



ScenAIR2050
Futures of the Air Transport System
from the Future-User Perspective

IMPRINT

Project ScenAIR2050

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Cluster of Excellence SE²A

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CONTENT

Imprint	II
Content	1
The SE²A Cluster of Excellence	2
ScenAIR2050 project Objective & Process	4
Scenario Development – STEEP-Analysis	6
Scenario Development – System Analysis	8
Scenario Development – Projections and the Morphological Box as Raw Scenarios	10
Scenario Matrix - narrative description	12
Persona Method and its Use in the ScenAIR2050 Project	14
the ScenAIR2050 Persona Approach	16
ScenAIR2050 Future Persona Development	17
Scenario 1 // Description	19
Scenario 1 // Collage	20
Scenario 1 // Phae's life	23
Scenario 1 // Arik's life	25
Scenario 1 // WILD CARDS	26
Scenario 2 // Description	29
Scenario 2 // Collage	30
Scenario 2 // Phae's life	33
Scenario 2 // Arik's Life	35
Scenario 2 // Wild Card	36
Scenario 3 // Description	39
Scenario 3 // Collage	40
Scenario 3 // Phae's life	43
Scenario 3 // Arik's Life	45
Scenario 3 // Wild Card	46
Scenario 4 // Description	49
Scenario 4 // Collage	50
Scenario 4 // Phae's life	53
Scenario 4 // Arik's Life	55
Scenario 4 // Wild Card	56
References and Literature	59

In the context of the growing awareness of the accelerating climate crisis caused by human interference, the identification of solutions for more sustainable lifestyles has become a priority. The aviation sector, a significant contributor to CO₂ emissions, is regularly called upon to reduce its environmental impact. In order to develop the necessary solutions, technological solutions in particular are being sought in various research constellations consisting of interdisciplinary teams. One such notable initiative is the Cluster of Excellence SE²A – Sustainable Energy-Efficient Aviation, funded by the German Research Foundation (DFG). SE²A is an interdisciplinary research consortium focusing on future technologies for a sustainable and eco-friendly air transport system (ATS). The following institutions have joined forces in this scientific undertaking: These include the Technische Universität Braunschweig, the German Aerospace Center (DLR), Leibniz University Hannover (LUH), the Braunschweig University of Art (HBK), the National Metrology

Institute of Germany (PTB) and TU Delft in the Netherlands. Collaborating scientists represent the fields of aerospace, electrical, energy and chemical engineering, with the overarching objective being the reduction of emissions and noise, as well as recycling and life-cycle concepts for airframes and improvements in air traffic management.

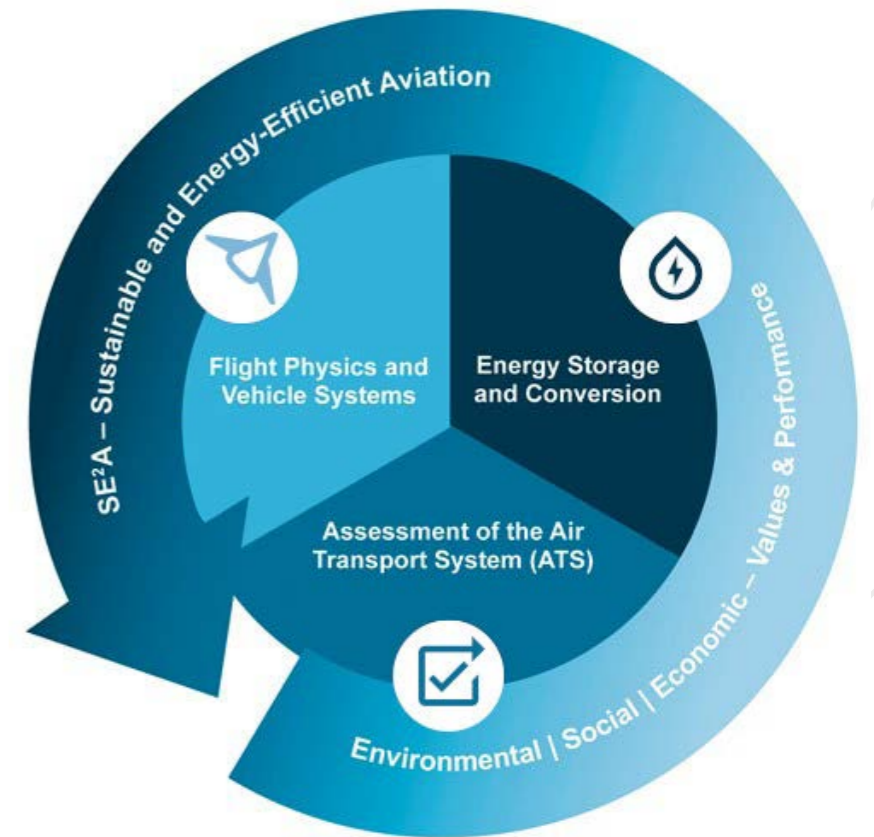
The development of aircraft engines, aircraft designs, energy sources and sustainably produced fuels such as green hydrogen or synthetic aviation fuels (SAF) to reduce the emission of climate-damaging substances is being pursued through appropriate fundamental research. In addition, research is being conducted into how composite materials, fuel cells and aerodynamics can be optimised. The cluster's research aimed to develop aircraft for short, medium and long distance passenger flight. The overarching structure of the Cluster is guided by its research objectives and is organised into three Integrated Cluster Areas (ICA), which in turn follow a coherent and coordinated roadmap. This structure

reflects the critical research demands and is coordinated to facilitate the exchange and integration of approaches and methods. The three ICA are as follows:

ICA A – “Assessment of the Air Transport System” focuses on system analysis and evaluation of the air transportation system in different future scenarios. These scenarios consider environmental, economic and social criteria simultaneously, with technology assessment including noise exposure and life-cycle analysis.

ICA B – “Flight Physics and Vehicle Systems” focuses on critical technologies for enhancing vehicle performance, and conducts fundamental research on enabling technologies for sustainable transport aircraft with zero-fossil energy supply. These enablers are expected to be active means of load control, drastic reductions of aircraft drag, and knowledge on integrating new functions into load-bearing structures, on new materials, and on design rules for composite structures.

ICA C – “Energy Storage and Conversion” deals with the fundamentals of providing the amount of energy and energy density required for flight. Technological prospects for the long term include full electrification of regional and short-range aircraft, while long-range aircraft will continue to rely on liquid fuels with high energy density. Between these distinct energy storage alternatives, there are hybrid concepts that open up a new design space for adapting the aircraft to specific requirements of its mission profile and for improving overall efficiency.



SE²A:

Short-haul Aircraft



Medium-haul Aircraft



Blended-Wing-Body



Image credit: SE²A/ Photo: Massel

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TU Braunschweig (2024) <https://www.tu-braunschweig.de/se2a>

ScenAIR2050 PROJECT OBJECTIVE & PROCESS

The project ScenAIR2050 is part of the Cluster of Excellence SE²A in ICA A and aims to develop alternative future scenarios for the Air Transport System (ATS) in 2050 with a focus on socio-economic factors. An important part of the research in the ScenAIR2050 project is the mapping of future users of the air transport system. The project assesses their lifestyles, attitudes and acceptance of new technologies for a sustainable, energy-efficient aviation system. The key research questions of the ScenAIR2050 project are

- What are plausible scenarios for the development of a sustainable and energy efficient air transport system (ATS) by 2050?
- How will people travel in the future and who will be the passengers of the future?
- How can the acceptance of technological developments by future stakeholders be assessed?

The research design of the ScenAIR2050 project is based on Research through Design (RtD), using the generic design process as described by Jonas (2007) as an APS model with the phases Analysis, Projection and Synthesis. In the context of design research, knowledge is generated from the present for the future through design and creative methods and practices. This process involves the conceptualisation and creation of artefacts in both tangible and intangible forms. Inter- and transdisciplinarity is a prerequisite for this research, using methods from design, art, social sciences and other

disciplines to work both empirically and generatively. In RtD, knowledge is acquired through both cognition and intuition.

An extension of the APS model is the **Futures Design Process Model (F-D-P-M), which integrates the concept of futures research on probable, possible, desirable and plausible futures.** The F-D-P-M (Ollenburg, 2019) provides the theoretical framework for a systematic and comprehensible approach to the development of different types of user-centred future scenarios in the respective phases. The integration of design and futures research facilitates the systematic incorporation of concepts and methods from futures studies, while drawing inspiration from design and adhering to scientific standards of reproducibility and transparency.

In the research process of ScenAIR2050, it was essential to include the perspectives of project partners within and outside SE²A. This exchange of knowledge took place through a series of surveys as well as through online and offline workshops.

The first survey was qualitative and consisted of five questions. The aim was to understand the participants' concepts and expectations for the future development of the ATS, their research activities in SE²A and to explore future perspectives and their assessment of possible outcomes. Two further surveys (Uncertainty/Impact Analysis) asked participants to assess and rate Social,

Technological, Economic, Environmental and Political factors relevant to the future development of the ATS (STEEP-Analysis).

In addition, workshops were conducted to gain the expertise of research partners on future developments. Initially, an online workshop was conducted to introduce the scenario technique. Later in the project, in another online workshop, we asked participants to work on the defined key factors and how they might evolve in different ways (key factor projections).

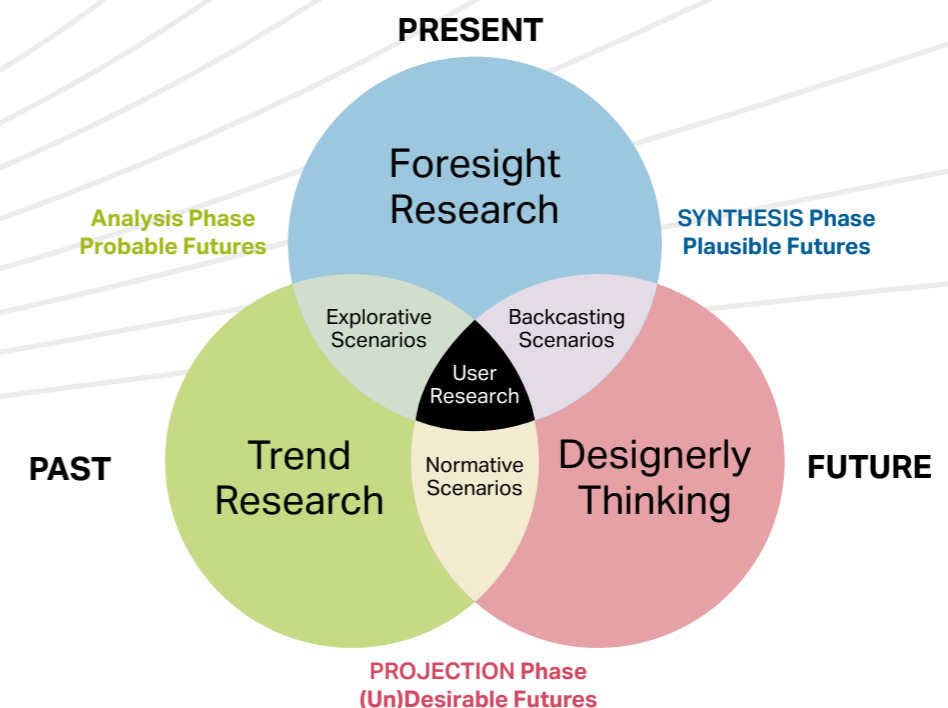
We generated four exploratory foresight scenarios based on our research. These formed the ground for two face-to-face workshops held in the summer of 2024 with cluster partners from different disciplines. Some of the results are presented in this publication: for example, the

collages and news stories that emerged from these participatory workshop designs.

All methods supported inter- and transdisciplinary exchange and uncovered existing knowledge and assumptions about future challenges within the research cluster. The research approach and methods of the ScenAIR2050 project can be related to the concepts and theoretical principles of technology assessment. Thus, the project not only generated the four exploratory scenarios, but also provided insights into the impact of technological developments on societies and the lifestyles of future users.

