# Session II: Technical Details and Demonstration Results

**Technical development: Overview and approach**
Prajwal Shiva Prakasha (DLR) and Thierry Lefebvre (ONERA)

**Framework: Development & implementation of a collaborative framework for aviation impact assessment**
Marko Alder et al. (DLR)

**Use Case 1: Assessing advanced propulsion systems using the Impact Monitor Framework**
Atif Riaz et al. (CU)

**Use Case 2: Assessing continuous descent operations using the Impact Monitor Framework**
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**Use Case 3: Assessing policies for the uptake of sustainable aviation fuels using the Impact Monitor Framework**
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# Use Case 3:

## *Assessing policies for the uptake of SAF using the Impact Monitor Framework*

**Inge Mayeres, Emanuela Peduzzi, Marko Alder, Fabian Baier, Kuno Buchtal, Sreyoshi Chatterjee, Maximilian Clococeanu, David Ennen, Marc Gelhausen, Alf Junior, Alexandra Leipold, Prajwal Shiva Prakasha, Patrick Ratei, Zarah Zengerling, Thierry Lefebvre**

TRANSPORT & MOBILITY LEUVEN

DLR

ONERA
THE FRENCH AEROSPACE LAB

14th EASN International Conference | Thessaloniki | 9th October 2024

Funded by the European Union

Coordinated by the German Aerospace Center

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# Content Overview

Impact Monitor Use case 3: Assessing policies at the ATS level

- Aims
- Technical implementation
- Demonstration exercise
- Benefits and conclusions
- Outlook

# Use Case 3 – Aims

- Demonstration of the Impact Monitor Framework and dashboard application at the Air Transport System level

- Demonstration exercise:
  - Impacts of 2 policies for promoting the uptake of sustainable aviation fuels (SAF) compared to reference scenario
  - Collaboration between 4 tools, with different scope and disciplines, from different modelling teams; no/limited prior experience with IM framework
  - Input from Use Case 1: new aircraft types in future fleet

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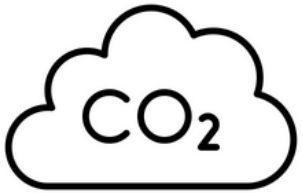
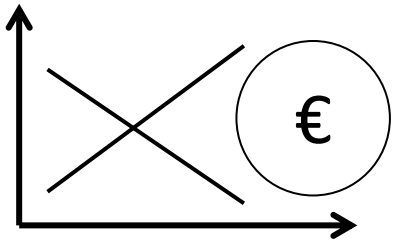
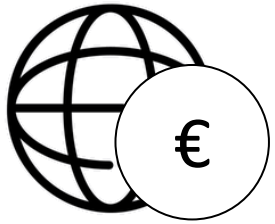
# Use Case 3 – Tools

| Scheduler @ DLR | Emissions tools (TCM) @ DLR | TRAFUMA @ TML | ECOIO @ DLR |
|---|---|---|---|
| Forecast of air traffic patterns | Emissions calculator providing in-flight fuel burn and $CO_2$ emissions based on response surfaces of detailed trajectory calculations | Economic model for the transport fuel markets and related $CO_2$ emissions | Economic input-output model |

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# Demonstration exercise ATS level

- Aim: demonstration via exploratory impact analysis of policies to promote uptake of SAF
- Reference scenario + 2 policy scenarios
  - Time horizon: 2035, 2050
  - Exploratory analysis
  - Focus on demonstration of Impact Monitor framework and dashboard
- Metrics (cf. IM toolbox): range of KPIs covering
  - Climate
  - Economy
  - Social/quality of life
  - Efficiency
  - Effectiveness


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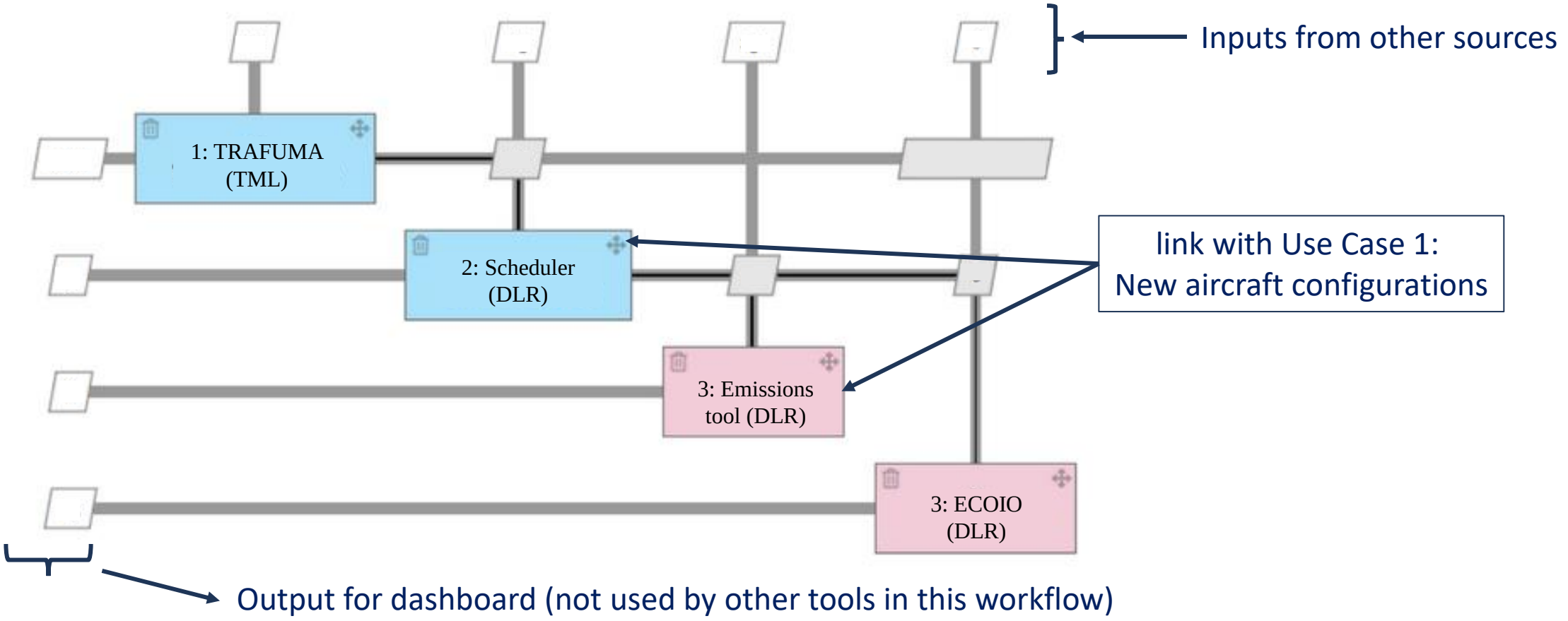
# Technical implementation

