Data & measurement for a zero CO$_2$ emissions future

Paul Peeters

Professor Sustainable Transport and Tourism,

Breda University of Applied Sciences

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria
Summit

The Envisioning 2030 project

- ***The Travel foundation, one of the Glasgow Declaration initiators, asked:***
  - How does global tourism look under the Glasgow goals for 2030 (-50%) and 2050 (zero)?
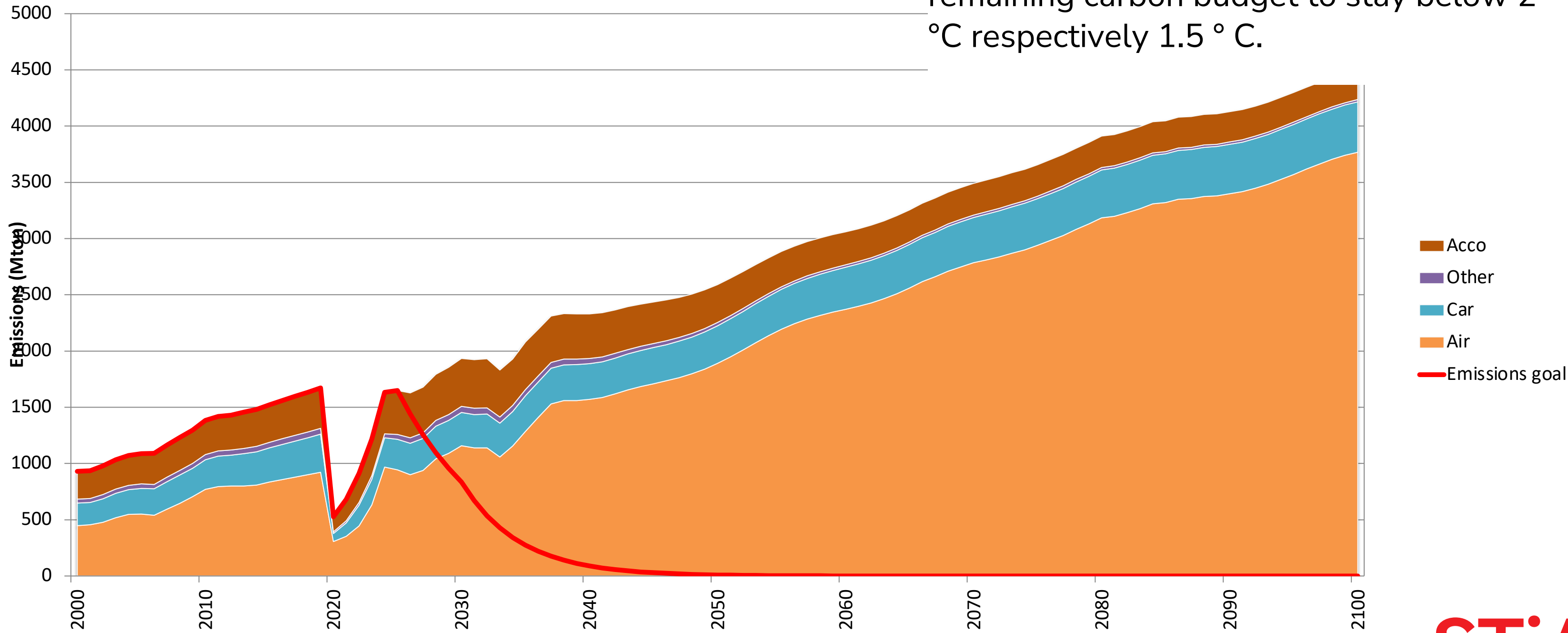 - This resulted in the: ***Envisioning 2030 project***

Note: tourism comprises all over-night trips whether for leisure (60%), VFR (25%) and ***business (15%)***

Peeters, P., & Papp, B. (2023). *Envisioning Tourism in 2030 and Beyond. The changing shape of tourism in a decarbonising world*. Travel Foundation.
https://www.thetravelfoundation.org.uk/envision2030/