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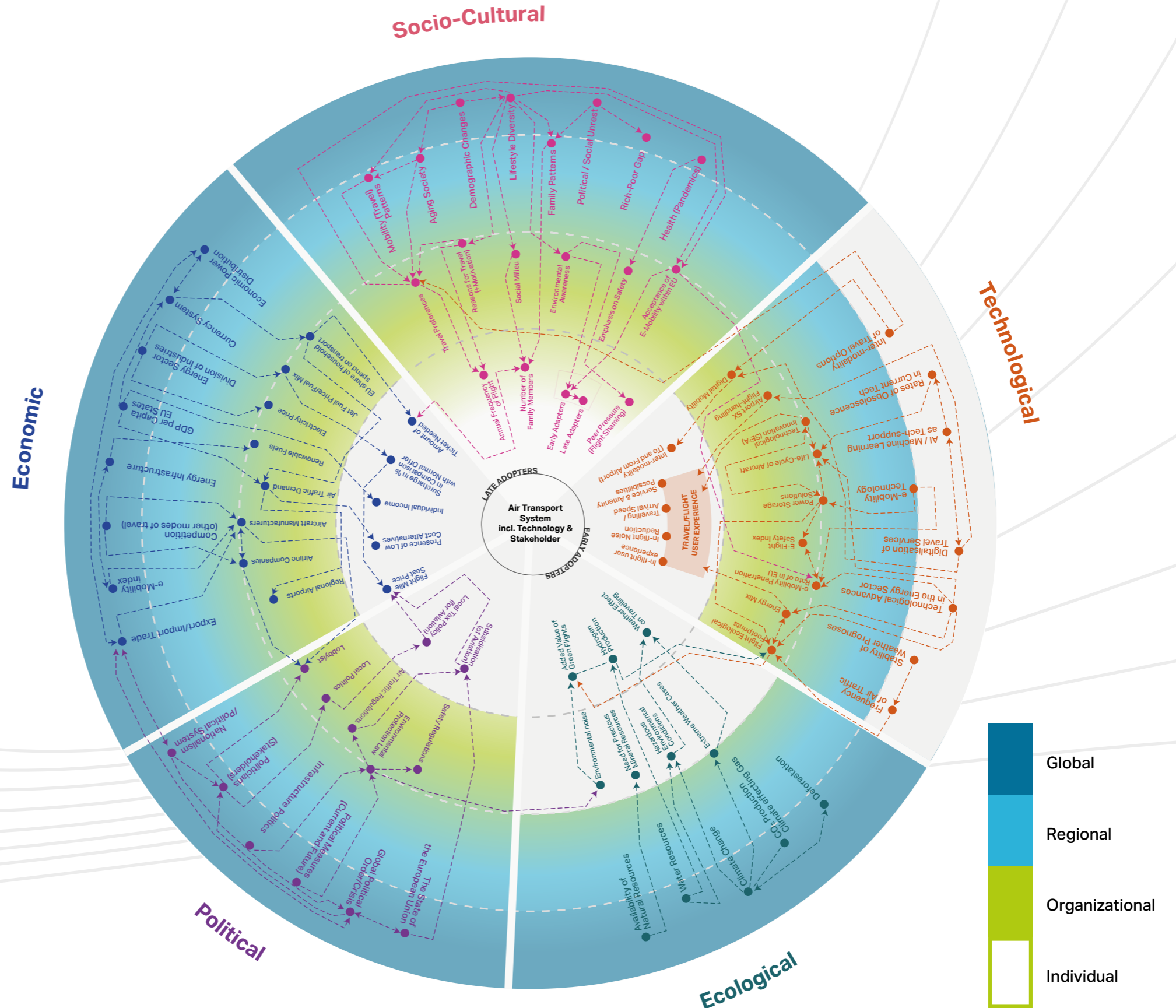


SCENARIO DEVELOPMENT – STEEP-ANALYSIS

In the process of developing scenarios for the Air Transport System (ATS) in 2050, the holistic and integrated methodology contributes to the plausibility and scientific rigour of the results. The approach supports the analysis of technological and social factors and their impact on the living conditions and lifestyles of future ATS users.

The research process involved the utilisation of a STEEP-Analysis. Initially, over 90 **S**ocial, **T**echnological, **E**conomic, **E**nvironmental and **P**olitical factors relevant to the development of a sustainable ATS in the future were collected. Through a series of interviews and workshops with project partners and experts, this was narrowed down to 25 key elements.

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SCENARIO DEVELOPMENT – SYSTEM ANALYSIS

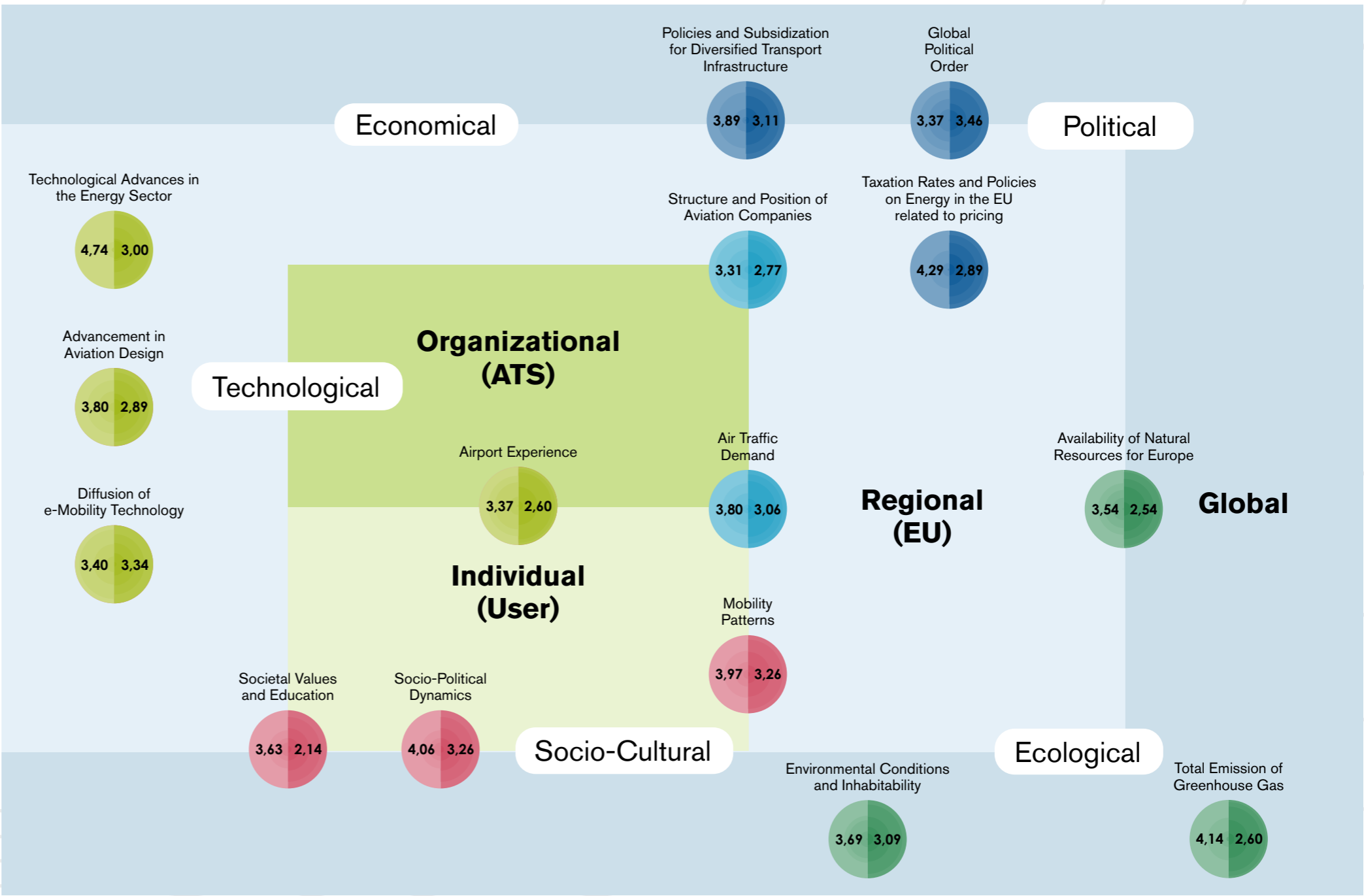
In the scenario process, an Uncertainty/Impact Analysis was used asynchronously, involving two surveys within the Cluster of Excellence. As a result, 15 factors were identified as central to the ATS. In the scenario methodology applied, these are the Key Factors, defined as areas with a high degree of uncertainty as to how they will evolve, while at the same time having a significant impact on the development of the future of the ATS.

The uncertainty of how each Key Factor will evolve is the basis for further research into plausible variations for change in that particular area. In futures research, these variations are referred to as projections. Each Key Factor should have at least two to four of such projections, representing divergent paths of development. In effect, they are like pinpointed scenarios that focus on one Key Factor.

By selecting one from each Key Factor, the projections become the building blocks for generating divergent exploratory scenarios. It is therefore important to have well-defined projections and also to carry out a Consistency Analysis. It evaluates the probability and plausibility of the simultaneous occurrence of the projections of one Key Factor to another. The results of the Consistency Analysis form the basis for scenario software such as Scenario Manager® to calculate an infinite number of raw scenarios.

(cont. next page)

SCENAIR2050 PROJECT: SYSTEM IMAGE OF THE AIR TRANSPORT SYSTEM



15 Key Factors with high uncertainty and high impact on the development of the Air Transport System in 2050.
(Graphics: Marius Land 2023 - for more information see Ollenburg 2024)

SCENARIO DEVELOPMENT – PROJECTIONS AND THE MORPHOLOGICAL BOX AS RAW SCENARIOS

In order to narrow down the number of scenarios in the ScenAIR2050 project, the calculation was performed under the premise that socio-cultural factors are dominant. The following depiction in the form of a Morphological Box of four raw scenarios is the result of the Consistency Analysis, the scenario calculation with the Scenario-Manager® software and an alignment to include all Key Factor projections.

01 Socio-political Dynamics	04 Mobility Patterns	07 Societal Values and Education	08 Customer Experience and Airports	09 Technological Advances in the Energy Sector	10 Advancement in Aviation Design	12 Propulsion Technology as Driver for e-mobility Diffusion	14 Air Traffic Demand	15 Structure and Position of Aviation Companies	18 Environmental Conditions and In-habitability	20 Total Emission of Greenhouse Gas	21 Availability of Natural Resources for Europe	22 Taxation Rates and Policies on Energy in the EU related to Pricing	23 Policies and Subsidization for Diversified Transport Infrastructure	24 Global Political Order
Post Truth - Ideological Divide with Based on Individualism	Parallel local & global lifestyle	Elite rules - Education Elitist with Social Equality Decreasing	Boutique Airports - High Delay with luxurious Functionality / De & Centralized	Energy crisis - rare availability of resources with fragmented global energy production	Ecology of Air Vehicles w/ Aircraft Classes open with Primate cost efficiency and profit.	Kerosene / SAF Turbine - e-Mobility is rarely available	Flying for the few - rich-poor gap increase with main transport air traffic	High competition between incumbent and start-up players	Natural Disasters occur frequently. Transportation shrinks but remains stable.	Business as usual / >3-4 degree / Severe Consequences	EU's industrial and economic opportunities are limited.	No regulations, local energy supply, insecurity, & conflicts	Free Market w/ emissions high with regulation by free market	Fragmentation of EU - mindset is nationalistic with global power loses.
Climate Crisis is Real - Ideological Consensus with Based on Individualism	New lifestyles no longer require long distances.	Protest and Unions - Education for Everyone with Social Equality Decreasing	Remote central airports, high security - High Delay from Door to Door High with Technical Functionality / Centralized	Sharing is caring - rare availability of resources with standardized global energy production	The sustainable fleet w/ Aircraft Classes fixed with Primate Sustainability	Battery Powered w/ e-Mobility is readily available	Local travel for the few w/ rich-poor gap increase with main transport intermodality	Polypolization of competing manufacturers and airlines. Channelled Lobby interests	Mostly local Transportation due to harsh conditions	Reduction of total CO ₂ / 1.5 to 2 degree Manageable Consequences	Accessing resources is becoming more difficult and must be compensated by new/alternative technologies.	High CO ₂ taxation = high energy prices w/ Full blown CO ₂ Carbon taxation	EU forced green transition w/ emissions net-zero with regulation by government.	EU as slow Bureaucracy-mindset is European with global power loses.
The Many Truths w/ Ideological Divide with Based on Community	People are globally networked. - with affordable travel & Digitalization	Some are more equal w/ Education Elitist with Social Equality Increasing	Fast-Paced Airports in the City - Low Delay from Door to Door with Functionality Luxury / Decentralized	Roaring markets - abundant availability of resources with fragmented global energy production	The profitable Aircraft Classes fixed with Primate cost efficiency & profit	Mixed Hybrid Electrical, SAF, Turbine w/ e-Mobility is tolerated	Flying for the masses w/ rich-poor gap decrease with main transport air traffic	Monopolistic European air company w/ high influence through lobbyism	Impact is mitigated by technological means.- Drastic measures & expansion of nature reserves	Politically managed decline / >2 degree / harsh consequences	EU's financial strength provides market power to buy resources.	No tax or subsidies, re-orientation to fossil fuels, further exploration	Flight budget w/ emissions high with regulation by government.	A "Make EU great again" mindset is nationalist with global power gains.
Together for Truth w/ Ideological Consensus with Based on Community	15-minute cities and adapted infrastructures in Europe's metropolis	A fair share for everyone w/ Education for Everyone with Social Equality Increasing	Networked central & local airports w/ Low Delay from Door to Door w/ Technical Functionality / De- & Centralized	World of plenty w/ abundant availability of resources with standardized global energy production	Alternative modes of flight w/ Aircraft Classes open with Primate Sustainability	Hydrogen w/ e-Mobility is available based on hydrogen technology	Local mobility pass w/ rich-poor gap decrease with main transport intermodality.	Monopolization through forced fusion w/ Due to the poor crisis resistance of commercial airlines	Restricted living spaces and no-fly zones voids harsh living areas.	Restricted living spaces and no-fly zones voids harsh living areas.	Europe meets its demands.	State run energy infrastructure - the EU becomes an "energy-dealer"	Green Innovation boom w/ emissions net zero with regulation by free market	EU as super democracy w/ mindset is European with global power gains.

Four raw scenarios for the Air Transport System in 2050 based on STEEP- Analysis

SCENARIO MATRIX - NARRATIVE DESCRIPTION

The ScenAIR2050 project has yielded scenarios that illustrate the evolution of fundamental needs and motivations into tangible narratives. They function as a testing ground for technologies and a wellspring of inspiration, prompting questions that have hitherto received only cursory consideration. These include the impact of climate disasters and climate change on travel habits; the future affordability of long-distance travel for households with low, but also medium, incomes; the influence of ideological beliefs on the aviation system; and the assessment of air travel as part of an environmentally friendly and sustainable transport infrastructure.