## Set-up of computational workflow using MDAx (MDAO Workflow Design Accelerator)

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# Technical implementation

Emissions tool (TCM)
@ DLR

TRAFUMA
@ TML

Set of collaborative tools and environment
@ DLR – Germany

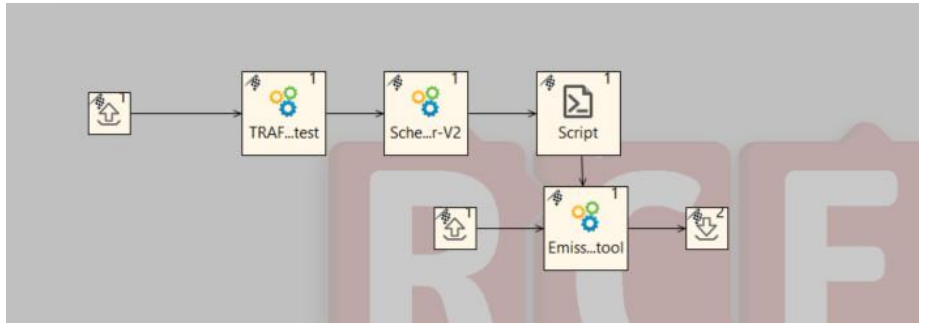
Scheduler
@ DLR

ECOIO
@DLR

Nextcloud
Hosted on Helmholtz

Cloud
Data
Storage


Dashboard Application

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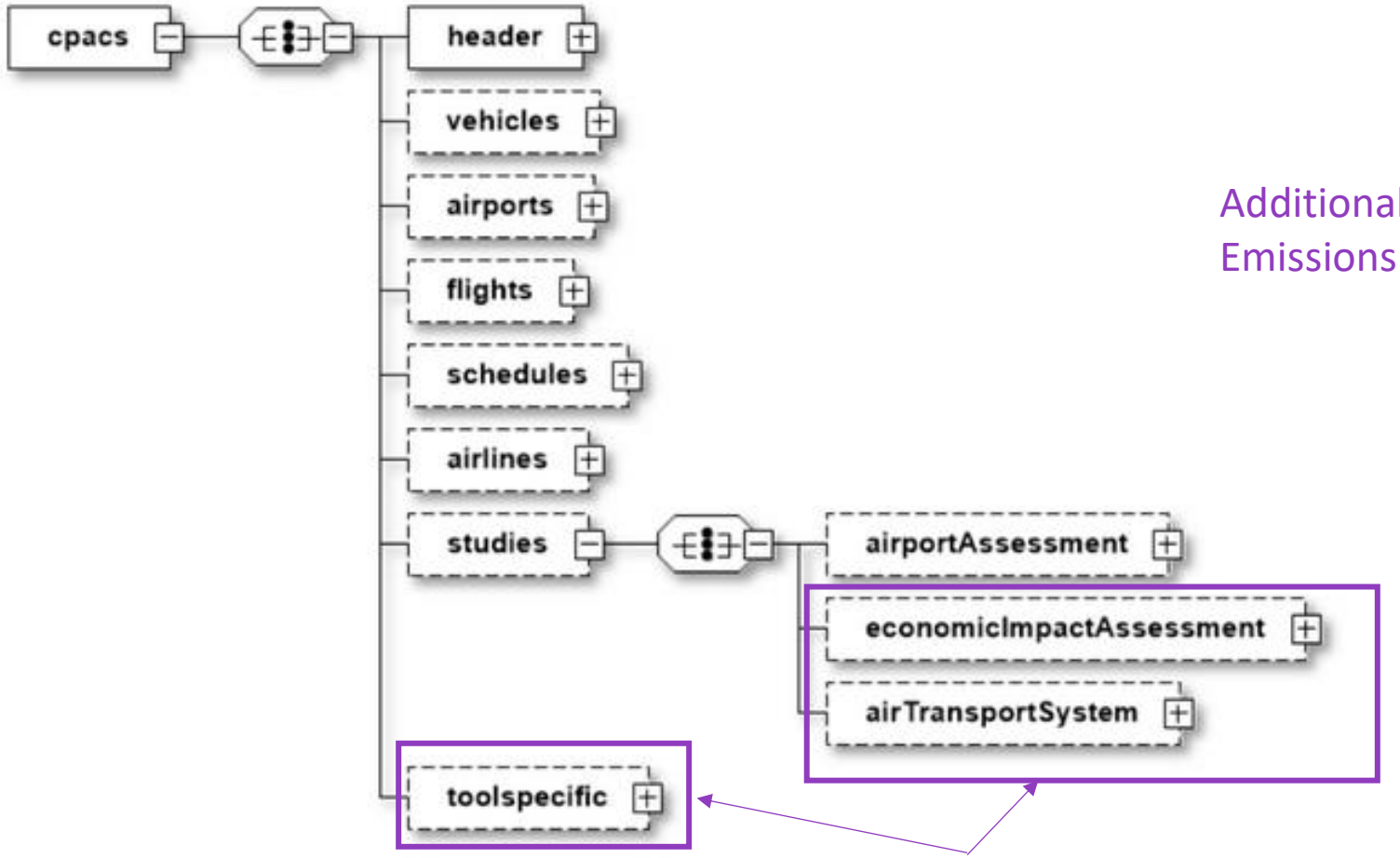
# CPACS extension for ATS Use Case