Data & measurability
Paul Peeters, June 24, 2024
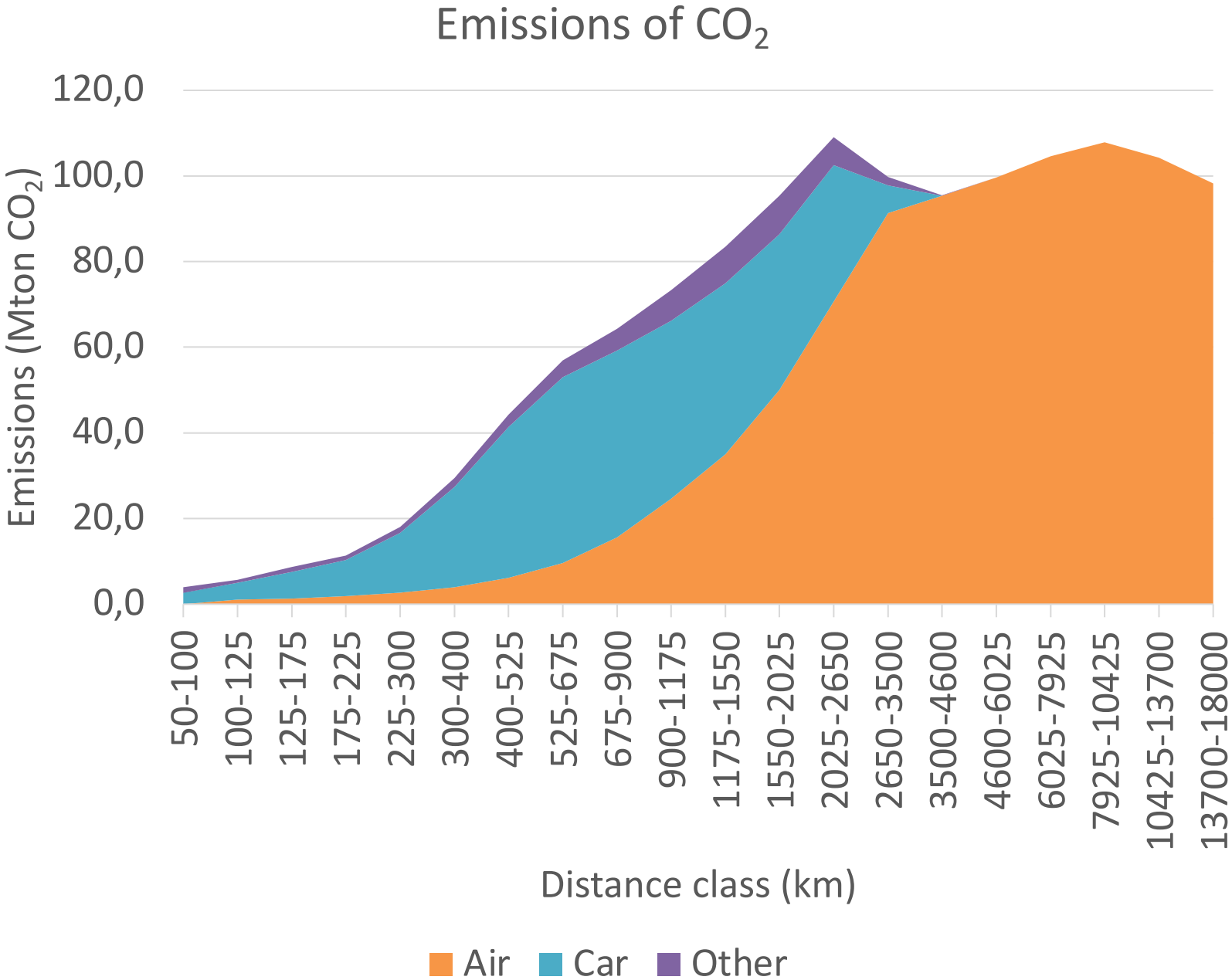
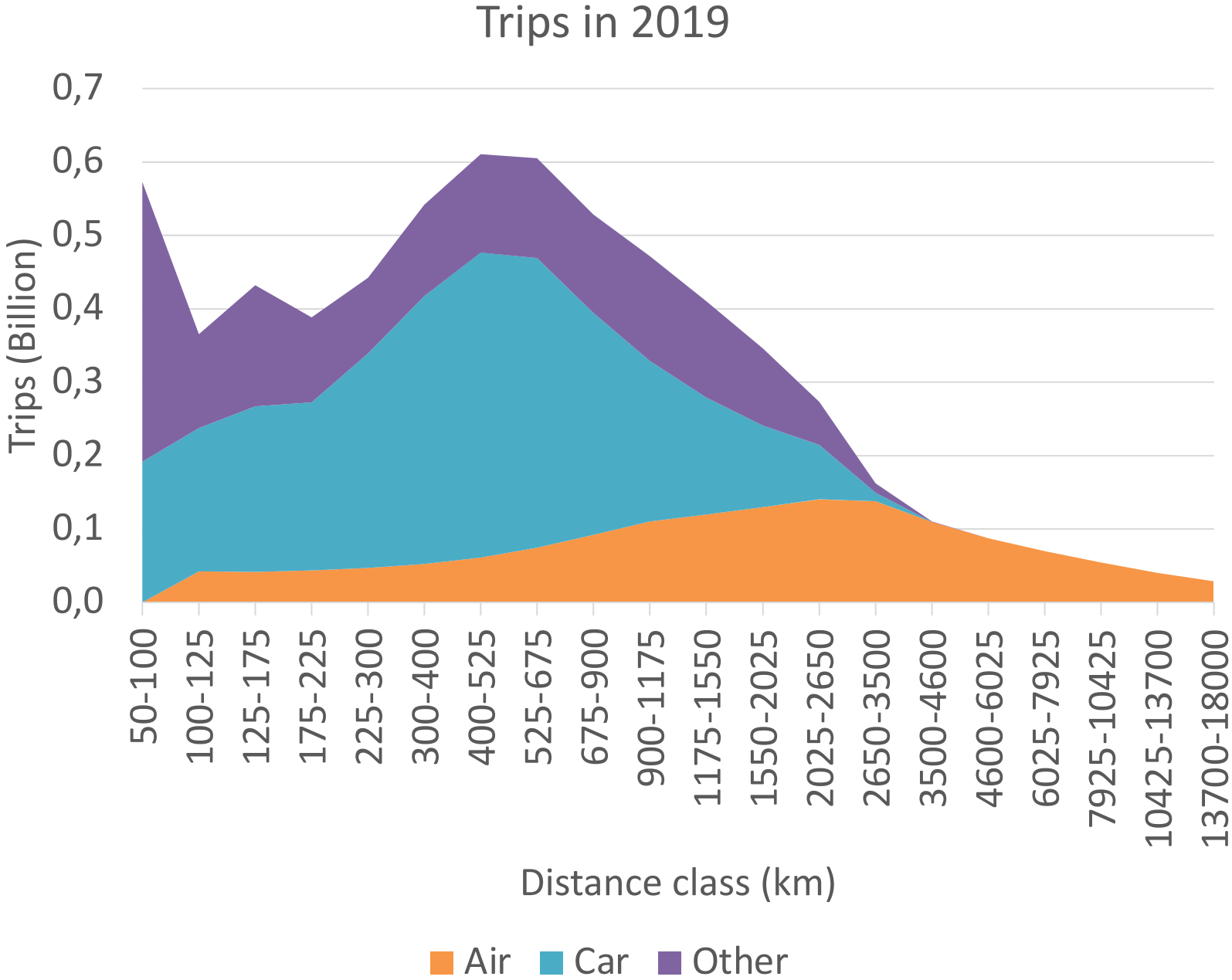# Business as usual: the problem

Tourism would consume 24-42% of the remaining carbon budget to stay below 2 °C respectively 1.5 ° C.

Data & measurability
Paul Peeters, June 24, 2024

Distance is the problem!

Trips in 2019

Emissions of CO$_2$

Distance class (km)

Distance class (km)

■ Air ■ Car ■ Other

■ Air ■ Car ■ Other

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria
Summit

# The role of the Paris Climate Agreements and NDC's

- Paris dictated all countries to create a National Determined Contribution (NDC) plan covering **every part of tourism** except international aviation and international shipping.
  - But, the most problematic part – international aviation - of emissions is NOT covered by Paris, but by ICAO
  - ICAO has created an offsetting scheme (CORSIA) for keeping emissions at the level of 2019 (NOT going to zero).

- Creating a zero-emissions tourism future is only possible with zero-emissions aviation:
  - Sustainable alternative fuels (SAF)
  - Revolutionary aircraft technology
  - Lower aviation volume

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria Summit

SAF: bio-fuels or E-fuels (Power-to-Liquids)?