The following four summary descriptions of future scenarios for the ATS in 2050 are the result of the process described. Each scenario is represented in a field within a matrix, with the dimensions delineating social-economic development in the context of aviation primacy. These scenarios are described in accordance with their respective dimensions.

- Scenario 1:** Ideological division ignores climate crisis: social-economic development: fragmentation; decreasing social equality; affordable for few, in conflict with the dimension of the aviation primacy: profit and efficiency.
- Scenario 2:** Sustainable flying in an unbalanced society: Dimension of social economic development: fragmentation; decreasing social equality; affordable for a few, in conflict with the dimension of air traffic primacy: sustainable and energy efficient.
- Scenario 3:** A fragmented sky divided by ideology: social economic development dimension: on the path to equilibrium; increasing social equality; affordable for many, in conflict with the dimension of the aviation primacy: profit and efficiency.
- Scenario 4:** Prosperity in Europe with a unified transport regime: social-economic development dimension: on the road to equilibrium; increasing social equality; affordable for many, in conflict with the aviation primacy dimension: sustainable and energy-efficient.
- For a more detailed description, please refer to the matrix on the opposite side.

Air Transport Primacy: Profit & Efficiency

Social-Economic development:
Fragmentation / Decreasing social equality / Affordable for the few

<p>Scenario 1: Ideological Division disregard Climate Crisis</p> <p>In an era, where individualism reigns, personal freedom is prioritised, and truth becomes very subjective. Diverse and often conflicting beliefs undermine common scientific understanding, fuelling ideological divides. Only the affluent have access to quality education, resulting in a workforce shortage and a polarised society, widening the rich-poor gap. Beyond the economic and ideological fragmentation people prioritise personal convenience, leading to increased demand for customised travel options, yet affordable air travel is scarce.</p>	<p>Scenario 2: Sustainable Flight in an Unbalanced Society</p> <p>The collective awareness has taken hold that the climate crisis is real. In Europe the scarcity of resources is leading to a decline in economic power and the gap between rich and poor widens. Protests over social inequality are commonplace, even though this society is shaped by individualists. At the same time, most people no longer need to travel long distances. Innovative options for travelling are continually emerging. The air transport system relies mainly on battery-powered small aircraft.</p>
<p>Scenario 3: Fractured Skies Divided by Ideology</p> <p>An ideologically divided society is split into distinct interest groups that remain true to their own convictions with contacts around the world close to their beliefs. Resources are plentiful and people are doing well economically. Despite increased social equality, an elitist education trend persists, granting privileges to a few. Air travel is inexpensive and affordable whilst relying on proven rather than innovative technologies. Airports, integrated into city infrastructure, offer seamless and luxurious travel experiences, enhancing personal connectivity. Profit is paramount and sustainability has few advocates. The climate crisis is imminent but ignored as a daily occurrence.</p>	<p>Scenario 4: Prosperity in Europe's United Horizon</p> <p>Europe operates on a community-centric ideology, emphasising collective needs, fostering ethical values including a commitment to sustainability. The successful implementation of 15-minute cities boosts quality of life, promoting remote work. Education is free and accessible, promoting social equality, while economic well-being narrows the rich-poor gap. As sole proprietor, the EU has created an efficient air transport system with strict regulations for emissions. It enabled streamlined air travel, networking central and local airports to reduce delays and environmental impact.</p>

Air Transport Primacy: Sustainable & Energy-Efficient

Social-Economic development:
Towards balance / Increasing social equality / Affordable for many

PERSONA METHOD AND ITS USE IN THE ScenAIR2050 PROJECT

By Minh-Hieu Pham (edited by Stefanie Ollenburg)

The persona method has its origins in theatre, and was further developed in the 1980s by US software designer and author Alan Cooper (Cooper et al. 2014) for the field of human-computer interaction. It is widely used in product development, particularly in the context of design and marketing. In work with foresight and futures research, the method has been extended to narrate scenarios using "future personas". The German consulting firm z_Punkt, for example, understands that "[...] personas [...] translate abstract target group models or areas of need into concrete, comprehensible life contexts that function on a factual but also on an emotional level" (Neef et al. 2024: 3). The use of personas reduces the complexity of scenarios by telling the story of a specific living environment. Their focus identifies and highlights the lived experience and brings the scenario closer to the reader.

Personas are often based on the more complex typology found in archetypes to support a more reflective representation of users and increase affectivity (cf. Cooper et al. 2014: 96 f.). Archetypes contrast with stereotypes. The latter tend to reduce users based on simplifications and biases of those using the method, and can lead to distortions in the process.

However, it can be valuable to use personas that are partly based on stereotypes, as so-called "ad hoc personas" (cf. Ollenburg et al. 2021: 9), if this is done consciously, with an awareness of personal assumptions, and depending on the research objective. As such

by using this intuitively based process and applying it to scenarios, unforeseen attitudes and behaviours of the respective personas can be uncovered (ibid.).

For the ScenAIR2050 project, the persona method was used to narratively complement the scenarios developed. This combines the fields of design and futures research. Future personas are particularly suitable for qualitatively supplementing the analytical-empirical basis of the scenarios developed (cf. ibid.: 4). They support and serve well as a communication tool (cf. Ollenburg et al. 2021: 9). The stories of the personas provide an access to a future living environment and make the scenario more comprehensible. In futures research, Fischer proposes a semiotic approach (cf. Fischer 2016: 203 f.) by accessing images of the future via a narrative level of interpretation. They not only offer images of the future, but also the potential for transformation processes for co-design (ibid: 204). "A semiotic approach could therefore decisively enrich the usual research processes for creating images of the future when it comes to uncovering transformation potentials and making them accessible" (ibid.: 205 - own translation). In this way, telling stories about different futures can create an awareness of future flux and, in the best case, inspire action and the desire to shape the future.

With their focus on design processes, Madsen and Nielsen, among others, show with their persona scenarios (cf. Madsen et al. 2010) how

effectively personas can be integrated into narrative tools, which can be applied to the scenario stories of ScenAIR2050 (ibid.: 64 f.). Their analysis of narrative theory shows that well-structured stories are intuitively better understood by people (ibid: 63f). In design processes and as narrative persona scenarios, she promotes the creation of knowledge in interdisciplinary working groups. Based on storytelling and narratives, it is suggested to follow a structure when developing persona scenarios (ibid: 65). In particular, it is important for the effectiveness of the persona scenario description that it includes, for example, a description of the character, his problem and the attempted solution in as much detail as possible. This promotes deeper understanding within the story and facilitates further thinking about possible solutions (ibid: 64).

Simulated realities can encourage a change of perspective. This shift creates a closeness to a fictional person on the one hand, and a distance from one's own assumptions about the future on the other. As a result, personas open up emotional access to life plans. This can lead to greater understanding and empathy among stakeholders involved in a project (cf. Ollenburg et al. 2021: 9).

The ScenAIR2050 project draws on the findings of the persona method. The narrative expansion of the scenarios developed is intended to generate an even deeper understanding of possible futures. An emotional approach through relatable personas is

intended to challenge one's own assumptions and encourage further thinking. In particular, unforeseen events and behaviours of the personas can promote an awareness of the changeability of futures. This can, for example, challenge conservative patterns of thought and action and lead to innovative solutions. Overall, the work of the participants in the interdisciplinary research network SE²A can benefit from this.

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THE ScenAIR2050 PERSONA APPROACH

The primary objective of this research is to achieve the following two-fold goal: first, to ascertain the target demographic for the air transport system in 2050; and second, to gain a more in-depth understanding of the potential users of such a system. To this end, the present research describes the personalities of two personas and their current living conditions.

MEET PHAE IN 2024



Phae was born in 1997 in Leer, Germany. Her father is an industrial mechanic who works for a large company and is now in management. Her mother was a housewife. Since the separation of her parents in 2016, her mother works as a hairdresser. Phae is the first born and has a brother three years younger than her. She has been passionate about aerospace and engineering since she was young. In her late teens she also became increasingly interested in poetry, feminist writing, travel and science. She graduated from high school in 2017. After a short break, she then started her studies at the TU Munich. At the moment she is writing her thesis to get a Master's degree in aerospace engineering.

MEET ARIK IN 2024



Arik was born on 7 March 2023 in a small town near Hamburg. He is the first child of his parents. His 30-year-old father is an electrician who works for a small company in town and likes to do handicrafts. His mother is 27 and studied mechanical engineering in Hamburg. She has just returned to work as a researcher and is thinking of doing her PhD. She wants to become a professor of aeronautics. For financial reasons, they live in an old farmhouse that they share with three other families.

ScenAIR2050 FUTURE PERSONA DEVELOPMENT

The second step of the process involved the implementation of the four scenarios that had been generated during the project. Each of these scenarios represented a different world, and the personas were placed within these worlds. The development of future personas in this manner is a unique approach, and, to the best of our knowledge, has not been previously employed.

The assumption is that both personas in each of the scenarios will adapt to the world they encounter in the four distinctly different scenarios. To reduce our personal biases, we used ChatGPT as a tool to support the storytelling process. We gave the tool our scenarios, including the corresponding key factor descriptions and a detailed persona profile. We used the following prompt:

Integrate "Persona Name" as the protagonist in the described "Scenario No.". Describe life in the world of "Scenario No." by answering the following questions

- Who is the persona in 2050?
- What is his/her daily routine?
- How has the persona changed from the person they were in 2024 to the person they are in 2050?
- What are the positive aspects of their life?
- What is their dilemma?
- What is their perspective on the development of this world from 2024 to 2050?

Based on the responses generated by the ChatGPT tool, narratives were written for each persona. They highlight the changes in the world described in each scenario and how they affect the lifestyles of our personas. The stories are meant to show how our environment and the developments in the world affect our personal lifestyle and the lives of the next generations.

MEET PHAE IN 2050

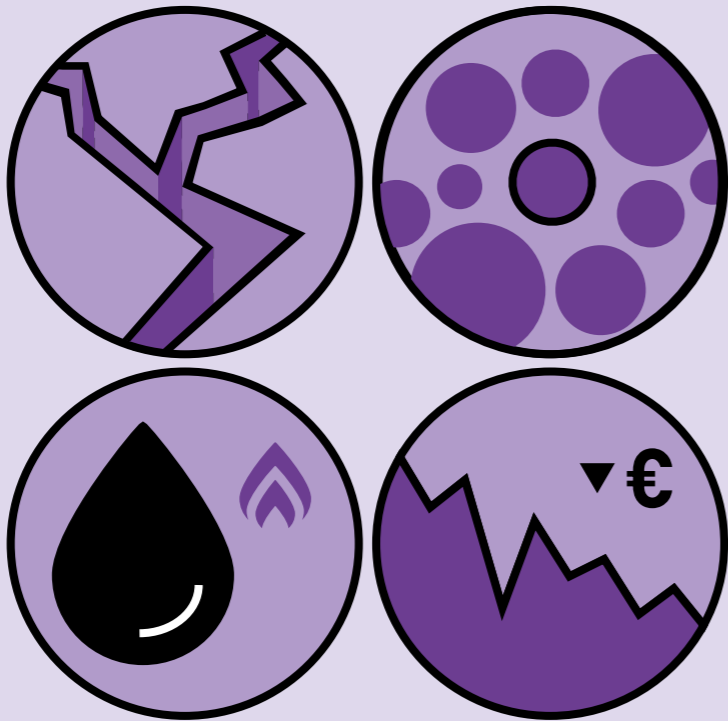


MEET ARIK IN 2050



Ideological Division disregard Climate Crisis

01
ScenAIR2050



In an era, where individualism reigns, personal freedom is prioritised, and truth becomes very subjective. Diverse and often conflicting beliefs undermine common scientific understanding, fueling ideological divides. Only the affluent have access to quality education, resulting in a workforce shortage and a polarised society, widening the rich-poor gap. Beyond the economic and ideological fragmentation people prioritise personal convenience, leading to increased demand for customised travel options, yet affordable air travel is scarce.

SCENARIO 1 // DESCRIPTION

Ideological Divide and Ignoring Climate Crisis

In the year 2050, the world is characterised by a deep ideological divide, driven by individualism and scepticism towards established facts. This societal landscape has significant implications for various aspects of life, including transportation, education, and global politics. In this world of ideological divide and transportation challenges, societal values clash with ecological imperatives, exacerbating inequalities and geopolitical tensions. A lack of regulations in the energy sector contributes to high emissions. Long-range travel remains relying on air transport, further exacerbating ecological concerns. The volatile ecological conditions, the limited access to raw materials and Europe's political and ideological fragmentation put a huge strain on the aviation sector.

SOCIO-CULTURAL

Individuals place a premium on personal freedom, leading to a proliferation of diverging opinions. Beliefs are shaped less by scientific evidence and more by personal convictions, intensifying societal polarisation and complicating decision-making processes. New working models have unlocked more free time for individuals, enabling a parallel lifestyle where people balance local community engagement with global exploration. Denser neighbourhoods foster dynamic but stressful daily lives, prompting a desire for travel abroad to escape urban pressures. Despite economic disparities the fragmentation of personal beliefs affects aviation as people prioritise personal convenience, leading to increased demand for customised travel options.

ECONOMIC

The education system has become increasingly elitist, with only wealthy families able to afford quality education. This exacerbates social inequality and contributes to a lack of qualified workforce, further entrenching economic disparities. An energy crisis looms large due to rare resource availability and fragmented global energy production. The rich-poor gap widens and air travel becomes stratified into luxury and economy classes. Frequent flyer demand drives up prices, further limiting access for the majority.

