable aviation grounded in both evidence and feasibility.

Expected output:

Teams must deliver a Final Presentation that synthesizes their full work across Objectives 1 and 2, combining a technical and analytical perspective with a strategic business outlook. The presentation should clearly articulate how quantitative modelling, economic assessment, and policy analysis converge to inform a realistic pathway toward aviation decarbonization.
The presentation will be delivered by the finalist teams during the closing event and should last a maximum of 5 minutes. It must be clear, visually coherent, and well-structured around the main takeaways, emphasizing both the analytical robustness and the practical implications of the team's findings for policy design and industry strategy in the context of sustainable aviation.

⚠️ **Important:** All teams must submit their Final Presentation to be eligible for evaluation. Teams that fail to do so will not be considered for the final assessment.

4. Key references:

- European Commission – ReFuelEU Aviation Regulation
- European Commission – Reducing emissions from aviation
- Council of the EU – Fit for 55: ReFuelEU and FuelEU Infographic
- https://ansperformance.eu/data/#cosub2sub-emissions-smallsmall-small-emitters-toolhttpswwweurocontrolinttoolsmall-emitters-toolsmallsmall
  - https://ansperformance.eu/csv/#aptflt-csv (for CO2 emissions by country, per month)

Other useful references:

- IATA – Fly Net Zero: Aviation's Commitment to Net-Zero Carbon by 2050
- IATA – Net Zero Roadmaps and Policy Frameworks
- Eurostat – Energy Balances: Aviation Fuel Final Consumption
- EASA - ReFuelEU Aviation Annual Technical Report
- EUROCONTROL Avtation Long-term Outlook
- https://flying-green.eurocontrol.int/#/net-zero

Additional data sources and references: You may use any publicly available data source that helps you address this challenge. Please ensure that all additional data sources are properly cited and included in the references section of your final report.

5. The submissions: Content to be delivered

In this section, the contents of the technical deliverables that students must complete to participate in this challenge are described. All deliverables must be **submitted via the *Final Submission Form*, clearly indicating the team name.**

⚠️ **Important**: Any violation of the delivery criteria will result in the disqualification of the team.

- **Deliverable 1: Code files**:

The code developed to address the problem should be properly commented and clearly presented, using **Google Colab**, alternating between code and explanatory text. The outputs of the execution must be fully visible, **including a printout of the structure and format of the resulting output file — otherwise, the team may be disqualified.**

⚠️ **Important: Teams that fail to clearly document and justify all assumptions made in the model, or that submit a final output that deviates from the specified table format and structure, will be disqualified from the final evaluation.**

- **Deliverable 2: Output file containing the predictions/calculations from Objective 1:**

The expected output is a concise dataset showing the four key metrics aggregated at the EU27 level for the two scenarios, for each year from 2025 to 2050, as defined in Objective 1.

Illustrative structure of the dataset. Values are placeholders; participants must calculate the evolution of each variable annually for each scenario (2025–2050):

Year	Scenario	Total fuel (Mt)	SAF share (%)	CO_2 emissions (Mt)	Avoided CO_2 (Mt)
2025	0	39.0	1.0	150.2	0.0
2025	1	39.0	2.0	150.2	0.0
2026	0	39.4	1.0	121.5	3.0
2026	1	39.4	3.0	120.5	4.0
...	...	...	...	...	...

Note: Figures are illustrative and expressed in million tonnes (Mt).

This is the formal structure of the table that you have to create:

Field Name	**Description**
Year	Calendar year of the observation, ranging from 2026 to 2050.
Scenario	Scenario identifier used in the analysis (0 = Business as Usual, 1 = Baseline).
Total_Fuel	Total fuel demand in million tonnes (Mt) for that year and scenario, including both conventional jet fuel and SAF.
SAF_Share	Share of Sustainable Aviation Fuel (%) in the total fuel mix for that year and scenario.
CO2_Emissions	Estimated total CO_2 emissions (in million tonnes, Mt) for that year and scenario, after applying the corresponding SAF share (if applicable).
Avoided_CO2	CO_2 emissions avoided (in million tonnes, Mt) compared to a fossil-only baseline scenario with 0% SAF.

⚠️**Important:** Teams that submit a final output deviating from the specified table format and structure will be disqualified from the final evaluation.

- **Deliverable 3: Executive Summary – Evaluate the economic and policy implications of SAF deployment**
  The Executive Summary should synthesize the team's full analysis by connecting the quantitative results from Objective 1 with the economic and policy evaluation from Objective 2. It must demonstrate how data-driven evidence, sound assumptions, and policy reasoning converge to explain the feasibility and trade-offs of SAF deployment in the European aviation sector.
  The document should be written as a concise, professional report (3–5 pages) that integrates key findings, assumptions, and insights derived from the team's modelling and analytical work. All parameters and data sources must be clearly documented, justified, and properly cited.
  The Executive Summary will serve as the basis for the Final Presentation, summarizing the most relevant results, conclusions, and strategic recommendations.