- Biofuels (and waste-fuels) use enormous areas to grow because:
  - Chlorophyll is an ***inefficient*** energy converter (some 1%-3%) while solar panels do 15-40%
  - Best current biofuels reduce emissions by 80%
- Therefore, bio-fuels inevitably compete with agriculture, food and nature
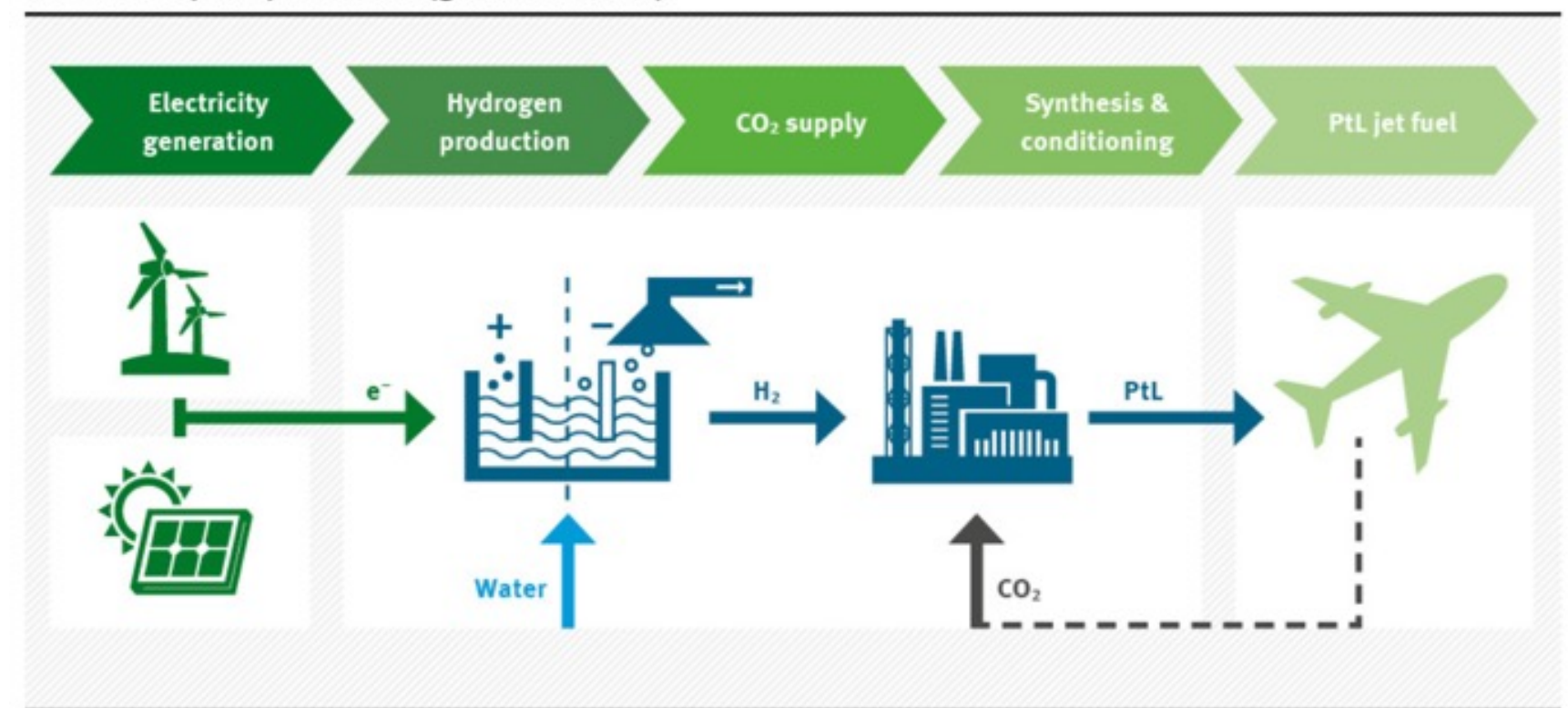
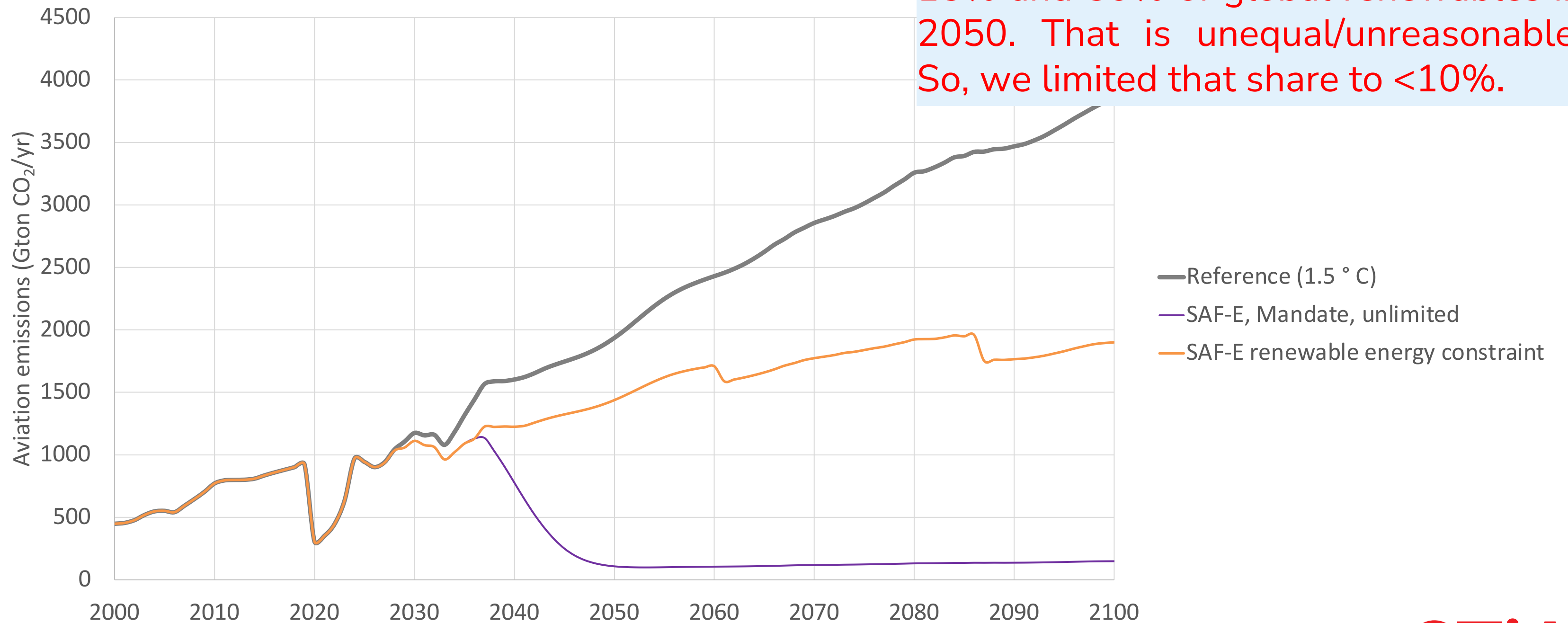Schmidt, P., & Weindorf, W. (2016). *Power-to-Liquids. Potentials and Perspectives for the Future Supply of Renewable Aviation Fuel*. Dessau-Roßlau

Introduce e-fuels with mixing mandate

Producing e-fuels would cost between 15% and 50% of global renewables in 2050. That is unequal/unreasonable. So, we limited that share to <10%.