Additional: integration of data from Scheduler and Emissions tools in existing structure

for TRAFUMA and ECOIO

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# Demonstration exercise – Use Case 3

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# Policy scenarios (SC_BLENDING and SC_ENVTAX)

- Assumptions for demonstration exercise
- **SC_BLENDING: blending mandates**
  - Aviation (all flights worldwide): 20% SAF in 2035 (min. 5% RFNBO in Europe) and 70% SAF in 2050 (min. 35% RFNBO in Europe)
    - No food and feed based fuels

- **SC_ENVTAX: Greenhouse gas tax aviation (worldwide)**
  - In 2035 and 2050
  - Assumption: 200 euro/tonne $CO_2$e (well-to-wheel with ILUC)
  - Tax replaces Emission Trading System for aviation within EEA, CH, UK

*Other policy instruments as in reference scenario for 2035 and 2050*

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# Fuel demand elasticities, fuel costs, emission factors

- TRAFUMA calibrated to be in line with elasticity in Scheduler & Emissions tool – derived on the basis of two existing price scenarios of DLR for 2035 and 2050

- Fuel costs, WTW and WTW with ILUC emission factors: literature review

- Framework allows to explore implications of other parameter values, or other policy definitions

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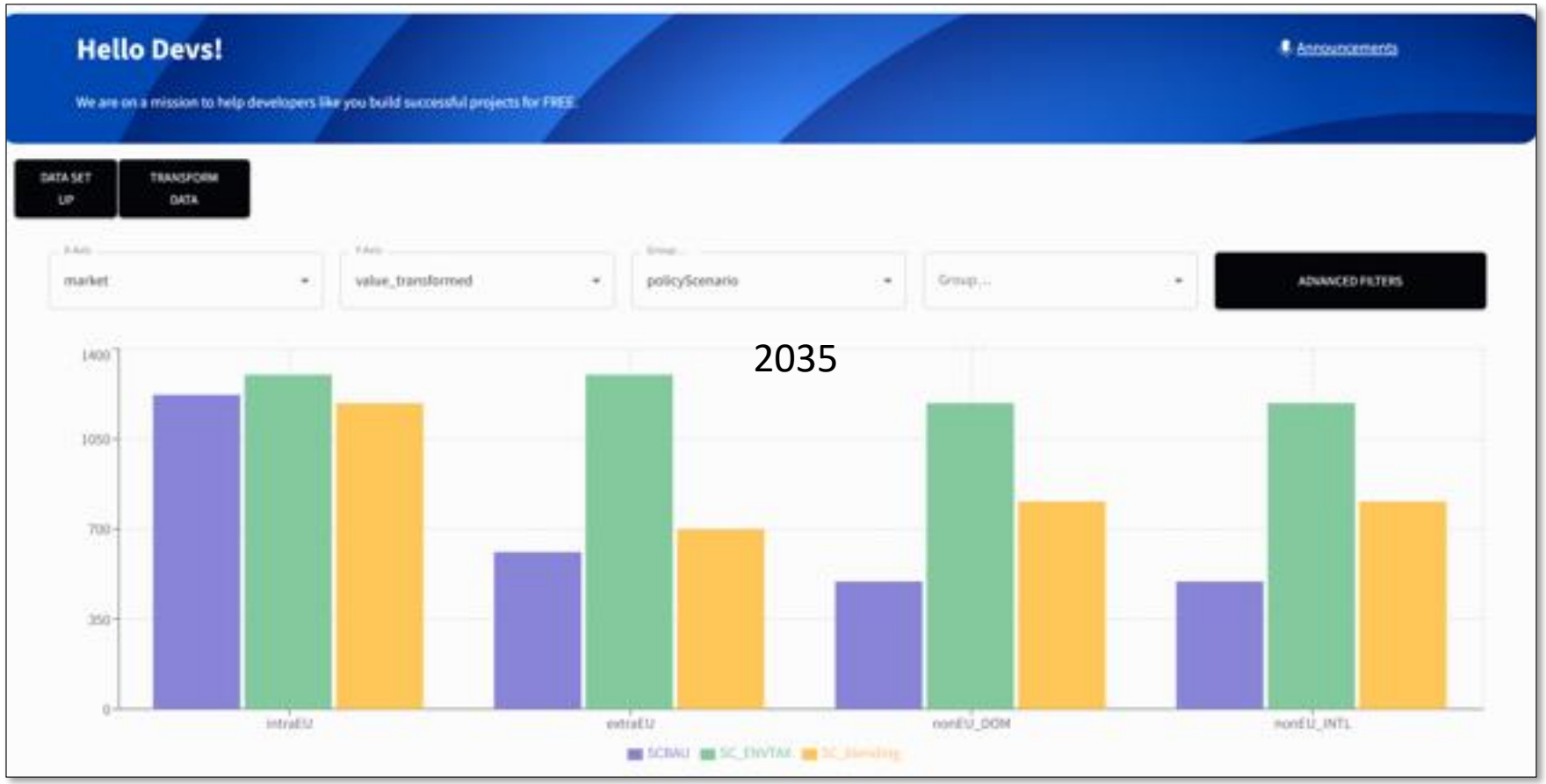
# Example metrics – TRAFUMA

## Fuel cost – per market (euro2016/toe)




- IntraEU: fuel for flights covered by ETS (EEA, CH, UK)
- ExtraEU: fuel for other flights departing in EEA, CH, UK
- nonEU: fuel for other flights (domestic or international)