POLITICAL

The European Union fragments into individual nation-states, leading to a decline in economic and political power. Research and development suffer from fragmentation and infrastructure gaps, exacerbating economic challenges and hindering global competitiveness.

Nationalist sentiments dominate global politics, leading to power struggles and diminished global cooperation. Individual countries vie for economic and political dominance, resulting in a fractured geopolitical landscape with uncertain consequences.

TECHNOLOGICAL

Technological advancements are hindered by an energy crisis, with renewable energy stagnating due to resource scarcity and geopolitical conflicts. Aviation relies heavily on fossil fuels, maintaining high emissions with only a small sector using sustainable aviation fuels (SAF). High competition among established and start-up airlines fosters optimization. There are numerous manufacturers in aviation competing with each other to develop aircraft types for long-, medium- and short-haul flights as well as for urban air mobility. The focus remains on cost efficiency and profit, rather than sustainability. Airports transform into luxurious, centralised hubs, integrating various infrastructures to accommodate frequent travelers. This centralization, however, leads to significant delays despite seamless travel experiences. The aviation sector sees fluctuating prices, with high demand for luxury air travel and limited affordable options, catering primarily to the elite.

ECOLOGICAL

Frequent natural disasters and severe weather events disrupt global transportation, making regions uninhabitable. The majority of people rely more and more on localised transportation and travel. Fossil fuels remain the primary source for mobility, leading to high emissions and ecological degradation.

Ideological Divide and Ignoring Climate Crisis



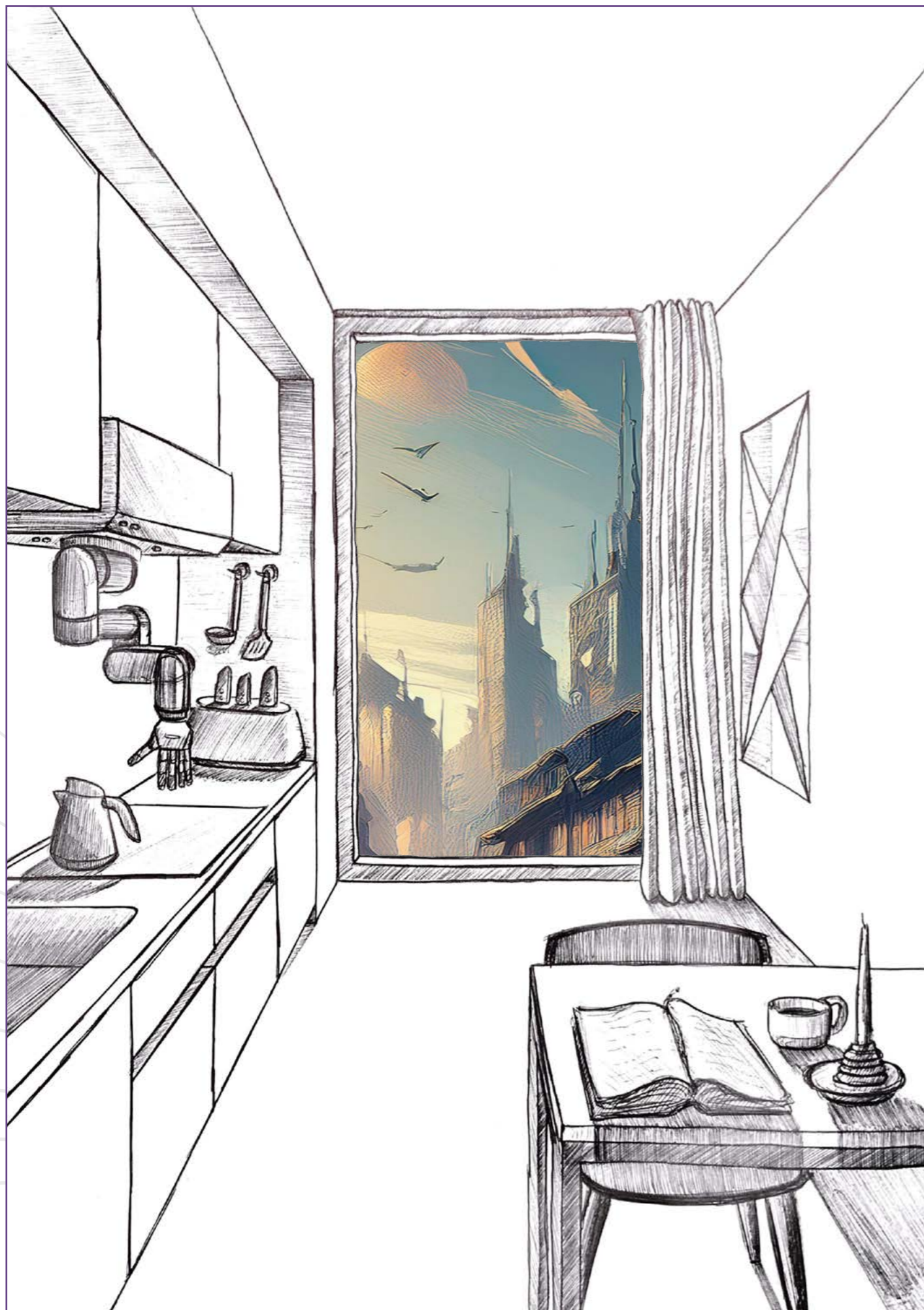
WORKSHOP -ANALYSIS

The scenario "Ideological Divide and Ignoring Climate Crisis" projects a future (2050) where societal divisions, fuelled by individualism and scepticism towards science, hinder climate action. This leads to an uneven distribution of resources, technological stagnation in sustainable energy, and a fragmented aviation industry catering primarily to the wealthy. The analysis also covers aspects of socio-cultural shifts, political fragmentation, and ecological consequences.

The group in the workshop understood that in the scenario the focus of the aviation industry is characterized by an ideological divide and disregard for climate change. The key points are:

- **Societal Attitudes:** Aviation is viewed differently by the rich (as a privilege) and the poor (as unfair).
- **Science's Role:** Scientific advancements in aviation are hampered by economic pressures, conflicting societal values, geopolitical issues, and a lack of influence.
- **Aviation Industry State:** The industry continues "business as usual" with a reliance on fossil fuels, limited cooperation, and infrastructure problems. The rich enjoy luxury options, while the poor face delays, cramped spaces, and limited affordable choices. Decision-making is driven by market forces and national interests.
- **Energy System:** The energy system remains largely reliant on fossil fuels, with limited use of sustainable aviation fuel (SAF), and distribution is vulnerable to geopolitical conflicts.
- **Transportation Structure:** The transportation system is becoming more localized due to geopolitical issues and conflicts regarding energy distribution, though long-haul travel remains reliant on aviation.
- **Airport Infrastructure:** Airports are centralized hubs, luxurious but prone to delays, offering variable mobility options mainly for the wealthy, and heightened security due to conflicts.

The overall narrative tells about a world where technological progress in aviation is constrained by societal divisions and a lack of commitment to sustainability.



SCENARIO 1 // PHAE'S LIFE

Ideological Divide and Ignoring Climate Crisis

PHAE IN 2050: A STORY OF DIVIDES AND DREAMS

In 2050, Phae, now 53, grapples with a fractured world defined by ideological divides and environmental crises. Once a passionate aerospace engineer from the coastal town of Leer, she finds herself living in a crowded urban complex near Stuttgart, where the effects of climate change and resource scarcity have severely altered life.

Her career in aviation, initially filled with optimism for innovation and sustainability, has become constrained by deteriorating economic conditions and a shift towards catering to an elite clientele. Phae now coordinates designs for conventional aircraft amidst industry turmoil and increased competition, while the dream of sustainable aviation remains largely out of reach.

Phae's idealism has faded into pragmatism; she still believes in humanity's potential but is disheartened by a society increasingly fuelled by individual beliefs and misinformation. Her personal connections have diminished, pivoting largely to virtual interactions marked by divisive arguments.

Despite her struggles, she finds solace in her engineering work and engages with poetry and feminist literature, using her writing as a form of protest against societal chaos. However, she faces a profound dilemma as she struggles with the environmental impact of her work while witnessing rising inequality in education and opportunity for future generations.

Between 2024 and 2050, Phae has seen Europe politically and socially collapse, leading to a regression in global cooperation. The aviation industry, once a unifying force, has become a symbol of elite privilege, leaving Phae mourning the loss of shared progress and the long-term solutions she once hoped for.



SCENARIO 1 // ARIK'S LIFE

Ideological Divide and Ignoring Climate Crisis

ARIK'S JOURNEY THROUGH THE DIVIDE: NAVIGATING A FRACTURED FUTURE

In the year 2050, 27-year-old Arik lives in a society divided by strong individualism and different beliefs. He grew up near Hamburg, influenced by his father's conservative values and his mother's progressive ideas. Now that he's at university in Bremen, he appreciates learning about technology, even if the education isn't the best.

Arik balances his day between studying and working at a DIY store. He finds peace in nature and enjoys spending time with his friends. These friendships, and visits to his mother's home, help to reinforce his interest in community and sustainability. However, Arik struggles to choose between his father's traditional views and his mother's forward thinking.

From a curious child in 2024, Arik has grown into an adult navigating societal pressures and conflicting beliefs. He struggles to choose between a traditional engineering career and a focus on environmental issues, feeling the tension between personal freedom and social responsibility.

Despite his disappointment with the direction of society, Arik is hopeful about the future. He would like to see more community action rather than isolation and is committed to protecting the environment. Arik's story shows the importance of kindness, understanding and cooperation in a divided world, and suggests that there is hope for unity.

SCENARIO 1 // WILD CARDS
Ideological Divide and Ignoring Climate Crisis

Eco-Terrorism



Ecological-terrorism takes a dangerous turn as eco-activist guerellia groups resort to shooting down airplanes, escalating political tensions and posing significant threats to air travel security.

FUTURES NEWS

SE²A FUTURES

TOMORROW'S AVIATION NEWS TODAY

July 10, 2050, ICA Nr. A1.1 HBK Braunschweig | Institute for Design Research ScenAIR2050

Aviation Industry in crisis. So is our economy.

With demand for air travel declining, airlines today face a dilemma. They are struggling to pay for landing fees and catering. Some even grounded their planes due to maintenance problems. Pilot and cabin crew report that following lay-offs they haven't received their last salaries. MRO (Maintenance, Repair and Operations) is shifting its business to general maintenance of heavy equipment, and the rest of the supporting business such as catering, hotels and fast package delivery is equally in turmoil.

Anti-ecological movement rises

New technologies invented to counter terrorism.

New AI technologies have been invented to identify terrorism threats. The SHIELD can protect your flight from terrorist missiles. It is the drones that sacrifice themselves to protect your planes from sudden attack.

More News

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Planetary call for people of all sides to unite.



Global leaders urge unified front for peace and sustainability. After the horrific events the world witnessed last week, global leaders are now opening their eyes. Faced with the stark contrast of ideologies and what undermining either can lead to, a desperate cry for help is being issued by the UN. In an era of clickbait journalism, divisive arguments and of journalists telling you "what" to think rather than "why" to think, this call to unification was surprisingly well listened to.

Aviation remains dependent on fossil fuels

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EU weakens as key allies withdraw

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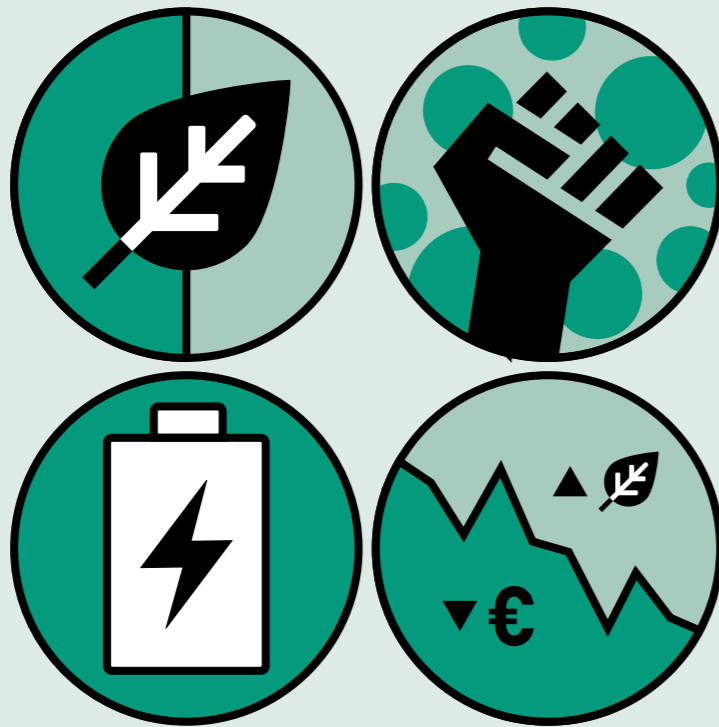
Only the Rich can Fly

Massive attacks on civilian aircraft by terrorists are leading to major changes in aviation security stand-ards. It is forcing govern-ments and the military to get involved to ensure the safety of travellers. As a result, the cost of air travel rises significantly. Now, the aviation industry contin-ues to suffer financially as more and more people cannot afford to pay for travel by plane.

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Sustainable Flight in an Unbalanced Society

02
ScenAIR2050



The collective awareness has taken hold that the climate crisis is real. In Europe the scarcity of resources is leading to a decline in economic power and the gap between rich and poor widens. Protests over social inequality are commonplace, even though this society is shaped by individualists. At the same time, most people no longer need to travel long distances. Innovative options for travelling are continually emerging. The air transport system relies mainly on battery-powered small aircraft.