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria
Summit

Technology: the 'Tesla' of the skies

- Kerosene tank
- Current battery technology electric plane

Data & measurability
Paul Peeters, June 24, 2024

But Hydrogen-Fuel Cell-Electric flight is possible

- Hydrogen combined with fuel cells and electric engines can deliver reasonable payload-range and travel time performance at zero-CO_2 emissions
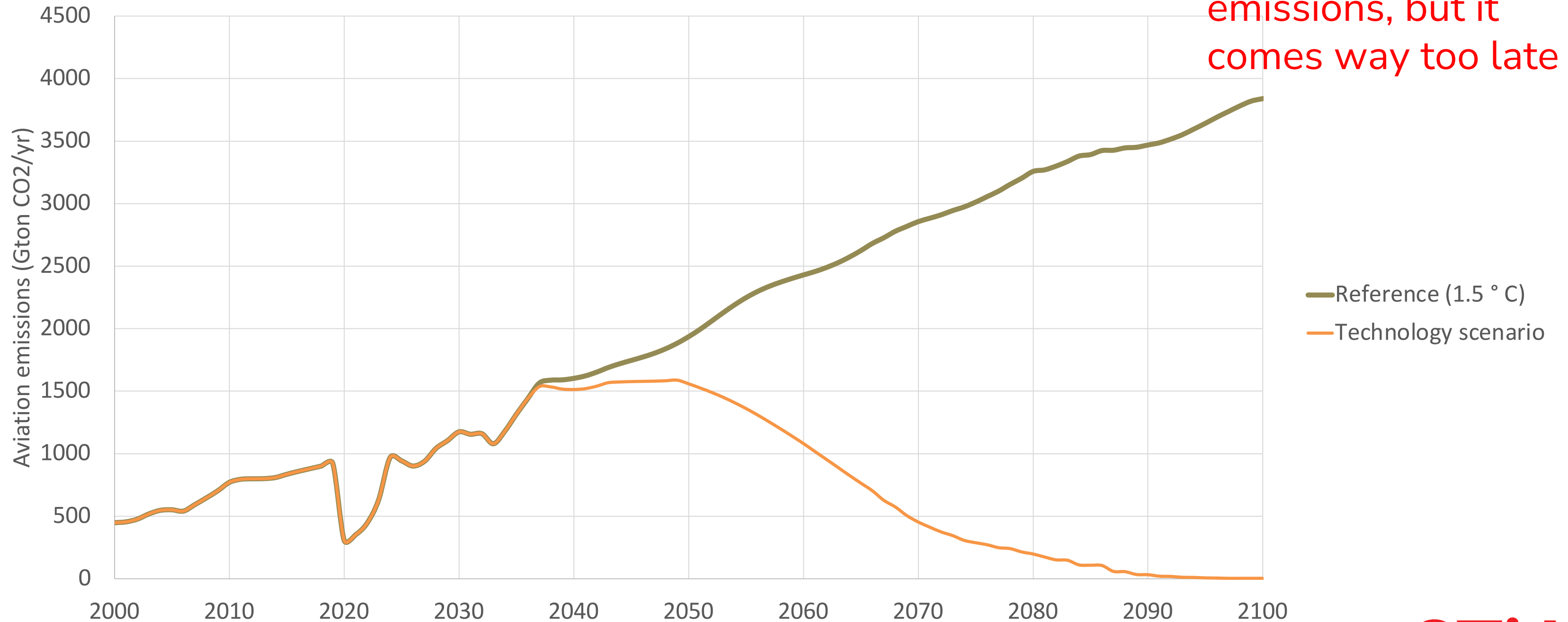

Universal Hydrogen
ATR-72 retrofit

ZeroAvia
Do228 test
flight

Data & measurability
Paul Peeters, June 24, 2024

Max (aviation) technology scenario

It may provide zero emissions, but it comes way too late

Legend:
- Reference (1.5 ° C)
- Technology scenario

Y-axis: Aviation emissions (Gton CO2/yr)