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# Example metrics – TRAFUMA

## Fuel cost – per market (euro2016/toe)


**In workflow:**
**Fuel cost is input in Scheduler**

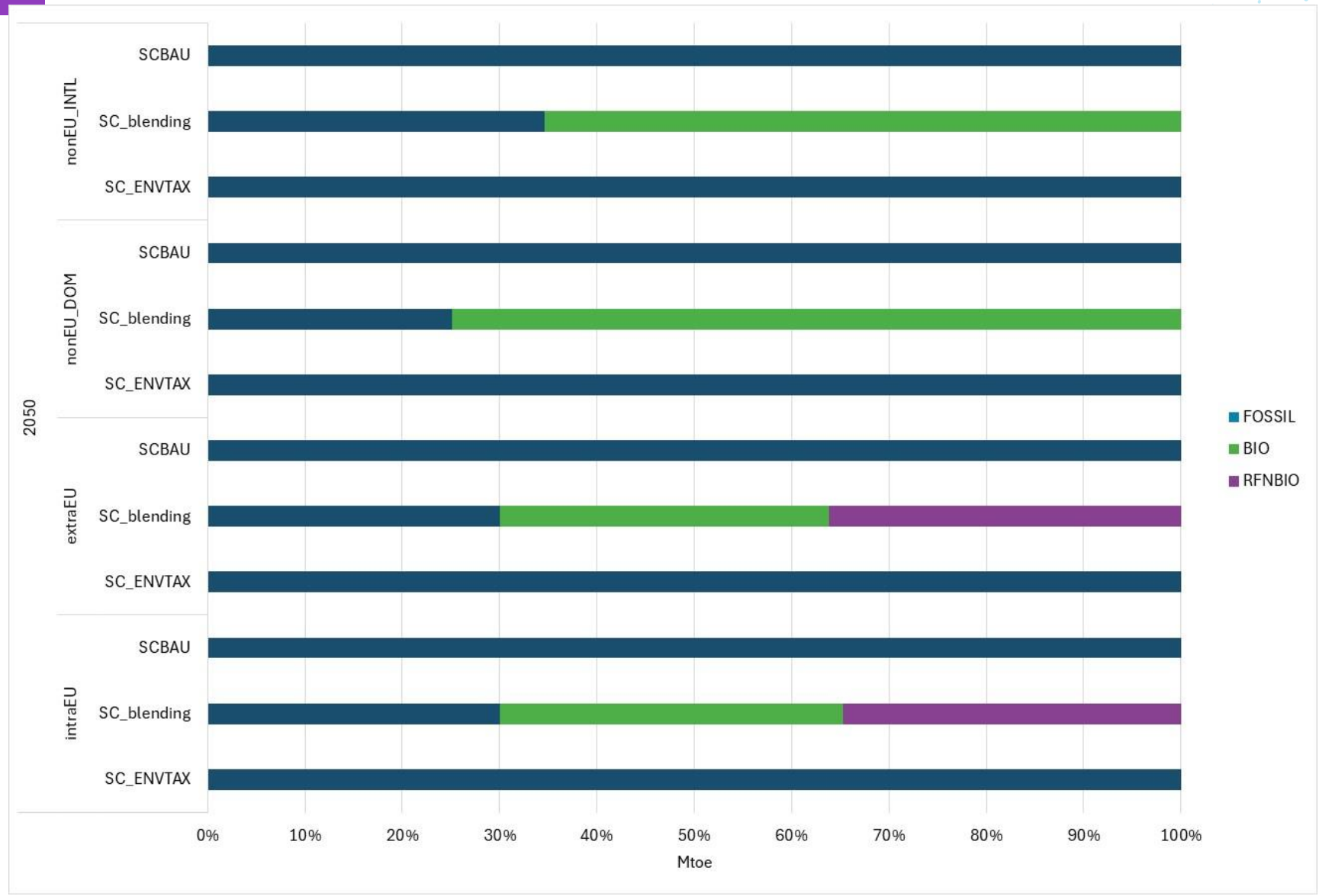
IntraEU: fuel for flights covered by ETS (EEA, CH, UK)
ExtraEU: fuel for other flights departing in EEA, CH, UK
nonEU: fuel for other flights (domestic or international)

# Example metrics – TRAFUMA

## Composition of fuel demand by aviation market and fuel type (%) - 2050

**In workflow: Dashboard**

- IntraEU: fuel for flights covered by ETS (EU, CH, UK)
- ExtraEU: fuel for other flights departing in EU, CH, UK
- nonEU: fuel for other flights (domestic or international)

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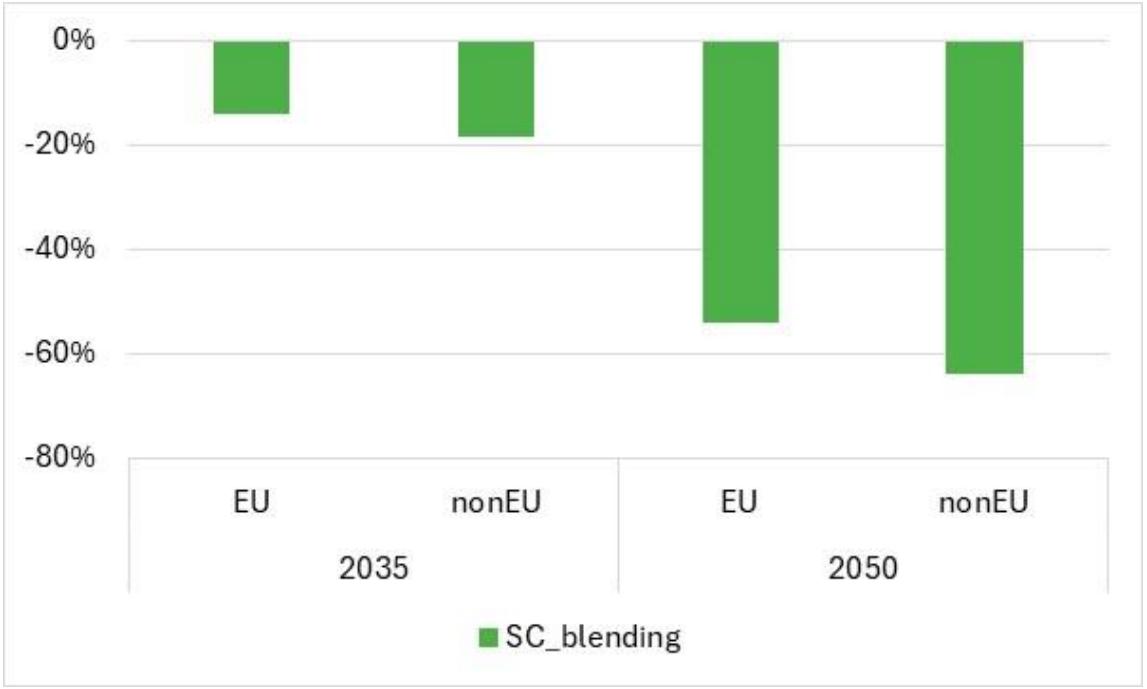
# Example metrics - TRAFUMA