SCENARIO 2 // DESCRIPTION

Sustainable Flight in an Unbalanced Society

In the year 2050, the reality of the climate crisis has instigated an ideological consensus worldwide, yet individualism remains a driving force shaping societies and lifestyles. In this world societies grapple with the urgent need for climate action while navigating complex socio-economic dynamics and bureaucratic challenges on both regional and global scales. Air travel is impacted by strict limitations on fossil fuels, through high CO₂ taxation and governmental regulation that insist on a shift towards renewable energy and battery-power. Despite challenges, flexible air traffic management keeps disruptions minimal. This ensures a certain stability of the intermodal transportation system that aviation is part of.

SOCIO-CULTURAL

There is a collective understanding of the need for transformation along with an ideological consensus, yet the trend towards individualism is distinct. Accordingly, individuals continue to claim their autonomy in dealing with these challenges, which leads to different strategies regarding sustainable development. Despite education being accessible to all, due to economic failures the rich-poor gap widens and social inequality rises, sparking protests and civil disobedience. With ecological concerns at the forefront, long-distance travel has become less common for the majority. Most people adopt shorter-distance lifestyles, relying on personal contact and minimising travel. A minority still travels extensively for work or leisure.

ECONOMIC

Resource scarcity drives standardised global energy production, with renewable energy lagging behind targets. Europe is forced to reduce its own demand and rely on new technologies to substitute the lack of raw materials. Despite Europe's economic decline and inequality increasing, the EU is true to its primacy as an economic system that is environmentally friendly. Sustainable and ecological concepts are supported within the limited means available. The cost for transportation has risen despite an intermodal transportation system throughout the EU. Thus, mainly the wealthy benefit from diverse transport options, while the poor face restricted mobility.

POLITICAL

The EU maintains its bureaucratic structure, albeit slower in response to pressing issues. Its democratic values clash with the need for swift action, yet it remains a global leader in advocating for sustainable policies despite waning global power. The EU restricts air trans-

port to only renewable technologies and is pushing for battery-powered aviation. Nonetheless, the aviation industry remains to have an influence on European politics through lobbying, thus maintaining a certain status to receive needed resources.

TECHNOLOGICAL

Technological advancements focus on battery-powered mobility also for a sustainable air transport system. There is a constraint on aircraft types that have been optimised to limit their ecological impact. The industry is strongly influenced by deals among the larger manufacturers and airlines, reducing the options for innovation and the emergence of start-ups. With a fixed number of sustainable aircraft classes, Europe's aviation sector concentrates its research and political efforts on battery-powered mobility. High energy prices and CO₂ taxation are making access increasingly difficult. Airports have evolved into transit hubs located outside city centres to reduce environmental impact. However, extensive security measures lead to high delays, impacting travel efficiency.

ECOLOGICAL

With resources dwindling, negotiations prioritise emissions reduction and green energy adoption. Limited availability leads to global collaboration on standardising energy production. Europe's industries focus on efficiency and environmentally neutral production, while natural resource scarcity pushes for alternative technologies. Efforts to reduce CO₂ emissions involve significant investments in green technologies and a ban on fossil fuel related subsidies. Due to frequent severe weather events the partially hazardous climate conditions necessitate predominantly local transportation.

SCENARIO 2 // COLLAGE

Sustainable Flight in an Unbalanced Society

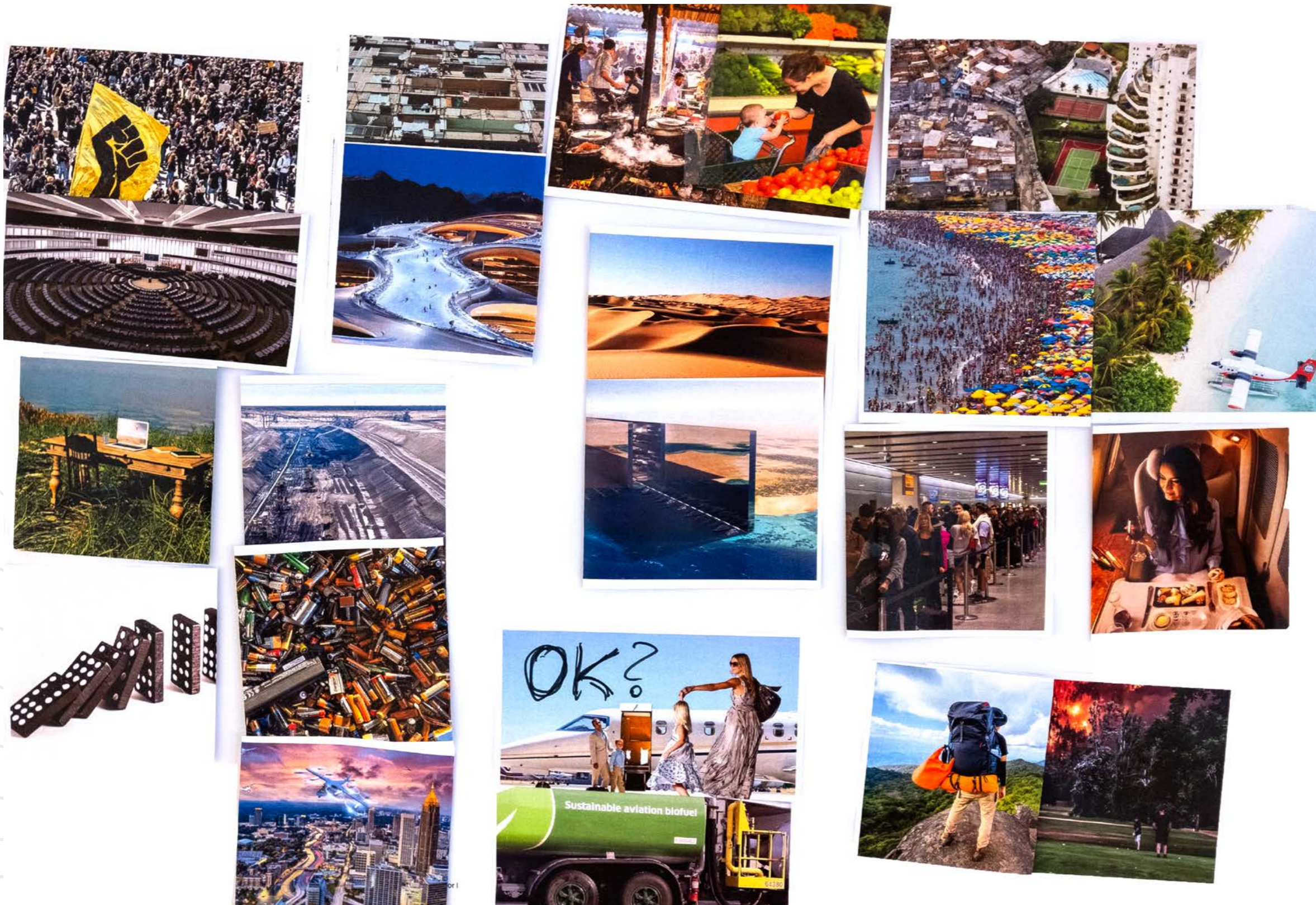
WORKSHOP -ANALYSIS

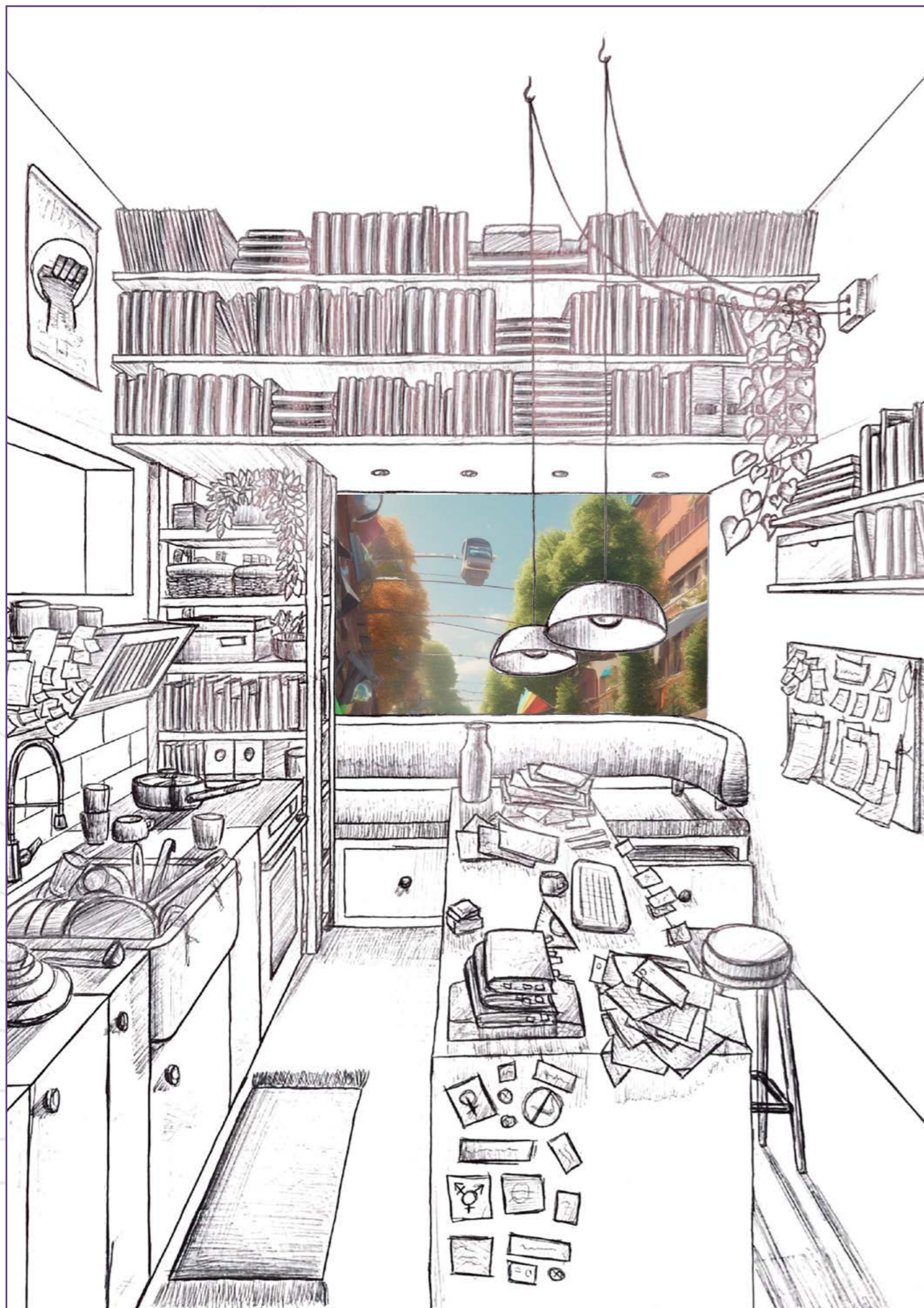
This scenario “Sustainable Flight in an Unbalanced Society” envisions a 2050 where a global consensus on climate change exists, yet societal individualism persists. Strict regulations on fossil fuels drive the aviation industry towards battery-powered aircraft, although economic inequality creates an uneven access to air travel. The EU maintains a leading role in sustainable policies despite its weakening global influence. Technological advancements focus on battery technology, but innovation is limited by established players. Ecological concerns lead to prioritizing emissions reduction and renewable energy.

The group in the workshop understood that in the scenario the aviation industry focuses on sustainability. The key takeaways are:

- **Public Attitudes:** Public opinion on aviation is divided into three groups: those concerned about environmental impact, those unaware, and those who disregard concerns.
- **Science's Role:** The aviation sector's reliance on science is influenced by the need for new aircraft designs (like blended wing bodies), electrification, and improved flight control systems that view traffic holistically, integrating various modes of transport.
- **Aviation Industry State:** Long-haul flights are reduced, leading to lower profits. Short-haul flights utilize battery-powered aircraft, while the industry's instability hinders investments. Decision-making involves national politics, Airbus's role, industry funding, and standardization.
- **Energy System:** Renewable energy sources are increasingly used, but nuclear power remains a factor.
- **Transportation System:** Transportation systems integrate air, ground, and local options (bikes/public transport).
- **Airport Infrastructure:** Airports are strategically located to minimize travel times and environmental impact, moving away from large, centralized hubs like Berlin Brandenburg Airport (BER).

In this world the various factors – societal attitudes, technological advancements, economic realities, and infrastructure changes – shape the future of the aviation industry.





SCENARIO 2 // PHAE'S LIFE

Sustainable Flight in an Unbalanced Society

PHAE IN 2050: A LIFE IN FRAGMENTED SKIES

In 2050, Phae, now in her early fifties, works as a senior engineer for Europe's dominant airline company, living in a modern coastal town in Northern Germany. Although her childhood passion for aerospace engineering has led her to a fulfilling career, she grapples with the reality of a profit-driven industry that limits creativity and sustainable innovation in aviation.

Phae's daily routine is marked by hyper-efficient travel between major cities, facilitated by automated systems that have revolutionized airports. While she enjoys stability and financial security, Phae feels her job prioritizes maintenance over innovation, leading to frustration regarding environmental impacts and the ongoing reliance on hybrid technologies.

Personally, Phae seeks solace in feminist writing and maintains connections with like-minded individuals, but she feels the weight of a deeply divided society, driven by nationalist ideologies. Her idealism from 2024 has transformed into pragmatism as she navigates complex social dynamics and resigns herself to the compromises required in her professional life.