Data & measurability
Paul Peeters, June 24, 2024

Breda University
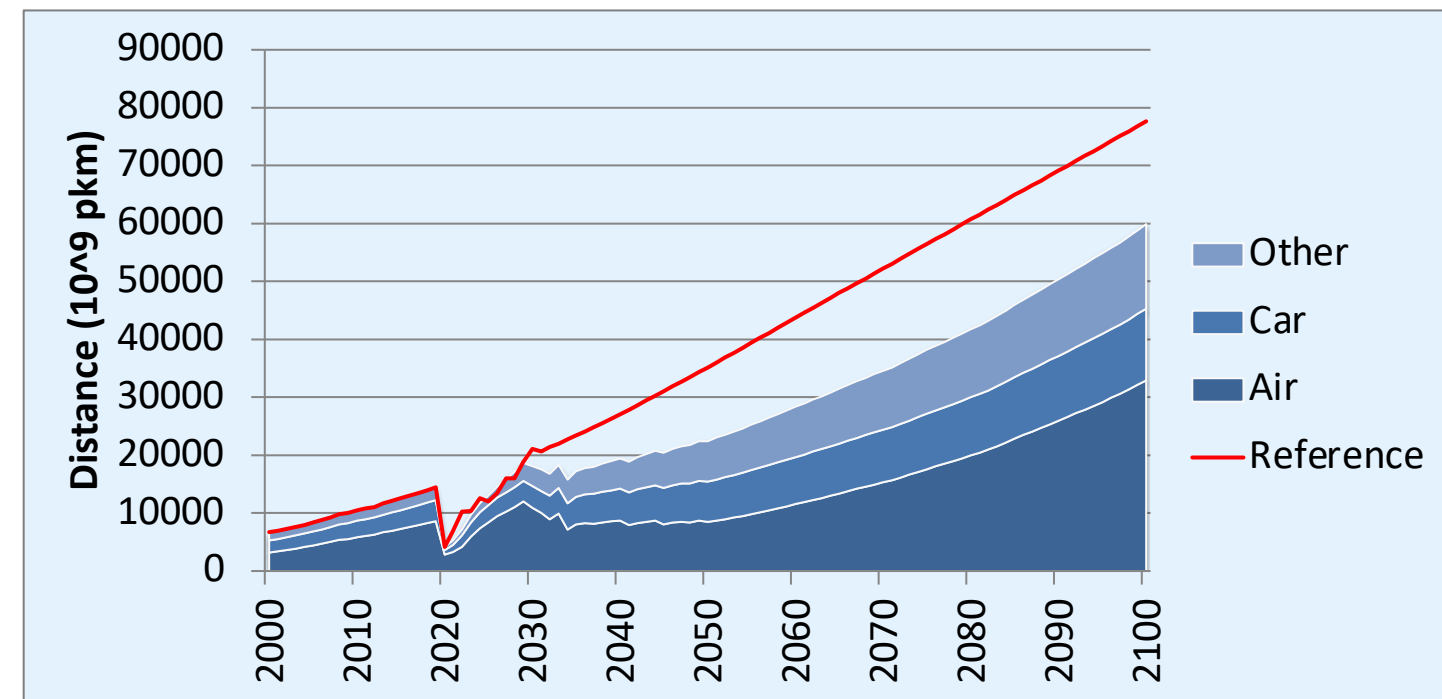OF APPLIED SCIENCES

STiAS
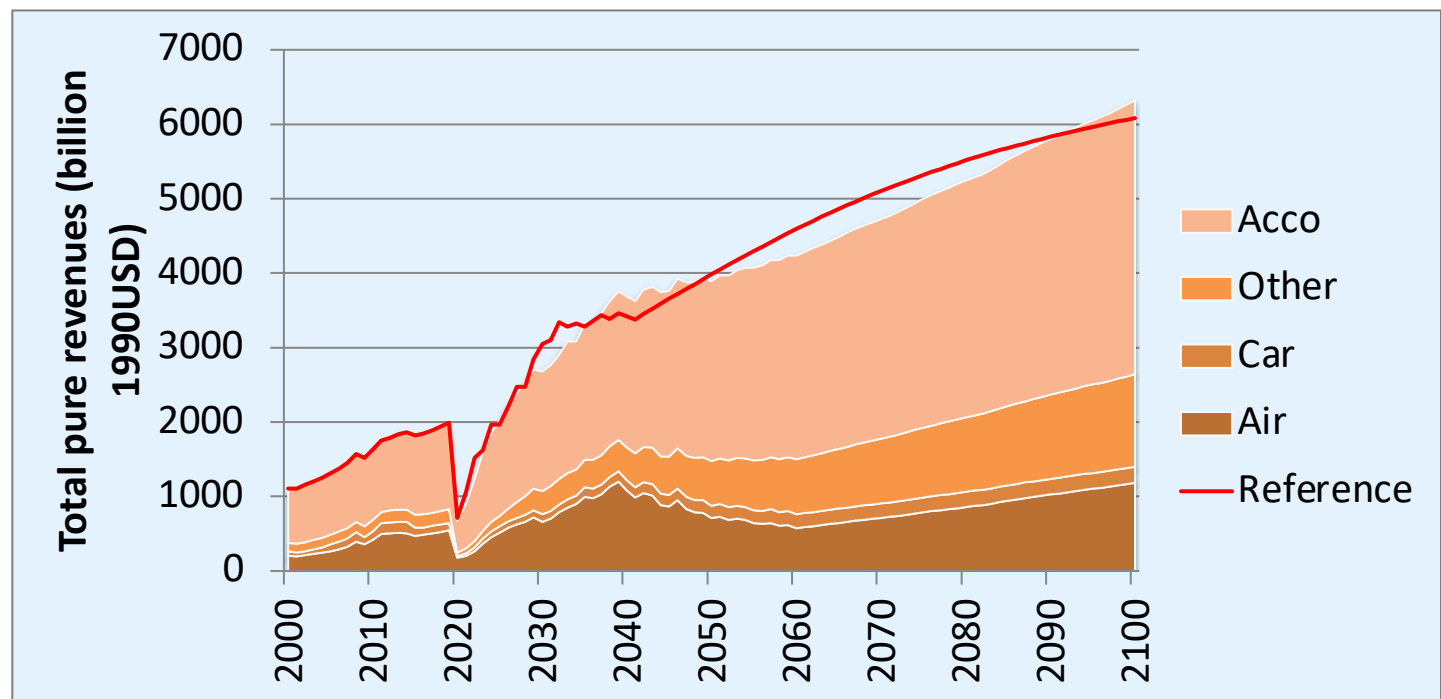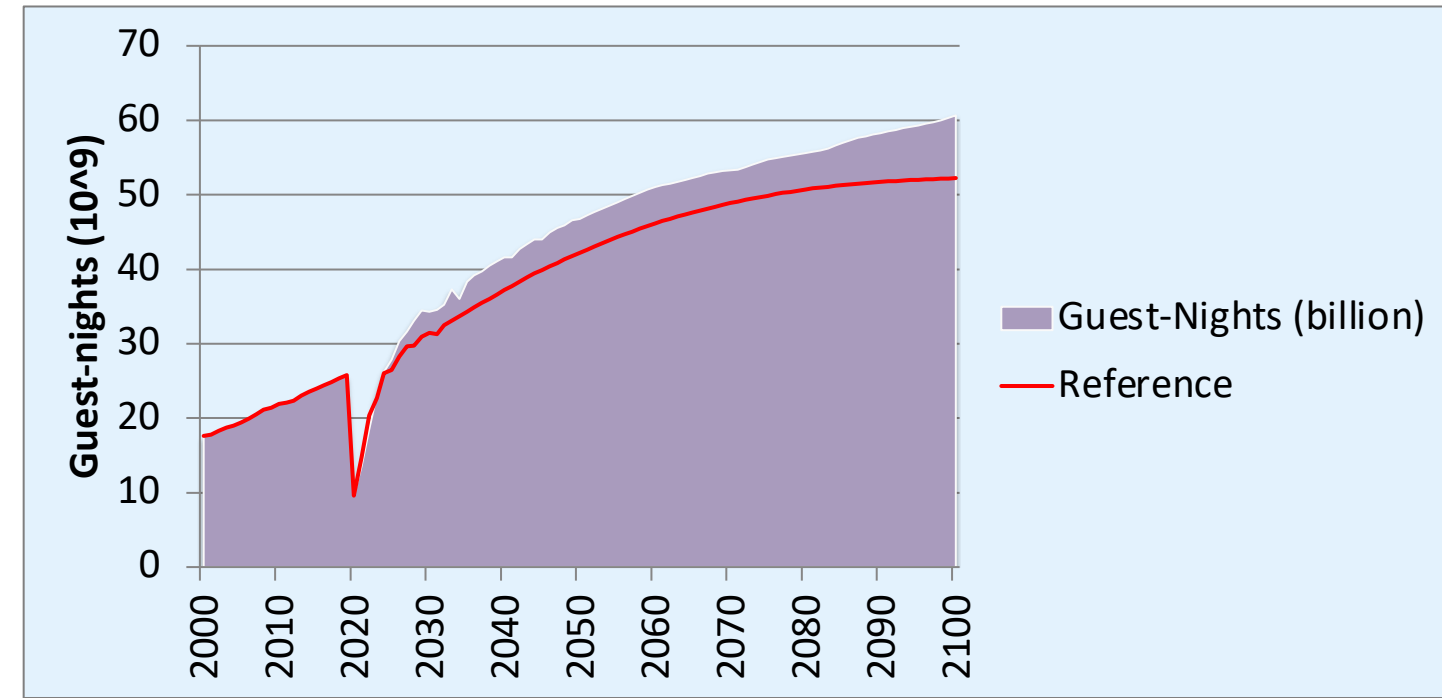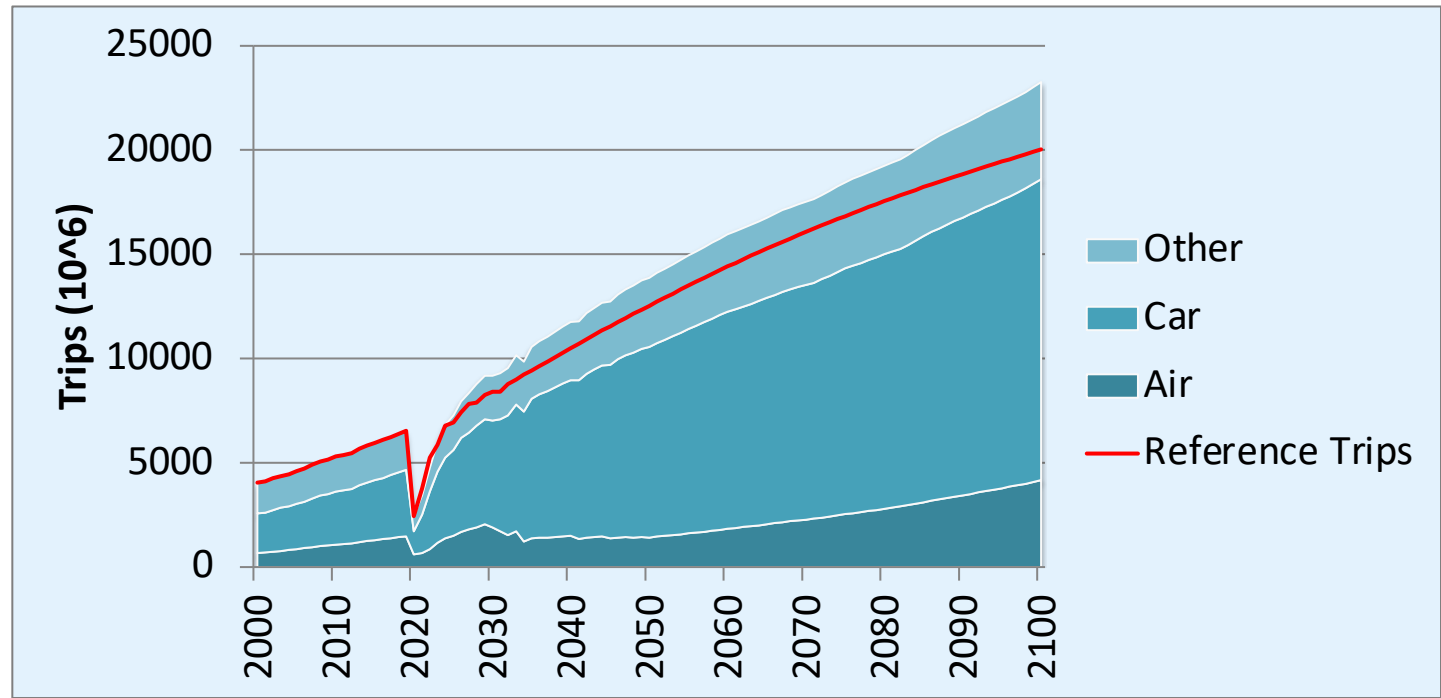Sustainable Tourism in Austria Summit