## Average emission factor per tonne of oil equivalent (WTW with ILUC)

(% change compared to reference scenario)

SC_blending

**In workflow: Dashboard**

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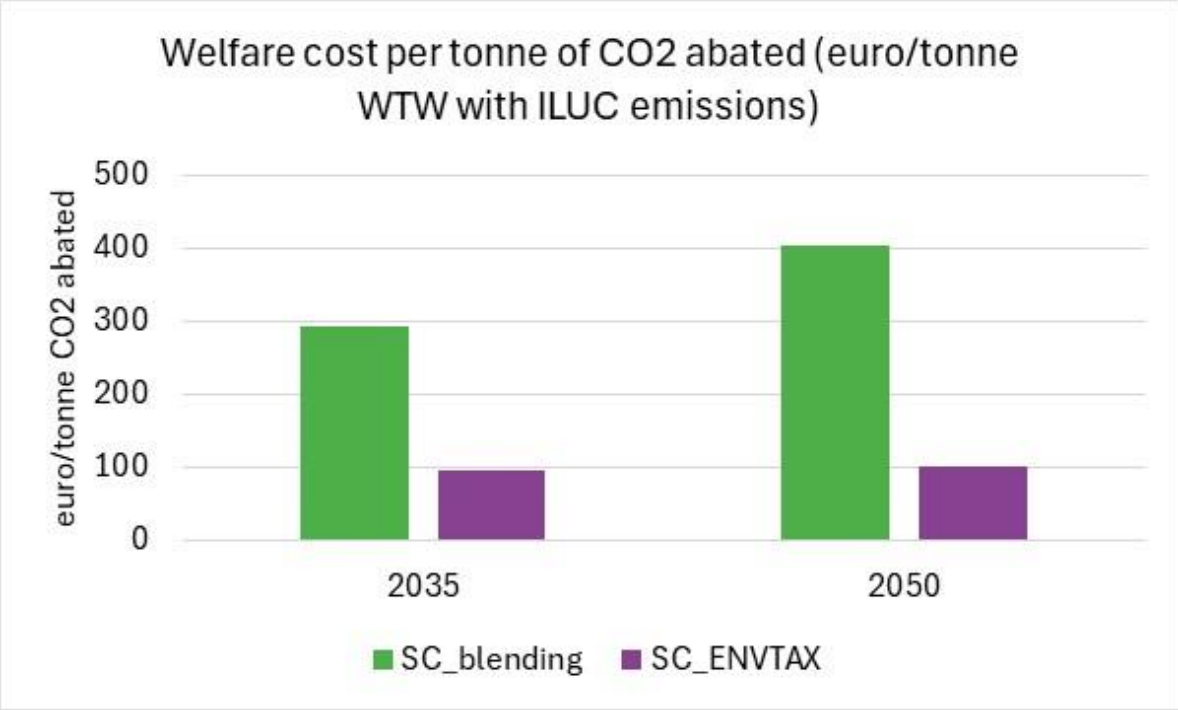
# Example metrics - TRAFUMA




**In workflow: Dashboard**

## Welfare cost per tonne of $CO_2e$ abated

= (Δ consumer surplus + Δ producer surplus + Δ government income)

/ (Δ $CO_2e$ emissions)

To be compared with abatement costs in other sectors and for other policies or change in policy levels and with societal benefits of $CO_2e$ emission reductions