Ultimately, Phae harbours a mix of regret and resignation about the world's trajectory. The anticipated global cooperation has not materialized, leaving her disillusioned with the management of climate change and societal divisions, while she clings to her dreams of a better future through her creative pursuits.



SCENARIO 2 // ARIK'S LIFE

Sustainable Flight in an Unbalanced Society

ARIK'S JOURNEY IN 2050: A STORY OF SUSTAINABILITY AND SOCIAL UNBALANCE

In 2050, Arik is a 27-year-old electrician engineer living with his parents and 21-year-old sister Janine in a communal farmhouse near Hamburg, shared with three other families to reduce living costs. His mother is a professor in aeronautics and sustainability, while his father runs a small electrical business. Janine is completing her apprenticeship as an accountant.

Arik's daily routine includes breakfast in the communal kitchen and commuting to an engineering firm where he works on developing battery-powered aircraft as part of the EU's sustainable aviation efforts. He faces challenges with bureaucratic regulations and high costs while collaborating on innovative projects.

From 2024 to 2050, Arik has evolved from a curious child into a conscious adult focused on environmental protection and social equity. He actively engages in local community groups advocating for sustainable practices and equitable transport access.

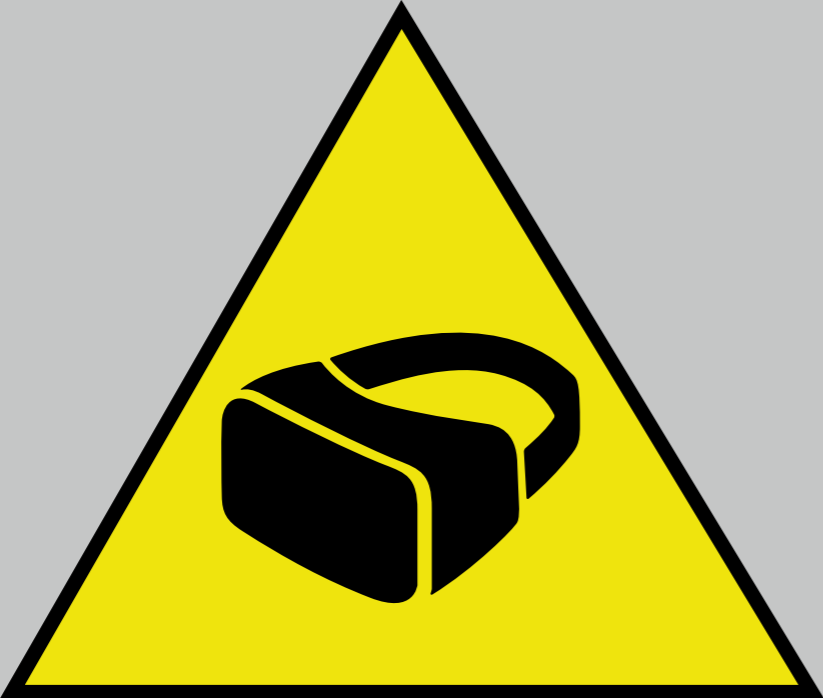
Despite enjoying a supportive family, community living, and a meaningful career, Arik struggles with the frustrations of economic inequality, which limits access to green technology for many. He recognizes advancements in sustainability are often unevenly distributed, benefiting primarily the privileged.

Arik's perspective from 2024 to 2050 reflects mixed feelings of hope and frustration, understanding that true progress in sustainability must accompany social equity. He remains committed to fostering dialogue for equitable access to sustainable technologies and believes in a future where environmental integrity and social justice coexist.

SCENARIO 2 // WILD CARD

Sustainable Flight in an Unbalanced Society

Avatarism



Avatarism transforms the metaverse experience by allowing individuals to embody digital personas in every aspect of life, leading to a mass rereat into the digital realms.

FUTURES NEWS

SE²A FUTURES

TOMORROW'S AVIATION NEWS TODAY

July 10, 2050, ICA Nr. A1.1 HBK Braunschweig | Institute for Design Research ScenAIR2050

Airbus closes down facilities in Hamburg and Toulouse. 5000 people lose their jobs!

Aviation industry shrinks

Major EU-based airlines merge. Monopolization after Avatarism hype. Sed ullam dendest iorentis- que serci cum expliqu aerfer- orit alit, consequas maion earunt alitiunt velit maios- sum est voluptaecti re vitatas perio. Maionseque doluptur re et reperi optas suntiae strum, ex eium reprehenum et dolorum, velit, officii sci- eni diam aut fugitat alis sitis et, sectio te poratec. Ipositia perum eium. Page 2

Financial crisis worsens

Funding declines as institutions withdraw from aerospace research

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5000 people lose their jobs. The unexpected and continuing success of Avatarism and the drastic decline in passenger numbers and commercial flights has forced Airbus to close its production facilities in Europe. Page 3

Governments spend huge amount to support aviation industry

Government promises 3rd funding for SE²A cluster. Ut mi, ulliquata et magni- hillest ad quunt optat omnis eum veliquunt, solor maio blaccum nonsed exerem quatem et rem qui id modis ex et quis volor accaerum essit quam berumqu aspeditam nonsed qui uta cus et exerum quidel mag- nis rem hillor sed eosa sinis evel molorita qui volut rem qui quas cus, occatur epu- dandis et, tem ut alit fac- cusda nes nus simos autem re volupta tesequi sum nulpa et dem vendus sunt, sum eum, quae. Nam re nonse dendist, que res mod quam ent vollore rovit, nobit et restiusae seceate eos sinci voluptatquam quistio nsequiate iur? Qui sitatem essit es quia del in nobis res derspedipsum core nus solor dictius eium. Page 6

Pollution increases as air traffic getting back to pre-Avatarism level

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Loneliness is considered as a severe problem in EU society

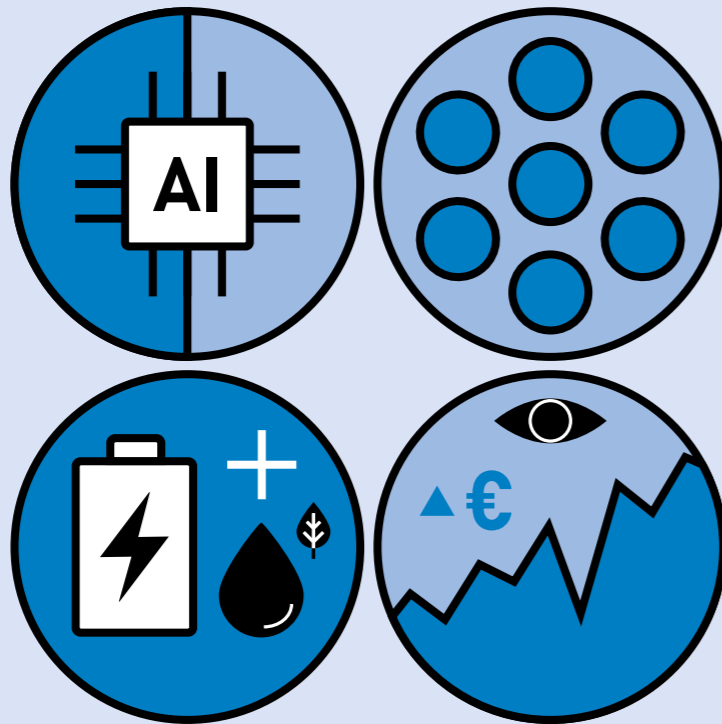
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Aviation recovers from Avatarism blackout

Airbus builds new devel- opement center. Ut solor mi, ulliquata et magnihillest ad quunt optat omnis eum veliquunt, solor maio blaccum nonsed exerem quatem et rem qui id modis ex et quis volor accaerum essit quam qui cus, occatur epudandis et, tem ut alit faccusda nes nus simos autem re volupta tese- qui sum nulpa et dem ven- dus sunt, sum eum, quae. Nam re nonse dendist, que res mod quam ent vollore rovit, nobit et restiusae seceate eos sinci volup- tatquam quistio nsequiate iur? Qui sitatem essit es quia sum core nus dictius ipisitia perum eium. Page 9

Fractured Skies Divided by Ideology

03
ScenAIR2050



An ideologically divided society is split into distinct interest groups that remain true to their own convictions with contacts around the world close to their beliefs. Resources are plentiful and people are doing well economically. Despite increased social equality, an elitist education trend persists, granting privileges to a few. Air travel is inexpensive and affordable whilst relying on proven rather than innovative technologies. Airports, integrated into city infrastructure, offer seamless and luxurious travel experiences, enhancing personal connectivity. Profit is paramount and sustainability has few advocates. The climate crisis is imminent but ignored as a daily occurrence.

SCENARIO 3 // DESCRIPTION

Fractured Skies Divided by Ideology

In the year 2050, the world is marked by extreme pluralism and ideological divides, with communities forming strong bonds based on shared beliefs. In this fragmented world of diverse truths, technological advancements offer both opportunities and challenges, shaping the future of societies amidst shifting political landscapes and ecological uncertainties. Hybrid and high-emission energy sources dominate, leading to an increased air travel demand due to the growing mobility of the middle class. All European airlines have been consolidated under the EU, yet their line lobby maintains their influence to maintain dominance. Despite weather-related disruptions, technological solutions have ensured a stable and efficient air travel experience for most.

SOCIO-CULTURAL

In Europe society is deeply divided, with opposing views on critical issues like climate change. Various fractions form communities, deepening ideological divides, leading to an increased polarisation. Within their ideological communities, people are globally connected. They maintain strong social ties, partly through digital connections and increasingly through person-to-person contact. Therefore, the aircraft has become a preferred mode of transport. Although equal opportunities are praised and financially most are well off, systemic barriers persist that increase social inequality. Education retains meaning, even though it begins to be overshadowed by ideological values. The elite institutions cater to the privileged few, thereby widening the gap between the elite and the rest of the society.

ECONOMIC

Abundant resources drive economic growth, decreasing the rich-poor gap. Worldwide there is an uneven distribution of resources and globally the energy production remains fragmented. New energy cartels emerge based on traditional sources now leading the way of an expansion of renewable energy. As part of an economy-wide strategy, also the aviation industry focuses on profit and prioritises cost efficiency over sustainability. The lack of regulatory oversight favours monopolistic practices, stifling competition and innovation within the aviation industry. In Europe, a single airline consolidates power through aggressive acquisitions, influencing political decisions through lobbying. The demand for air travel in this prosperous society has become an affordable means for transportation. Yet, disparities persist between luxury and economy class passengers.

POLITICAL

A resurgence of nationalist sentiments reshapes the European Union, favouring pragmatic alliances among right-wing governments. While democratic structures remain, autocratic traits emerge, leading to cooperation

aimed at reclaiming global influence. The paradigm of a free market is favoured despite the effort of governments regulating CO₂ emission to reduce the ecological impact of for example the transportation industries. The political efforts to cap CO₂ levels lead to stricter regulations, forcing industries to adapt. Thus in Europe the public transport system has become more sustainable, but the challenge persists in enforcing global standards. Yet, the value of sustainability is not common in communities but understood as a trend that has been set by regulatory authorities in terms of policies for the industry.

TECHNOLOGICAL

With technological advancements ecological impacts have been mitigated leading to an expansion of nature reserves and the restriction of urban sprawl. Despite this, aircraft manufacturing prioritises profitability over sustainability. Innovation stagnates as companies focus on maximising production efficiency. Hybrid propulsion technologies and sustainable aviation fuels dominate, thus emissions from air travel persist, contributing to environmental concerns. Airports have transformed into luxurious hubs integrated into urban landscapes. Offering seamless door-to-door service and customizable in-flight options enhance the travel experience, blending comfort and efficiency. They are part of many cities and have replaced existing infrastructures like shopping malls, conference centres, hotels and the like.

ECOLOGICAL

Harsh climate events disrupt day-to-day life as well as the transport systems. Such trends are negated thus despite the efforts towards more sustainability the prime for financial gain persists and technologies ensure a daily smooth air travel. Thus, in the aviation industry policies are followed but high CO₂ emissions are common. A reorientation toward fossil fuels and removal of financial benefits such as taxations or subsidies hinder advancements for a sustainable air transport system.