Combining options to ZET

Big change? Only 15% of all BAU-trips must shift market in the ZET-scenario. Particularly from long-haul to medium- and short-haul.

Data & measurability
Paul Peeters, June 24, 2024
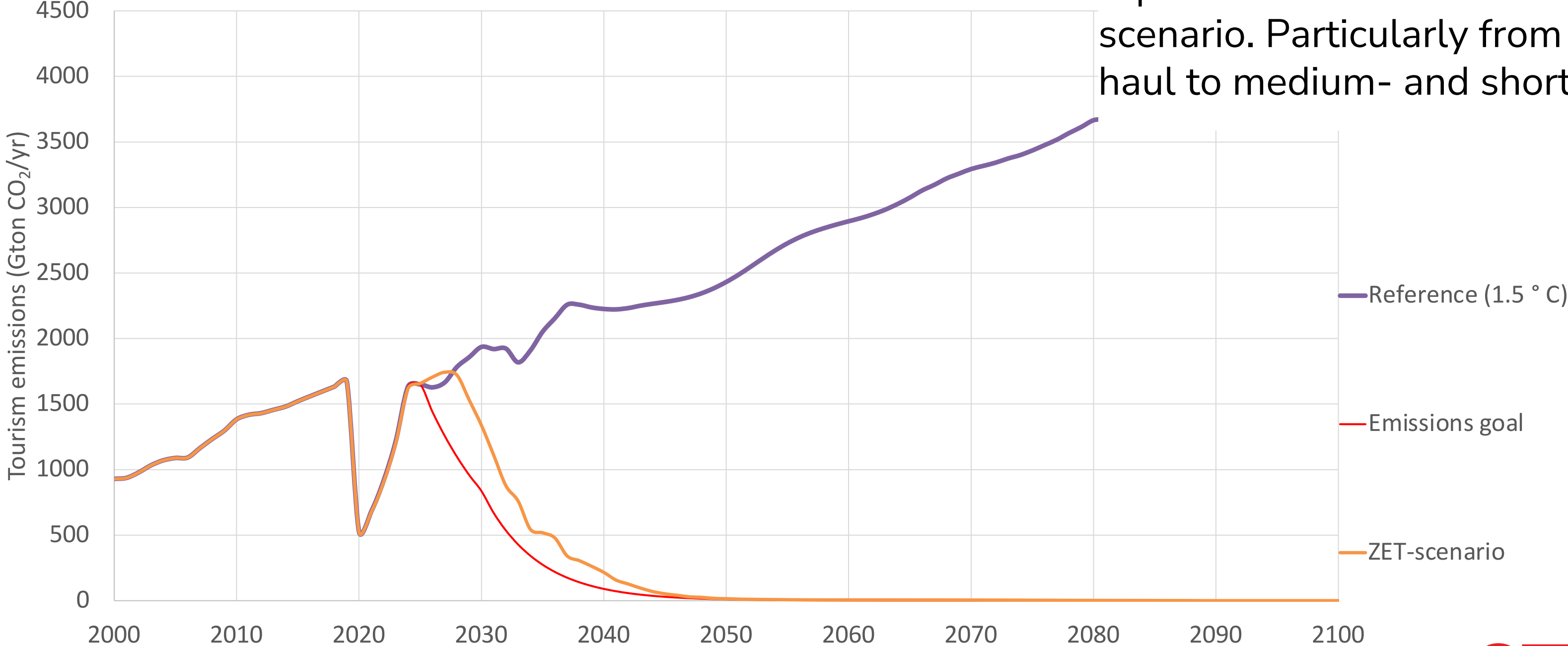
Consequences of the ZET

What do we need to know for zero-emissions?

- Everything on the ground is part of the Paris Agreement. Go with the flow as tourism sector:
  - Electrify everything
  - Save energy
  - Invest in renewables
  - Modal shift to public transport and rail

- Key parameters are:
  - Less air travel
  - Shorter distances
- So, destinations and tour operators should essentially measure the following metrics:
  - Share of tourists by air
  - Total distance travelled by tourists from home to the destination
    - Shares of SAF (share of their investments in electric flight)

Data & measurability
Paul Peeters, June 24, 2024

https://easy-peasy.ai/ai-image-generator/images/international-flights-airplanes-around-globe

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria Summit

How to calculate environmental impact?

$$E = \beta * V$$

$$\sum E \leq D$$

- "The environmental impact **E** of an activity is equal to the specific impact (per unit of the activity) **β** times the total volume **V** of the activity" and
- "for sustainable development the sum of all the impacts **E**" must be lower than the bearing capacity **D** of the earth (or region, country).
- Therefore 'the sustainability' of a product (or sector) can only be judged if all parameters **E**, **V**, **β** and **D** are evaluated. One-dimensional thinking leads to wrong conclusions!

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria
Summit

Ways to measure carbon footprints

- Direct emissions:
  - The emissions caused by burning fuel in cars, busses, diesel-trains, cruise-ships and aircraft
  - The emissions caused by the electricity powerplant that provides your accommodation, electric cars with electricity