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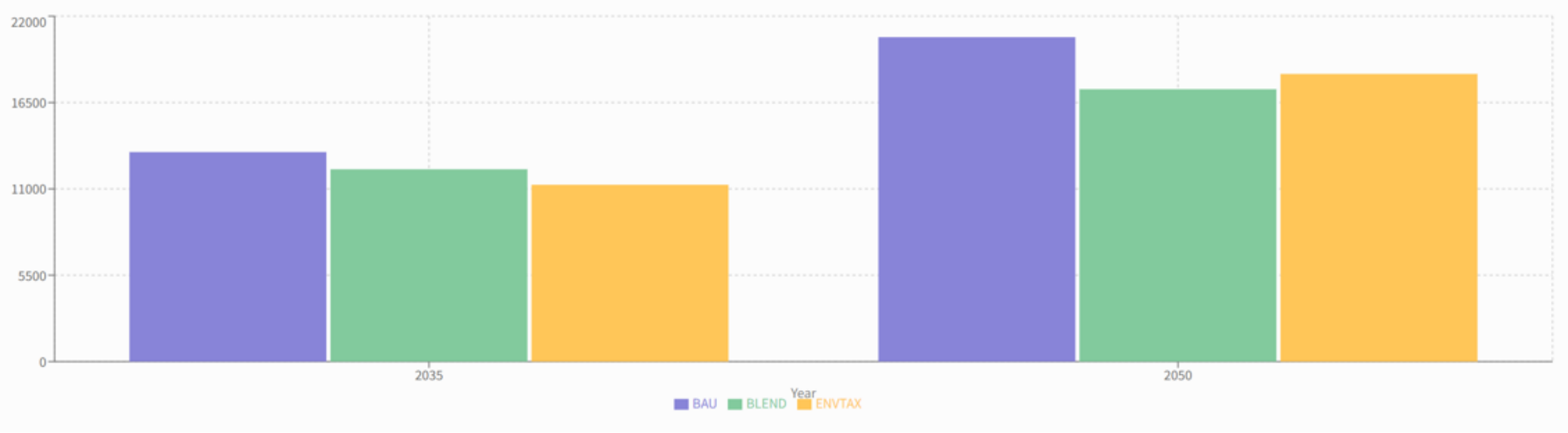
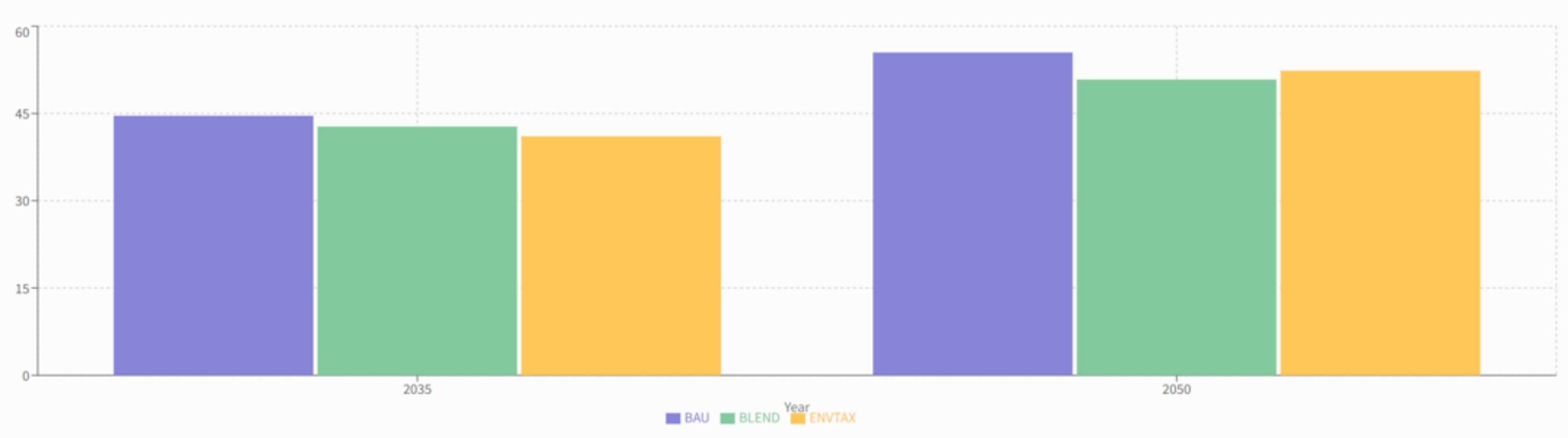
# Example metrics – Scheduler

## RPK for all fleet (all scenarios 2035/2050)



# Example metrics – Scheduler

## Flights for whole fleet (all scenarios 2035/2050)




**In workflow:**
**inputs for Emissions tool and ECOIO**

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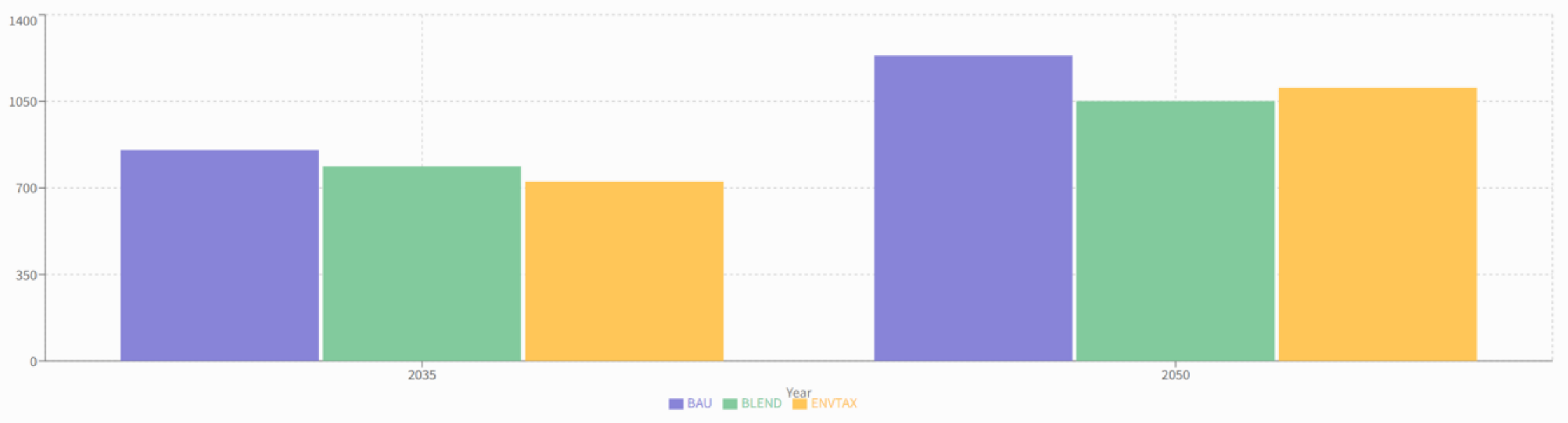
# Example metrics – Emissions tool (TCM)