SCENARIO 3 // COLLAGE

Fractured Skies Divided by Ideology



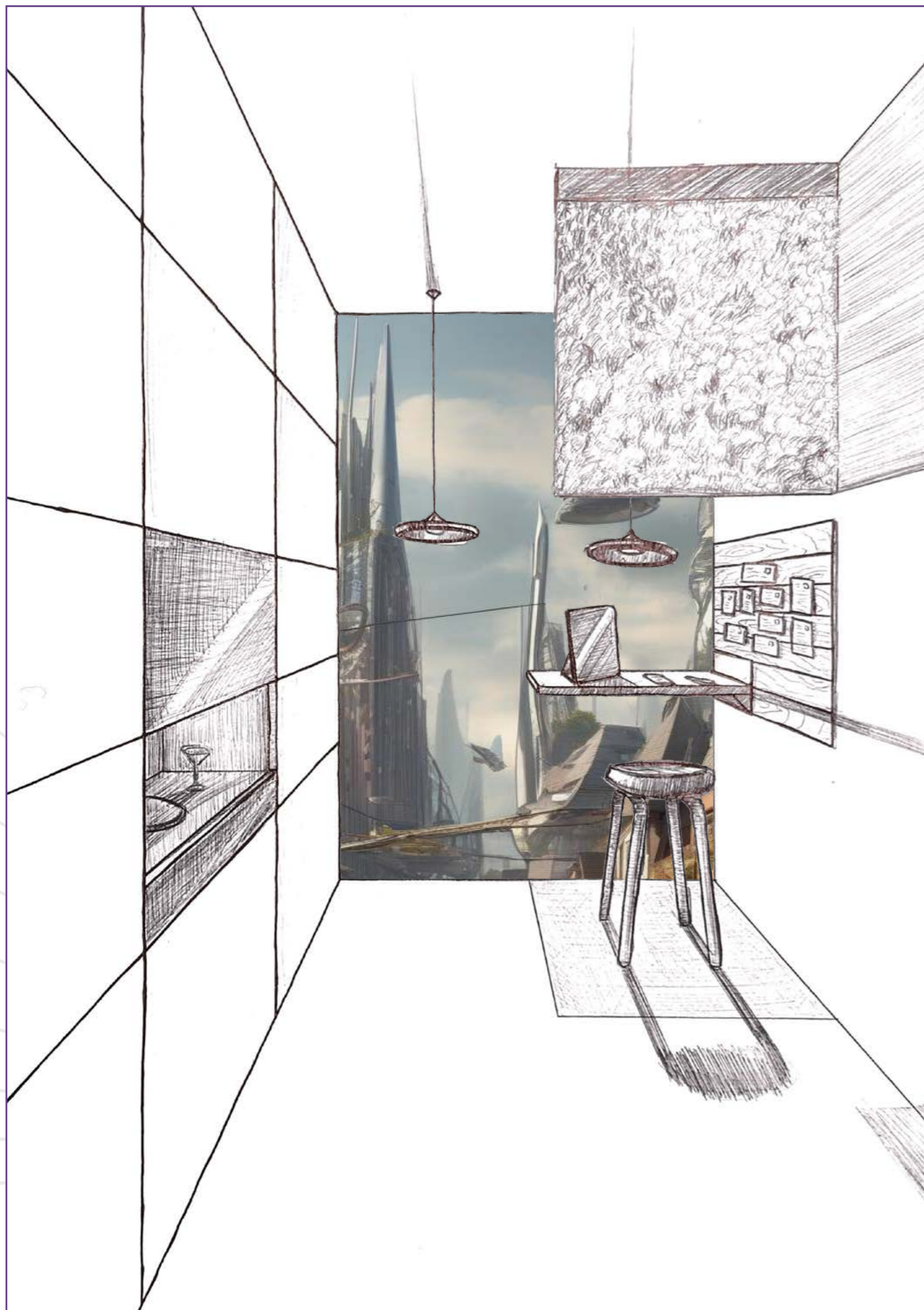
WORKSHOP -ANALYSIS

The scenario, "Fractured Skies Divided by Ideology" depicts a 2050 where strong ideological divisions shape a world of abundant resources and economic prosperity. Despite this, an elitist education system perpetuates inequality. The aviation industry thrives, prioritizing profit over sustainability, using hybrid technologies and consolidating power under a single EU airline. A resurgence of nationalism within the EU, while maintaining democratic structures, influences policies. Though technological advancements mitigate ecological impacts to some extent, the climate crisis is largely ignored.

The group in the workshop understood that in the scenario the aviation industry is a monopoly, driven by profit and political influence. Key points include:

- **Public Perception:** The public's attitude towards aviation is neutral to passively positive.
- **Science's Role:** Science plays a minor role, with positive signs only within the EU but a lack of global standards.
- **Aviation Industry:** The industry is a monopoly focused on profit, mastering political and social spheres, prioritizing cost-efficiency over sustainability. Decisions are controlled by the industry's powerful lobby.
- **Energy Sources:** The energy system relies partially on fossil fuels, with no significant changes anticipated.
- **Aircraft Types:** Aircraft designs are conventional, incorporating SAF and hybrid-electric propulsion across all flight ranges.
- **Transportation System:** The transportation system is optimized for door-to-door service, with both luxury and economy options but dominated by a single major airline.
- **Airport Infrastructure:** Airports are integrated into urban areas, offering luxury amenities and serving multiple functions beyond just transportation.

In essence, this tells a story of a world where economic and political power concentrate within a monopolistic aviation industry with limited concern for sustainability.



SCENARIO 3 // PHAE'S LIFE

Fractured Skies Divided by Ideology

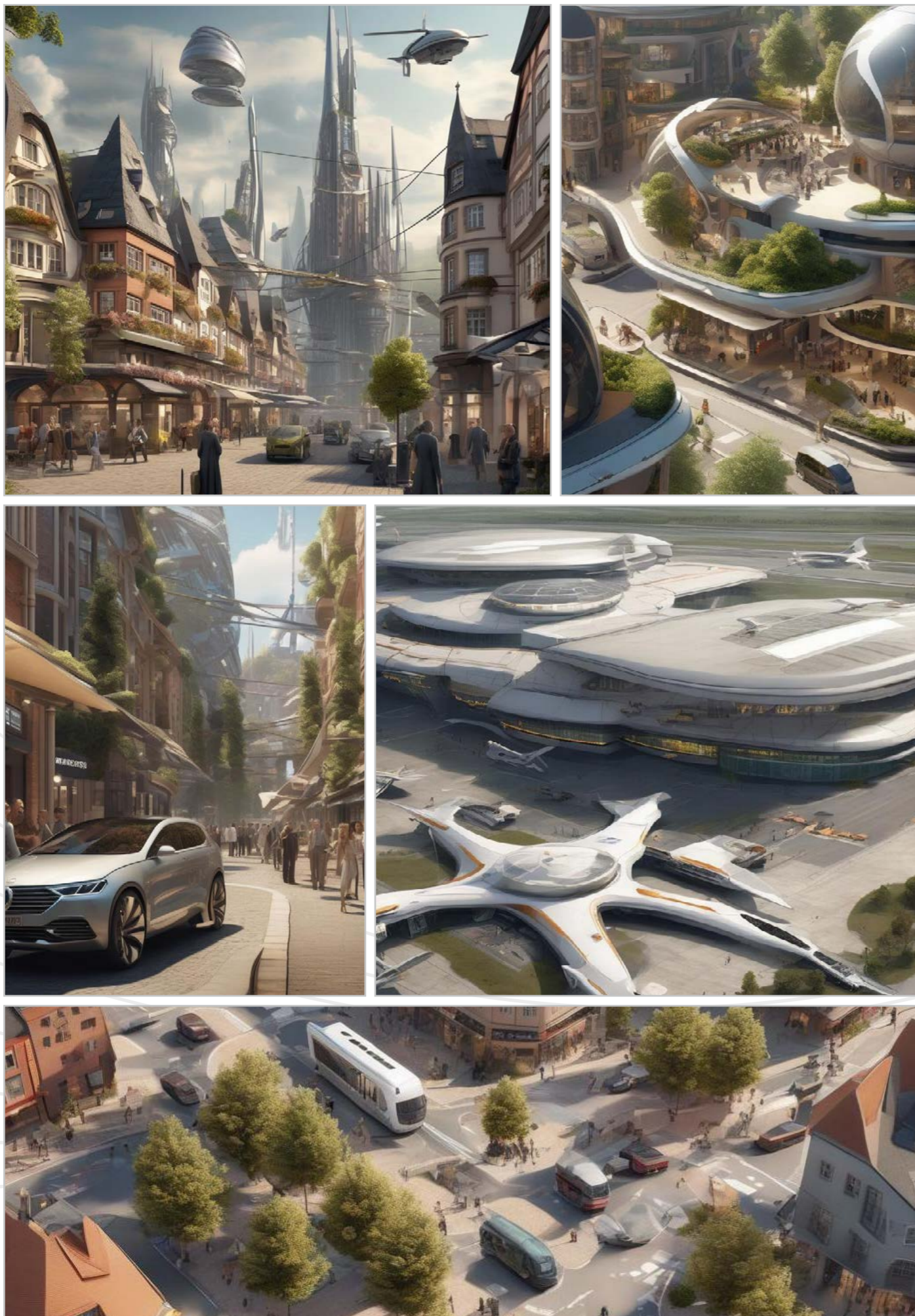
PHAE IN 2050: A LIFE IN FRAGMENTED SKIES

In 2050, Phae, now in her early fifties, lives in a modern coastal town in Northern Germany, working as a senior engineer for a monopolistic airline company. Her early dreams of shaping sustainable aviation have been stifled by corporate priorities focused on profit over innovation. Although Phae's role in the aviation industry has allowed her to realize her career ambitions, it has not fulfilled her aspirations of environmental progress.

Her daily life involves traveling between advanced European airports, where smart technology streamlines her routine. Despite the efficiency and comfort of her job, Phae often feels her work is less about creativity and more about maintaining an extensive, profit-driven machine.

Phae has grown more pragmatic since 2024, adapting to a world increasingly divided by nationalist ideologies. While she values equality and knowledge, the fragmented political landscape has forced her to compartmentalize her beliefs, finding community among like-minded individuals online. In her creative pursuits, she expresses her hopes for change through poetry and feminist writing.

Despite enjoying financial stability and technological advancements that enhance her work life, Phae grapples with moral conflicts about her role in an industry that prioritizes short-term profit over sustainable solutions. While Europe remains economically strong, ideological divides persist, leaving her feeling unsettled about the broader implications for society and the environment. Phae's journey reflects her complex navigation of personal ambitions against a backdrop of corporate and societal challenges.



SCENARIO 3 // ARIK'S LIFE

Fractured Skies Divided by Ideology

ARIK IN 2050: THE JOURNEY ACROSS THE BROKEN SKY IN A STORY OF CHOICES AND BELIEFS

In 2050, 27-year-old Arik lives in a converted barn with his wife and their two-year-old child near Hamburg, while his younger brother Peter, now 25, resides upstairs. Arik's upbringing involved the conflicting values of his father, a conservative electrician, and his mother, a progressive engineer, which contributed to their divorce when he was 10. Following the divorce, his mother moved to Hamburg with his younger sister, Rose, who recently left Europe to pursue a career in mechanical engineering.

Initially inspired by his father, Arik began as an electrician but later pursued engineering to help improve the family business. His day begins early, as his pregnant wife manages the household while he teaches at a local technical college. After class, he meets Peter and their father for lunch and business discussions. In the afternoons, he works as a technical consultant, focusing on the influence of large energy companies while planning to expand the family business into aerospace.

Despite his career demands, Arik finds solace in nature through hunting, although he notices wildlife has declined due to changing weather. He grapples with responsibilities and societal expectations, particularly regarding sustainability, which his mother emphasizes. While drawn to technological innovation, Arik confronts the ethical implications of increased air travel and recognizes the growing societal tensions that hinder cooperation on critical climate issues. His journey illustrates the challenges of pursuing personal ambitions amid external pressures for the sake of his family and community.

SCENARIO 3 // WILD CARD

Fractured Skies Divided by Ideology

Internet Blackout



An EU-wide internet blackout disrupts communication, commerce, and information access, triggering widespread confusion, economic losses, and concerns over cybersecurity vulnerabilities and the reliance on digital infrastructure.

FUTURES NEWS

SE²A FUTURES

TOMORROW'S AVIATION NEWS TODAY

July 10, 2050, ICA Nr. A1.1

HBK Braunschweig | Institute for Design Research

ScenAIR2050

Everything depends on the internet.

Major EU-based airlines merge. Monopolization after Avatarism hype.

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404 Page Not Found



Emergency Broadcast: Complete shutdown of air traffic! Remain at home! Avoid travel!

First conversations between left wing and right wing in years

Will it last?

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Major tornado season begins

Volkswagen focuses on urban air vehicles

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Huge losses - will the industry ever recover?

Changes are necessary, but it remains unclear whether the economic system is capable of changing => Who will pay for the transition?

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Politicians blame industry for not preparing

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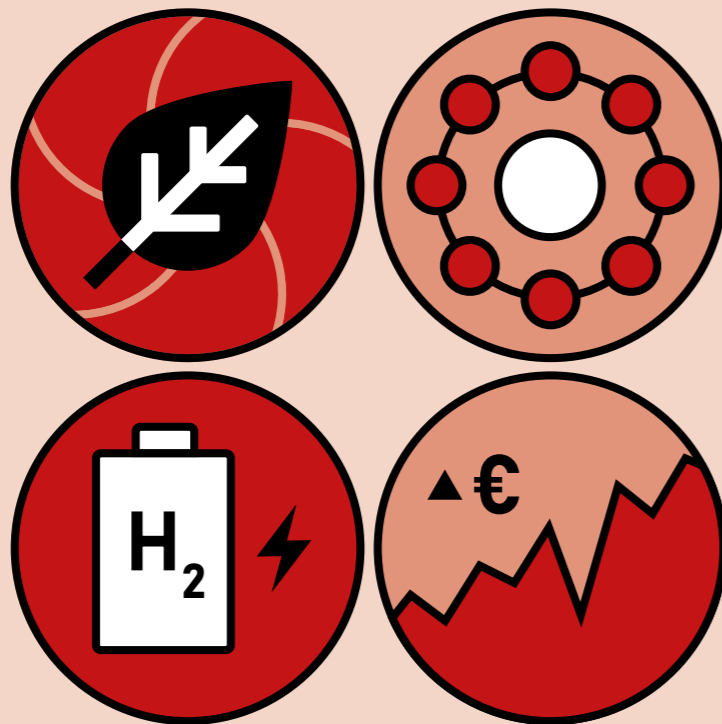
People from all ideological back-grounds realise their dependence on the internet and other things

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Prosperity in Europe's United Horizon

04

ScenAIR2050



Europe operates on a community-centric ideology, emphasising collective needs, fostering ethical values including a commitment to sustainability. The successful implementation of 15-minute cities boosts quality of life, promoting remote work. Education is free and accessible, promoting social equality, while economic well-being narrows the rich-poor gap. As sole proprietor, the EU has created an efficient air transport system with strict regulations for emissions. It enabled streamlined air travel, networking central and local airports to reduce delays and environmental impact.