⚠️ **Important:** Teams that fail to clearly document and justify their assumptions will not be eligible for final evaluation.

- **Deliverable 4: Final Presentation – Communicate a clear, evidence-based vision for sustainable aviation**
  The Final Presentation should bring together all the analytical and strategic work developed throughout the challenge, combining the quantitative modelling (Objective 1) and the economic and policy analysis (Objective 2) into a single, coherent and persuasive narrative.
  Teams must translate their findings into a clear, visually engaging, and evidence-based presentation that highlights how data and innovation can guide the aviation sector toward net-zero emissions. The presentation should summarize the main takeaways, policy implications, and strategic recommendations, demonstrating both analytical rigor and business-oriented insight.
  The finalist teams will deliver their presentations during the closing event. The presentation should last a maximum of 5 minutes and be structured around the most relevant conclusions, ensuring clarity, consistency, and impact.

⚠️ **Important:** All teams must submit their Final Presentation through the Final Submission Form to be eligible for evaluation. Teams that fail to do so will not be considered for the final assessment.

6. Evaluation Criteria

Having described the objectives, dataset information, and technical delivery requirements in the previous sections, this section outlines the evaluation criteria.

The evaluation will be based equally on technical excellence (50%) and communication and strategic insight (50%), in alignment with the required deliverables:
The code/notebooks, the output dataset (aggregated metrics for EU27, by scenario and year), the Executive Summary (3–5 pages), and the Final Presentation.

1. Overall weighting

- **Technical component: 50% of the final grade**
  Evaluates the team's analytical reasoning, clarity of logic, code quality, and use of credible data sources and assumptions.

- **Executive Summary & Presentation: 50% of the final gra**de
  Evaluates the team's ability to synthesize technical findings into clear, evidence-based strategic insights and communicate them effectively.

2. Technical component (50%)

T1 — Problem understanding and assumptions
Clarity in defining the problem and documenting **all assumptions** (demand evolution, emission factors, SAF adoption rates, etc.), supported by credible references. Logical

consistency between assumptions, data sources, and the two required scenarios. Missing or poorly documented assumptions will be penalized.

T2 — Data exploration and quality of sources
Appropriate exploration of datasets and sources, including verification of credibility and reliability of external data. Clear justification for the chosen datasets and discussion of limitations, biases, or data gaps.

T3 — Logical design and scenario formulation
Sound and coherent methodology for constructing the required **two scenarios** (e.g., baseline vs. policy-driven).
Demonstrates clear reasoning and consistency between datasets, assumptions, and resulting metrics.
The design should be reproducible, traceable, and clearly explained.

T4 — Computation of metrics and output format
Accurate computation of the four required metrics per year and per scenario:
Total_Fuel (Mt), *SAF_Share (%)*, *CO_2_Emissions (Mt)*, and *Avoided_CO_2 (Mt)*.
Strict compliance with the **required structure and formatting** of the output dataset is mandatory. Any deviation may result in disqualification.

T5 — Code quality and reproducibility
Code must be clean, properly commented, and clearly organized in **<u>Google Colab</u>**, alternating code and explanatory text.
All relevant **outputs must be visible**, including printed verification of the structure and format of the final dataset.

3. Executive Summary & Presentation (50%)

B1 — Integration between technical and strategic analysis
The **Executive Summary (3–5 pages)** must demonstrate how quantitative results from the scenario analysis support the team's policy or business conclusions.
Assumptions, parameters, and sources must be explicit and logically connected to the outcomes.

B2 — Coherence and feasibility
The proposed conclusions and recommendations should be realistic, reflecting a balance between environmental ambition, economic feasibility, and technological readiness.
Limitations and uncertainties should be clearly acknowledged.

B3 — Strategic relevance and societal impact
Ability to extract meaningful insights from the data and articulate their implications for policymakers, industry, and society.
Demonstrates how the proposed solutions contribute to environmental and societal goals.

B4 — Clarity and persuasiveness of the presentation
Final presentation (max. 5 minutes) should be visually coherent, concise, and persuasive.
Focus on key takeaways, clarity of communication, and storytelling supported by data.

B5 — Formal compliance and citation
Strict adherence to submission formats and deadlines.
All data sources and references must be properly cited.
Failure to comply may result in disqualification.

4. Eligibility and penalties

To be eligible for evaluation, teams must submit **all required deliverables**:

- the **code/notebook with visible outputs**,
- the **output dataset in the exact required structure**,
- the **Executive Summary**, and
- the **Final Presentation**.

Grounds for disqualification include (but are not limited to):

- Missing or undocumented assumptions,
- Output dataset not following the required structure or fields,
- Missing or invisible code outputs (e.g., no evidence of final dataset structure),
- Failure to submit the executive summary or final presentation.

5. Tie-breaking criteria

In case of a tie, teams will be ranked based on:

1. **Accuracy and compliance** of the output dataset (T4)
2. **Integration and coherence** of the Executive Summary (B1)
3. **Clarity and persuasiveness** of the Final Presentation (B4)
4. **Code quality and reproducibility** (T5)