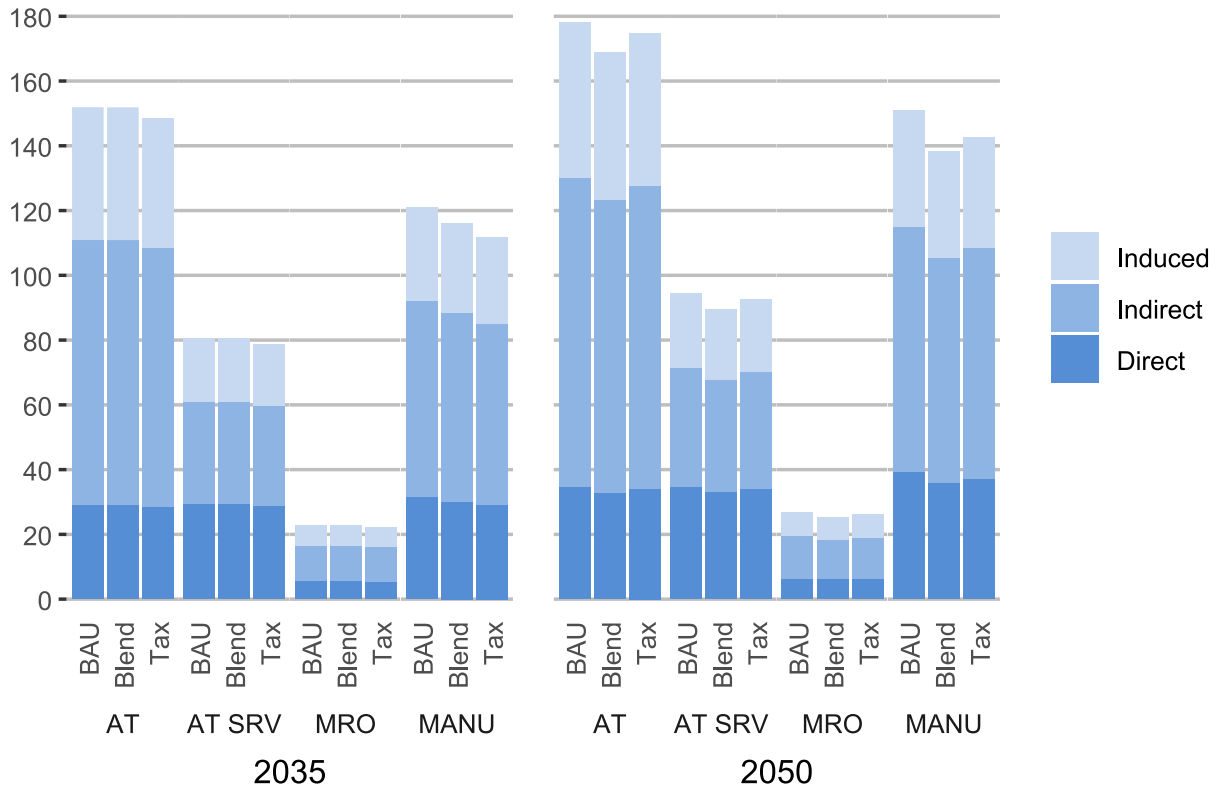
## $CO_2$ for whole fleet (all scenarios 2050/35) – fuel burn



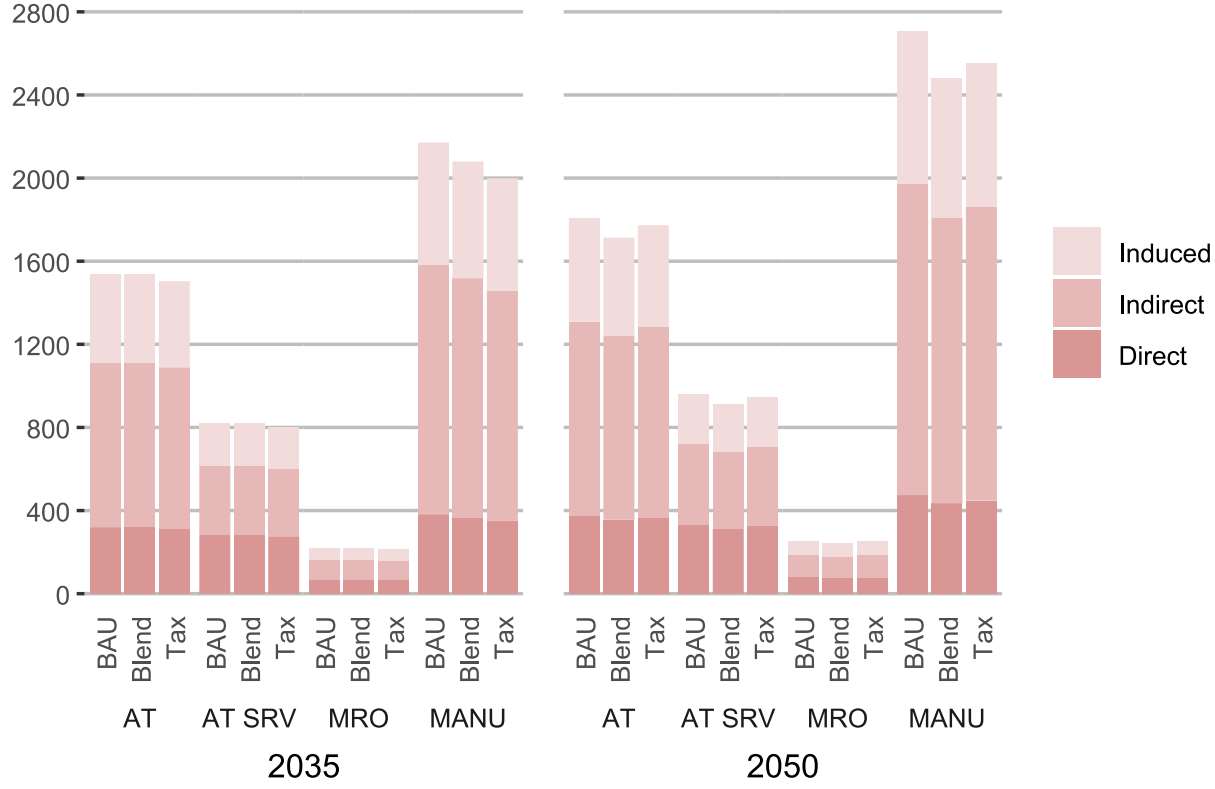
# Example metrics – ECOIO

Per subsector
AT = Air transport, AT SRV = Air transport related services (e.g., airport services), MRO = Maintenance, repair and overhaul, MANU = Manufacture of aircraft and components