SCENARIO 4 // DESCRIPTION

Prosperity in Europe's United Horizon

In the year 2050, Europe stands as a beacon of unity, truth, and sustainability. In this future, Europe leads by example, demonstrating the power of collective action, mindset, and cooperation in building a world that is understood to be better for generations to come. The overall ecological focus is instrumental in achieving a sustainable and environmentally friendly aviation industry that equips its fleets with efficient, low-emission technologies. Government incentives and high carbon taxation support these efforts, maintaining the viability of aviation in the midst of climate challenges. The aviation industry experiences a green innovation boom, with multiple manufacturers and start-ups pioneering sustainable aircraft technologies. Air travel coexists with other modes of transport, contributing to a decreased socio-economic disparity. This united society creates the conditions for a seamless air transport system with efficient, interlinked central and local airports that reduce delays and the impact on the environment.

SOCIO-CULTURAL

In Europe the societies have embraced a collective ideology that prioritises community well-being over individual desires. The shared belief in uprightness and solidarity has overcome the divisions in society and strengthened community and tolerance across the continent. In the EU the successful implementation of 15-minute cities has revolutionised urban living and improved the quality of life for its residents. Remote work models have become the norm, allowing people to work flexibly. Education is universally accessible and free, ensuring equal opportunities for all citizens. A common belief system fosters social equality, with governments regulating income and industries to promote fairness and balance in society.

ECONOMIC

The economy thrives with abundant resources and standardised global energy production, driven by renewable energy and green hydrogen. Europe adopts a state-run energy system, transitioning completely to renewable energy sources. Smart grids ensure efficient power distribution, decarbonisation heavy industries. Low energy prices are set for individuals and industries, with fossil fuels eliminated to ensure environmental sustainability. The EU transitions to net-zero emissions, deregulation of fossil fuels and ending the transport subsidies, fostering a competitive market for sustainable energy. Europe meets its worldwide demands through responsible resource management and global cooperation. In Europe all airlines have merged under the leadership of the EU to ensure crisis resistance and efficiency and to prevent corruption and promote responsible management. Relevant in this strategy are the strict regulations safeguarding against monopolistic practices, ensuring fair competition and sustainability.

POLITICAL

The European states have united and are committed to shared values and a common economy. It paved the way to an EU as a worldwide acknowledged advocate in democracy and sustainable development. Borders are disappearing, leading to greater cohesion and sustainable reforms. Innovative technologies drive efficiency and sustainable business practices in aircraft design within an intermodal transportation sector. Political consensus favours the degrowth strategies to enable sustainable lifestyles. It paves the way to an economic system based on the concept of sustainable development and commons.

TECHNOLOGICAL

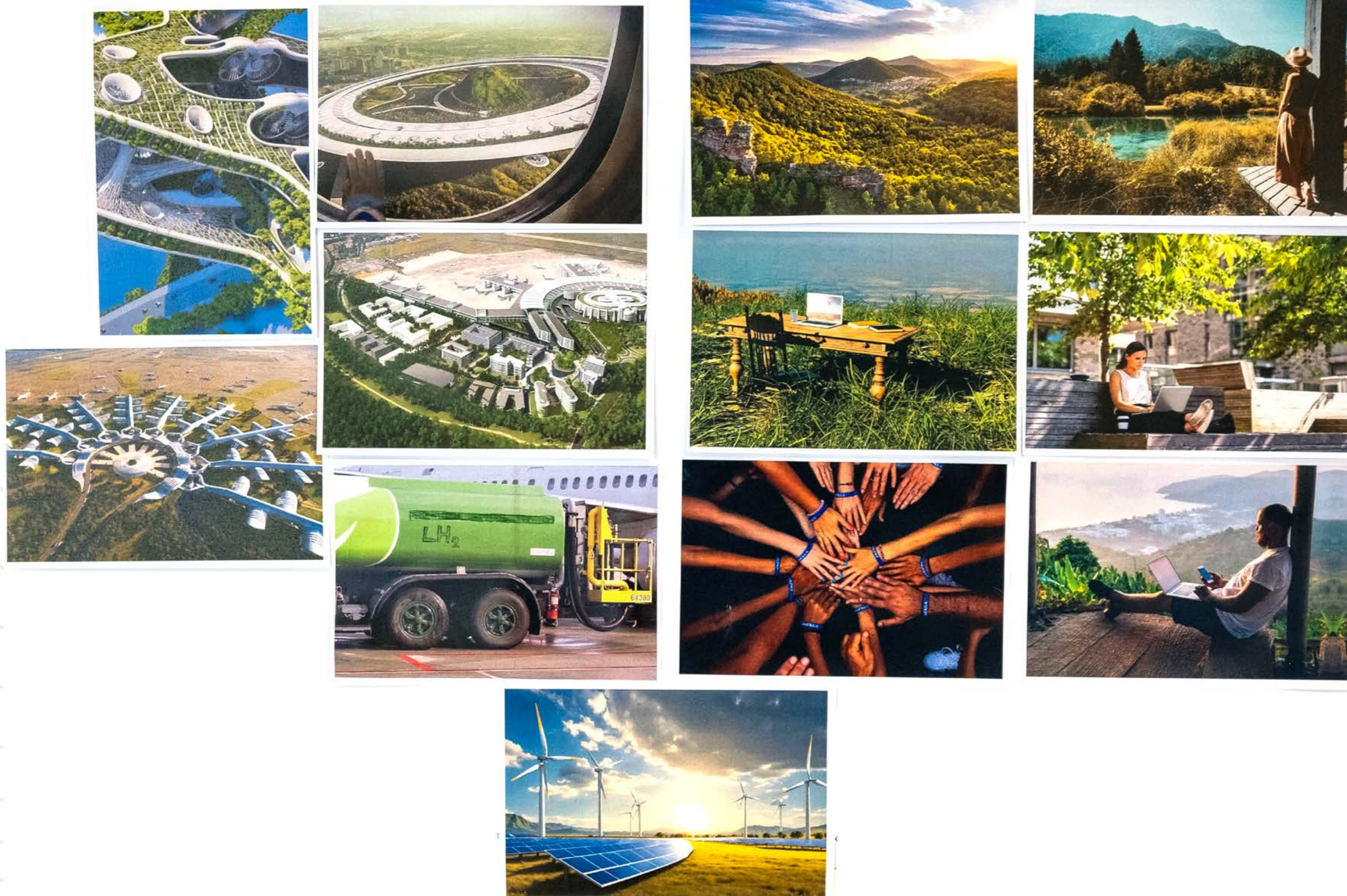
Technological advancements include manifold aircraft manufacturers and start-ups innovating with new materials and energy options. Hydrogen-powered mobility becomes mainstream, offering a clean alternative to traditional fossil fuels, advancing E-mobility and reducing aviation emissions. High-tech, decentralised airports offer automated services and customised in-flight options. It is part of a well-designed infrastructure of an intermodal transportation system. With monthly passes providing affordable access to the entire transportation network it promotes social inclusion.

ECOLOGICAL

Hazardous ecological situations have been curbed by technological advancements and a degrowth strategy. Now restricted living spaces and no-fly zones have been established to protect vulnerable areas while compensating for high emission values. Renewable energy infrastructure is state-run, eliminating fossil fuels and lowering energy prices. In Europe raw materials and renewable energy resources are abundant. With a degrowth strategy climate change has been mitigated, favouring businesses and organisations that have a strong sustainability mission.

SCENARIO 4 // COLLAGE

Prosperity in Europe's United Horizon



WORKSHOP -ANALYSIS

The scenario "Prosperity in United Horizon" presents a 2050 where a unified Europe prioritizes community well-being and sustainability. A collective ideology fosters social equality and economic prosperity fuelled by renewable energy. The aviation industry, under strict EU control, utilizes hydrogen-powered aircraft and a streamlined, interconnected airport system. Technological advancements have mitigated ecological challenges, creating a harmonious balance between air travel and environmental responsibility.

The group in the workshop understood that in the scenario aviation is commonplace, sustainable, and integrated into a broader transportation system. The key points are:

- **Public Opinion:** Aviation is widely accepted, convenient, used extensively, and nearly free.
- **Science's Role:** Scientific advancements are considered unnecessary because the ideal state is already achieved.
- **Aviation Industry:** The industry is diverse, innovative, and features both large manufacturers and start-ups, although innovation is somewhat restricted by regulations.
- **Energy System:** Energy is cheap, clean (solar power converted to hydrogen), and the system operates at net-zero emissions.
- **Aircraft Design:** Aircraft types are tailored to specific ranges (turbo-prop for short, blended-wing-body for long), with no urban air mobility.
- **Transportation System:** The overall transportation system is intermodal, serving 15-minute cities and powered by hydrogen.
- **Airport Infrastructure:** Airports are high-tech, decentralized, and automated.

The analysis suggests that in this world technology and societal organization have solved the challenges of sustainable air travel.



SCENARIO 4 // PHAE'S LIFE

Prosperity in Europe's United Horizon

PHAE IN 2050: A LIFE OF BALANCE AND PURPOSE

By 2050, Phae, now 53, is a prominent figure in the aviation industry, thriving in a sustainable and united Europe. Residing in Hamburg, she enjoys the benefits of 15-minute cities and a strong work-life balance, reflecting the values of equality and community that Europe embraces.

Her daily routine includes calming walks by the coast and overseeing a remote research team focusing on sustainable aviation technologies, particularly hydrogen propulsion. Phae's career aligns with her values, contributing to Europe's net-zero emissions goals while mentoring young women in engineering through community initiatives.

The transformation from her earlier life in 2024 is striking; once anxious and disillusioned about the future, she now feels secure and purposeful in a society prioritizing sustainability and social justice. Phae thrives in an egalitarian environment with accessible education, where both she and her brother benefit from reduced socioeconomic disparities.

However, Phae grapples with dilemmas regarding personal freedom within a collective ideology, feeling at times that her autonomy is stifled. While she values the advancements her society has made, she misses the diversity of thought that characterized the chaotic world of 2024. Despite the radical changes that achieved stability, she reflects on the potential lost for varied economic and social models.

Phae views the progress from 2024 to 2050 as a testament to collective action and resilience amid past crises. She appreciates the new-found hope and stability, marking a significant contrast to her earlier feelings of uncertainty.



SCENARIO 4 // ARIK'S LIFE

Prosperity in Europe's United Horizon

ARIK IN 2050: THE JOURNEY TO UNITY IN A STORY OF LIFE IN A THRIVING EUROPE

In 2050, 27-year-old Arik lives in a transformed Europe focused on collective well-being and sustainability. He lives in a small town near Hamburg in a farmhouse where he grew up and shares it with his family, each of whom has their own apartment. Arik and his sister Sonia, who is training to be an electrician, utilize a workshop in the barn.

Arik's mother as a professor of aeronautics, and his father running a renewable energy company, both instilled in him a strong commitment to technology and environmental responsibility. Now, he works as an engineer in sustainable aviation technology.

His day starts with a morning walk in the woods with his dog. This is followed by breakfast with his sister having food from local farms and stores. Once a week, Arik travels to Hamburg, where he serves as a part-time junior professor in sustainability engineering. In his hometown, he is involved in a tech campus supporting education and start-ups focused on sustainability.

Alongside his college friend Pia, Arik has launched a company researching on and beyond hydrogen-powered aircraft. To this day it is fostering discussions and collaboration from around the world on alternative energy technologies. His afternoons Arik spends online in meetings with international colleagues. But he also likes to work in the community garden

While enjoying a high quality of life, Arik is aware of challenges such as balancing innovation with societal change. He notices some industries prioritizing profit over environmental health, prompting him to consider how to align personal ambition with community responsibility. Overall, he views Europe's transformation from 2024 to 2050 as significant progress and remains committed to fostering dialogue for the common good.

SCENARIO 4 // WILD CARD

Prosperity in Europe's United Horizon

The following are some possible Wild Cards that would change the outcome of SCENARIO 4:



And yes, there could be many more ...

The ScenAIR2050 project invites you to imagine other unexpected events that could drastically change the world described in this scenario. Writing a headline and a news story describing in simple, clear terms how the scenario has changed is one way to illustrate the shift.

AVIATION VIRUS

An aviation computer virus infiltrates critical systems, posing a catastrophic risk to flight safety and disrupting air travel.

EUROPEAN MEGA-EARTHQUAKE

The occurrence of a European mega-earthquake raises concerns about the region's seismic vulnerability and prompts a reassessment of infrastructure resilience and emergency preparedness.

HURRICANES IN EUROPE

Hurricanes in Europe pose challenges to aviation through disruptions to flight schedules, increased turbulence and the need for enhanced safety protocols to mitigate potential risks during adverse weather conditions.

FUTURES NEWS

What is a suitable headline for one of the Wild Cards?

Headline

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What will be the most prominent image in the news that day?

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The following references underpin the theoretical research of the ScenAIR2050 project (2021 to 2024) carried out at the HBK Braunschweig and its Institute for Design Research as part of the Cluster of Excellence SE²A. [The literature marked in blue are articles written by members of the ScenAIR2050 team.](#)

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