- Indirect emissions:
  - Lifecycle: emissions for producing transport vehicles (cars, aircraft), infrastructure
    - This will be obligatory by EU legislation for enterprises claiming to sell 'green' products.
  - Supply-chain measurements
  - Non-CO_2 impacts in aviation
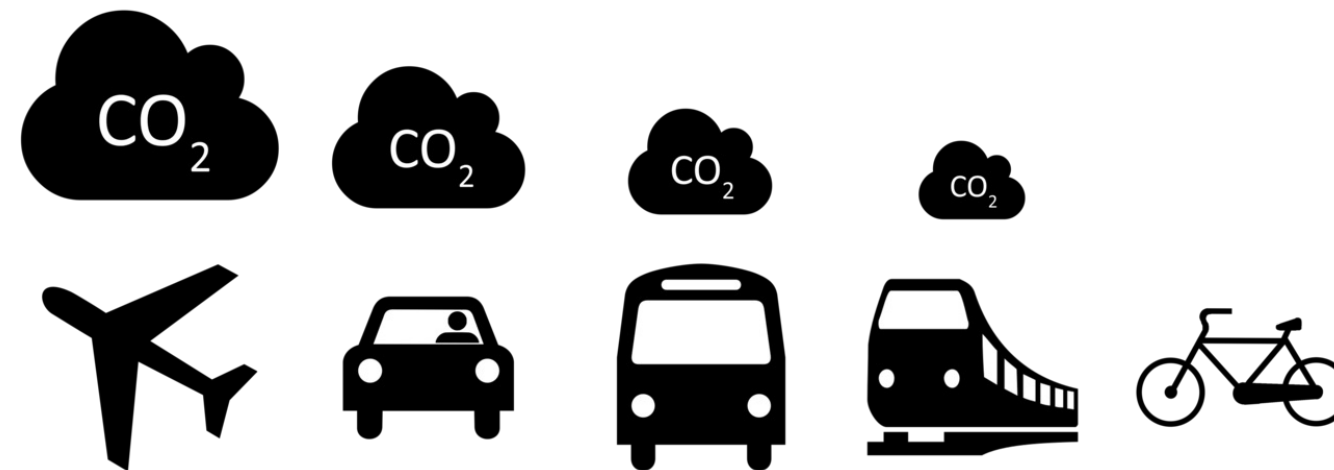
https://commons.wikimedia.org/wiki/File:Carbon_footprint_scale_of_transportation_means_

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria
Summit

Use and misuse of carbon footprints

- To inform tourists so they change behaviour
- To inform enterprises, so they change supply
- To inform politicians, so to can take the right decisions for sustainable development

- But data/measurements are often used to:
  1. Delay decision making: "they do not know the multiplier for non-CO2, supply chains, etc. so let us first wait for solutions in the models!"
  2. Confuse the public/politicians: "long-haul flights are better than short-haul"
  3. Shift responsibility:
  4. Obscure reality: "we will make the airport zero-emissions by 2030", we saved 50% energy in lighting hotel", "we, airline X, saved a million kg of CO2 last year"
  5. Used for things that cannot work like ecolabelling flights...

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
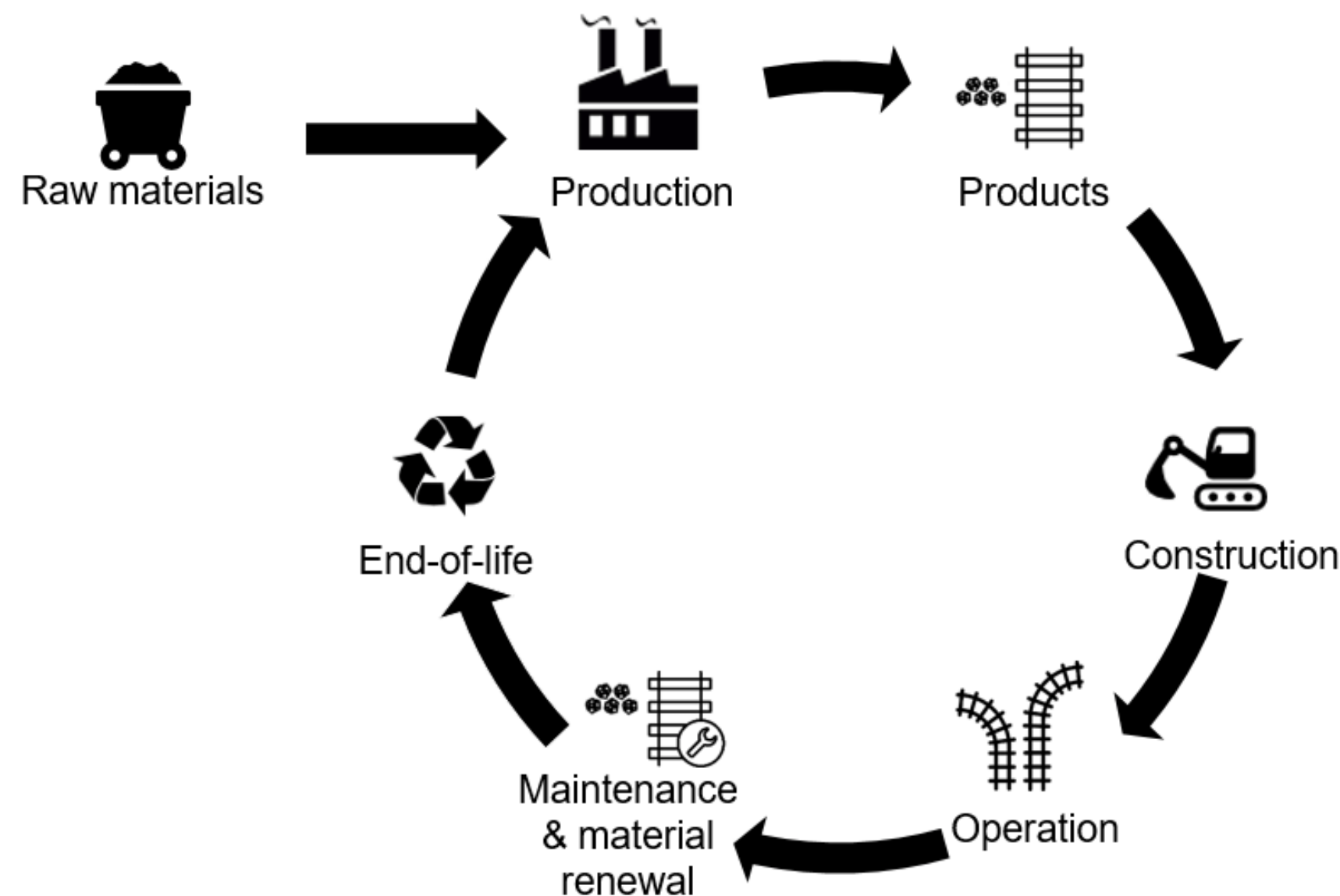Sustainable Tourism in Austria
Summit