**Gross value added** created by the aviation industry in the EU 27 (in billion euro)




**Employment** created by the aviation industry in the EU 27 (in thousand jobs)

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**In workflow: Dashboard**

# Benefits and Conclusions

## Enhanced Efficiency and Productivity

- Streamlined workflows
- Improved data sharing
- Real-time collaboration

## Innovation and Knowledge Sharing

- Cross-functional collaboration
- Knowledge transfer
- Accelerated research and development

## Improved Decision-Making

- Comprehensive analysis
- Scenario planning
- Risk mitigation

## Improved Regulatory Compliance

- Centralized data management
- Enhanced traceability
- Reduced risk of non-compliance

## Cost Reduction

- Resource optimization
- Reduced development time
- Improved collaboration

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# Outlook

- Focus: **demonstration** of IM framework at **ATS level**
- **Flexible set-up** allows to analyse range of policy assumptions, model parameters in efficient way
- **Next steps** for Use Case 3:
  - Finalisation of RCE integration
  - Finalisation of communication with dashboard application
  - Lessons learnt + roadmap for further development of Impact Monitor framework and dashboard
    - At ATS level and integrated for Aircraft/Airport/ATS level

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# Thank you!


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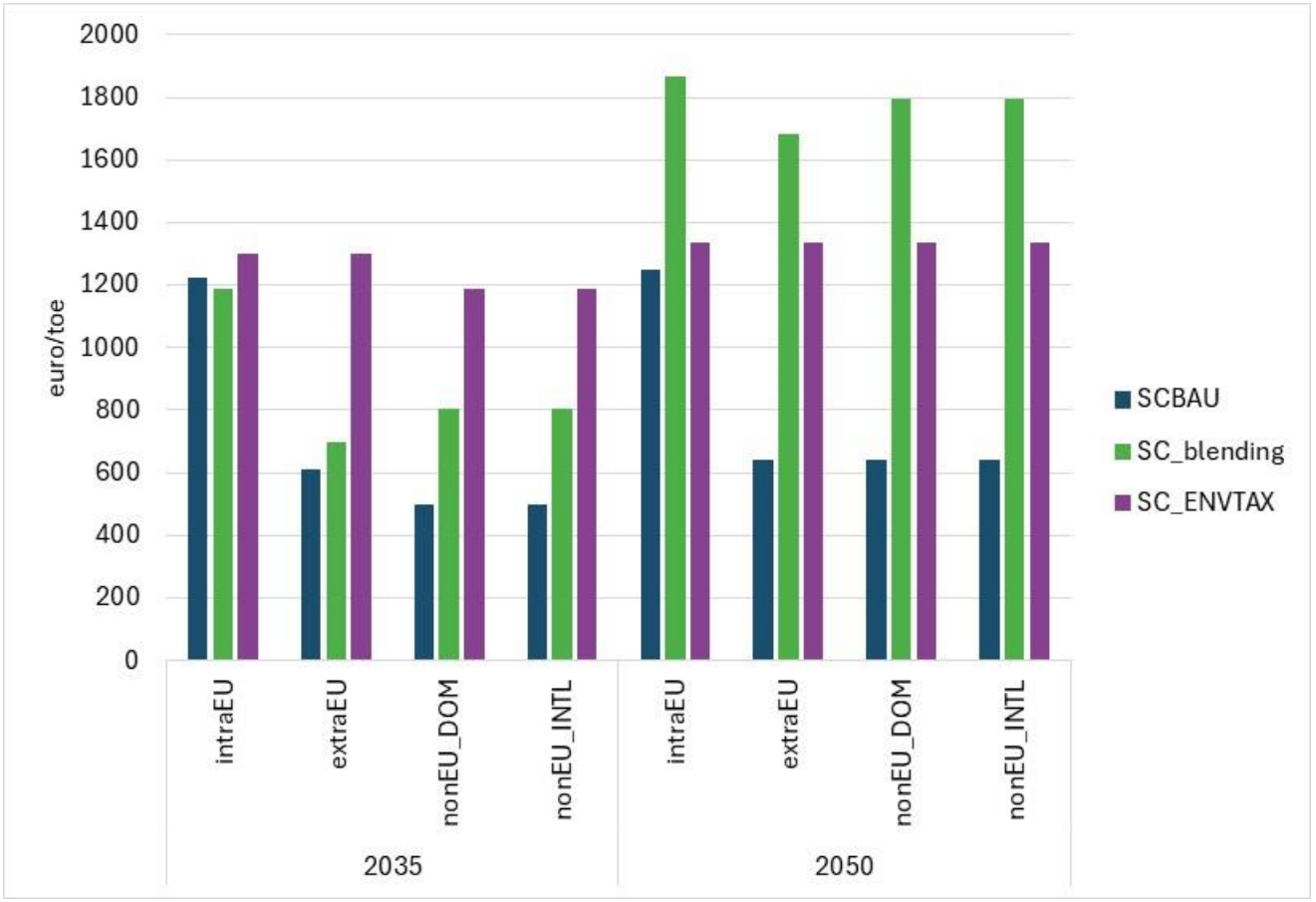


IF POSSIBLE, TO BE REPLACED BY FIGURE PRODUCED IN DASHBOARD

**In workflow:**
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