Example carbon info air tickets

- Someone buying 'green' flight saves 8% emissions (average is some 10-15%)
- Nice saving. But is it?
  - Assume 100% of customers will choose the green flight:
    - That will be first sold out; then the others buy grey flights: with 80-90% seat occupancy → no kg of CO$_2$ will be saved mas the fleet is not changed, only the number of travellers is slightly differently distributed over flights
  - However, only 1-2% changes behaviour for this information
  - Many will see 'green' flights and reason "flying can be green, so no reason to bother anymore".
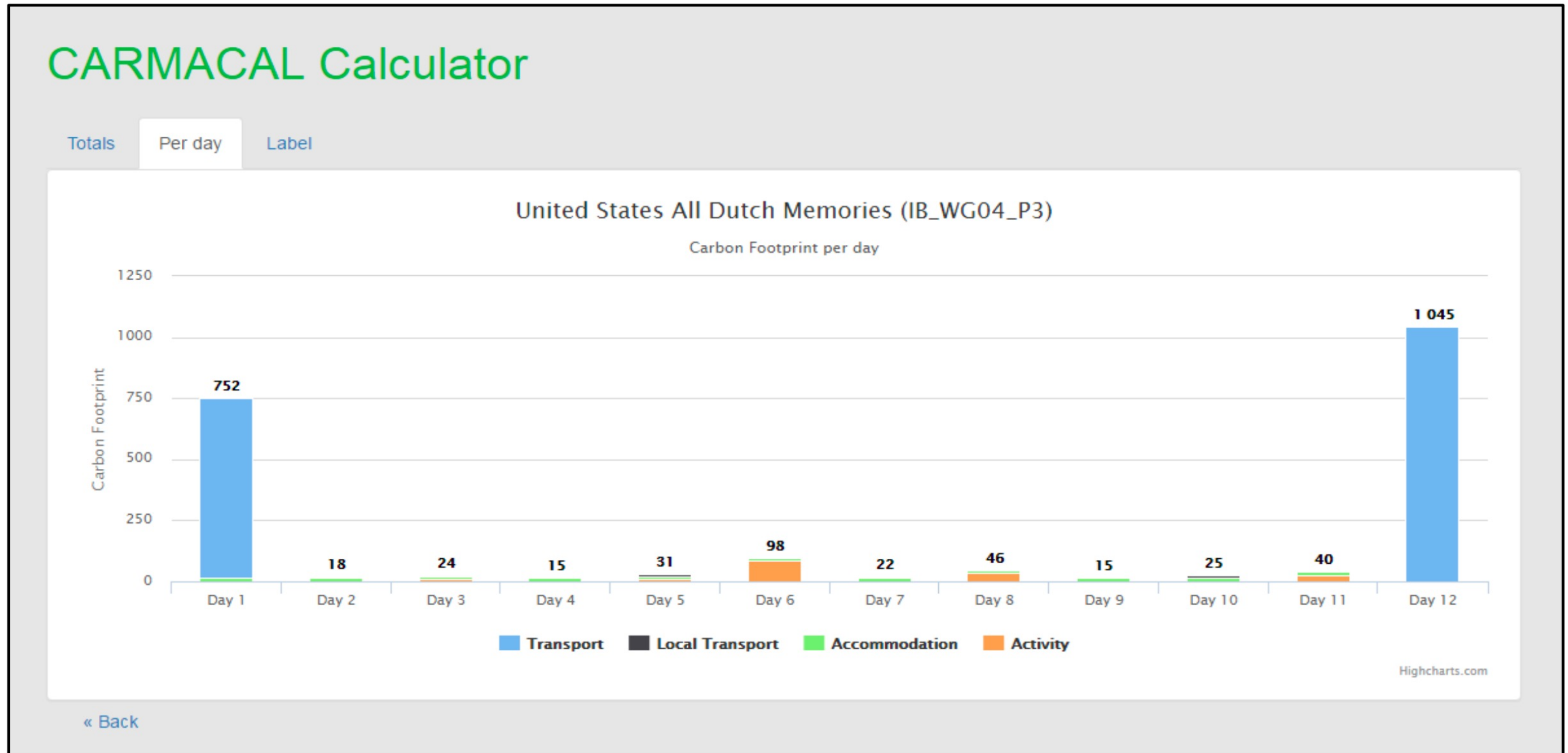
7:00 AM – 8:25 AM Lufthansa	1 hr 25 min AMS–MUC	Nonstop	74 kg CO2e Avg emissions ⓘ	€123	⌄
9:05 PM – 10:30 PM Lufthansa · Operated by Lufthansa CityLine	1 hr 25 min AMS–MUC	Nonstop	90 kg CO2e +20% emissions ⓘ	€123	⌄
9:00 PM – 10:25 PM KLM	1 hr 25 min AMS–MUC	Nonstop	92 kg CO2e +23% emissions ⓘ	€213	⌄
3:35 PM – 5:00 PM KLM	1 hr 25 min AMS–MUC	Nonstop	92 kg CO2e +23% emissions ⓘ	€235	⌄
6:40 PM – 8:05 PM KLM · Operated by KLM Cityhopper	1 hr 25 min AMS–MUC	Nonstop	69 kg CO2e -8% emissions ⓘ	€235	⌄
7:15 AM – 8:40 AM KLM · Operated by KLM Cityhopper	1 hr 25 min AMS–MUC	Nonstop	85 kg CO2e +13% emissions ⓘ	€262	⌄
9:35 AM – 11:00 AM KLM	1 hr 25 min AMS–MUC	Nonstop	92 kg CO2e +23% emissions ⓘ	€262	⌄
12:05 PM – 1:25 PM KLM · Operated by KLM Cityhopper	1 hr 20 min AMS–MUC	Nonstop	85 kg CO2e +13% emissions ⓘ	€294	⌄

Breda University OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria Summit

The case of (high-speed) rail and infrastructure emissions

- For **planning** a new line: relevant but highly depending on traffic volume.
  - But predicting traffic is almost impossible.
  - And CO$_2$ is in the first place serving people with better network and system with overall a relatively low footprint, not just CO$_2$.
- For **the traveller**, the choice should be based on marginal emissions; rail infra emissions are **irrelevant** ("Use that existing infra!")
- For TO, TA, destinations: make sure your **clients use rail** as much as possible
- **The problem** is the slack in the system (from other behaviour through ordering new aircraft to improved supply):
- **Short-term**:
  - Aviation is *hard-to-abate*, rail is *easy-to-abate* (some are true zero-emissions);
  - Air travel invites **ten times** larger distances and overconsumption

Raw materials → Production → Products → Construction → Operation → Maintenance & material renewal → End-of-life → Production

Data & measurability
Paul Peeters, June 24, 2024

Breda University OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria Summit

CARMACAL carbon management

Zero-emissions? Keep it simple and pragmatic!

- Measuring 'zero' is useless. We need **supply measures** because supply is the major problem and needs to change:
  - Reduce **airmiles**
  - Increase share of **SAF** (ultimately to 100% within 25 years)
  - Reduce average **distance** travelled of visitors/clients (reduce)
  - Invest only in **real zero-technology** in accommodation and attractions
  - Increase share **electric cars** in OD- and local transport
  - Increase share **public transport** in OD- and local transport
  - Increase share **vegan/vegetarian** meals
  - Reduce amount of **meat** per meal

Papp, B., Neelis, I., & Heslinga, J. H. (2023). Don't hate the players, hate the system! – The continuation of deep-rooted travel patterns in the face of shock events. *International Journal of Contemporary Hospitality Management*. https://doi.org/10.1108/IJCHM-09-2022-1177

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria Summit

Wrapping up

- Measure tourism's **aviation dependency, OD-distances, energy**
- We have no time to develop ever more detailed/comprehensive data models
- Ecolabels only if it changes the system massively and within a couple of years
- Use carbon footprint for product development and **carbon-management**
  - We don't have time to wait for ever more comprehensive or detailed metrics
  - More complex $\rightarrow$ more confusion
- Use **common sense** and stay away from 'fairy tales'
- If something sounds **too beautiful** to be true, it is generally false.

Data & measurability
Paul Peeters, June 24, 2024

Breda University
OF APPLIED SCIENCES

STiAS
Sustainable Tourism in Austria Summit