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Powering the future of air travel with sustainable aviation fuel

www.metafuels.ch

Introducing metafuels

- **metafuels** AG (Adliswil, ZH) was formed with the single objective of developing, commercialising and deploying the **aerobrew** technology, a new and innovative breakthrough sustainable aviation fuel (SAF) technology that promises to make affordable net-zero aviation a reality.
- **metafuels** AG closely cooperates with the Paul-Scherrer-Institute and the ETH Zürich.



- **aerobrew** is innovative, efficient, highly scaleable and able to tap into the future global renewable energy systems efficiently.

Introducing **aerobrew**

- **aerobrew** converts e-methanol to e-SAF
- With proven e-methanol technology available, **aerobrew** closes the last technology gap in the MtJ production chain.
- **aerobrew** is superior to alternative e-SAF technology:
 - Higher carbon efficiency - converting more valuable green carbon feedstock to products
 - Higher SAF selectivity – generating significantly less by-products
 - Higher energy efficiency - maximising use of renewable electricity
 - Superior cost of production - ensuring long term competitiveness.
- **aerobrew** is highly scaleable - with single production units expected to be 2000 tons/day or higher.



SAF Market Size



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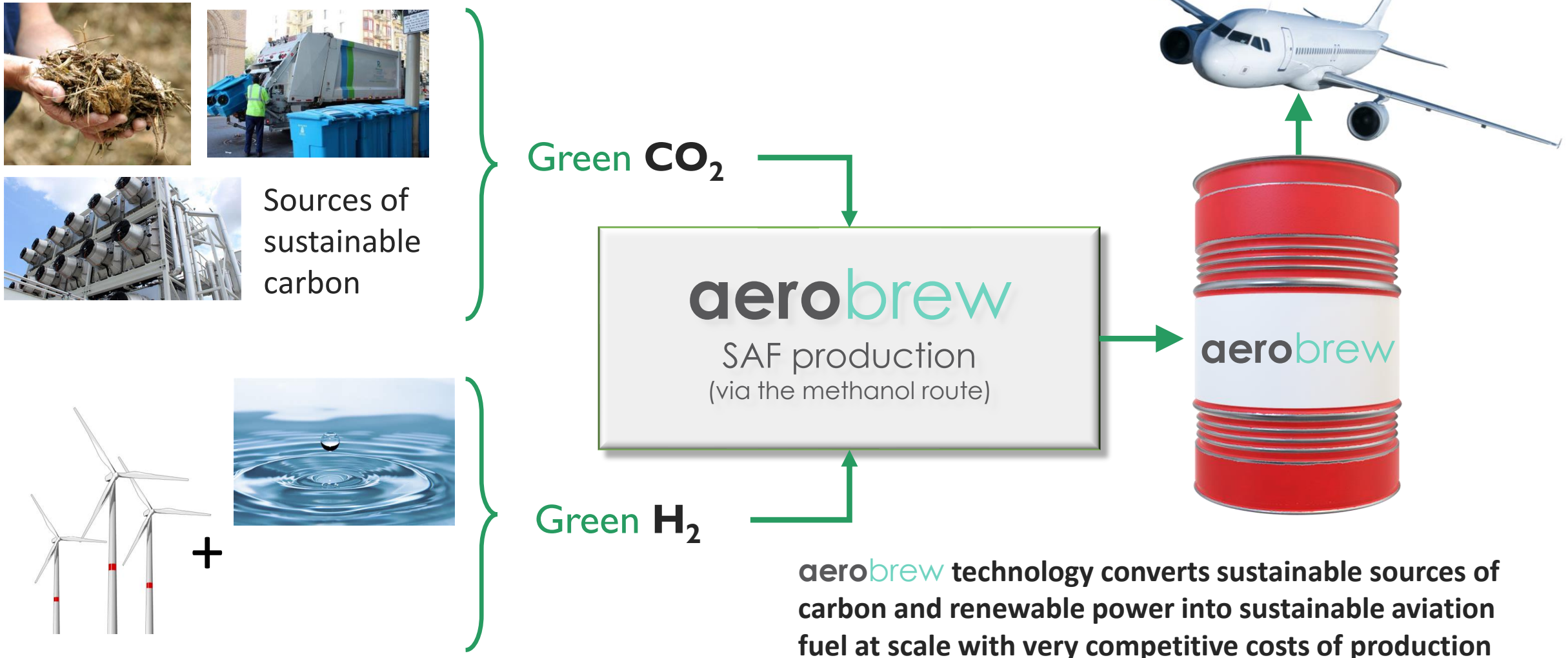
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Strategic and political relevance for Switzerland















- 2017 – Switzerland ratifies Paris Accord committing to reduce GHG emissions by 50% by 2030 compared to 1990 levels
- 2019 - Swiss government establishes 2050 net-zero GHG emissions target
- 2021 – Switzerland adopts Long-term Climate Strategy including a net-zero emission target for the aviation sector.
- The measures foreseen for the decarbonisation of the Swiss aviation sector are worked out in the Strategy for Sustainable Development (SNE 2030).
- Action plan N°5 of the SNE 2030 states that synthetic aviation fuel, produced from renewable energy sources, can make a significant contribution to the overall decarbonisation goals

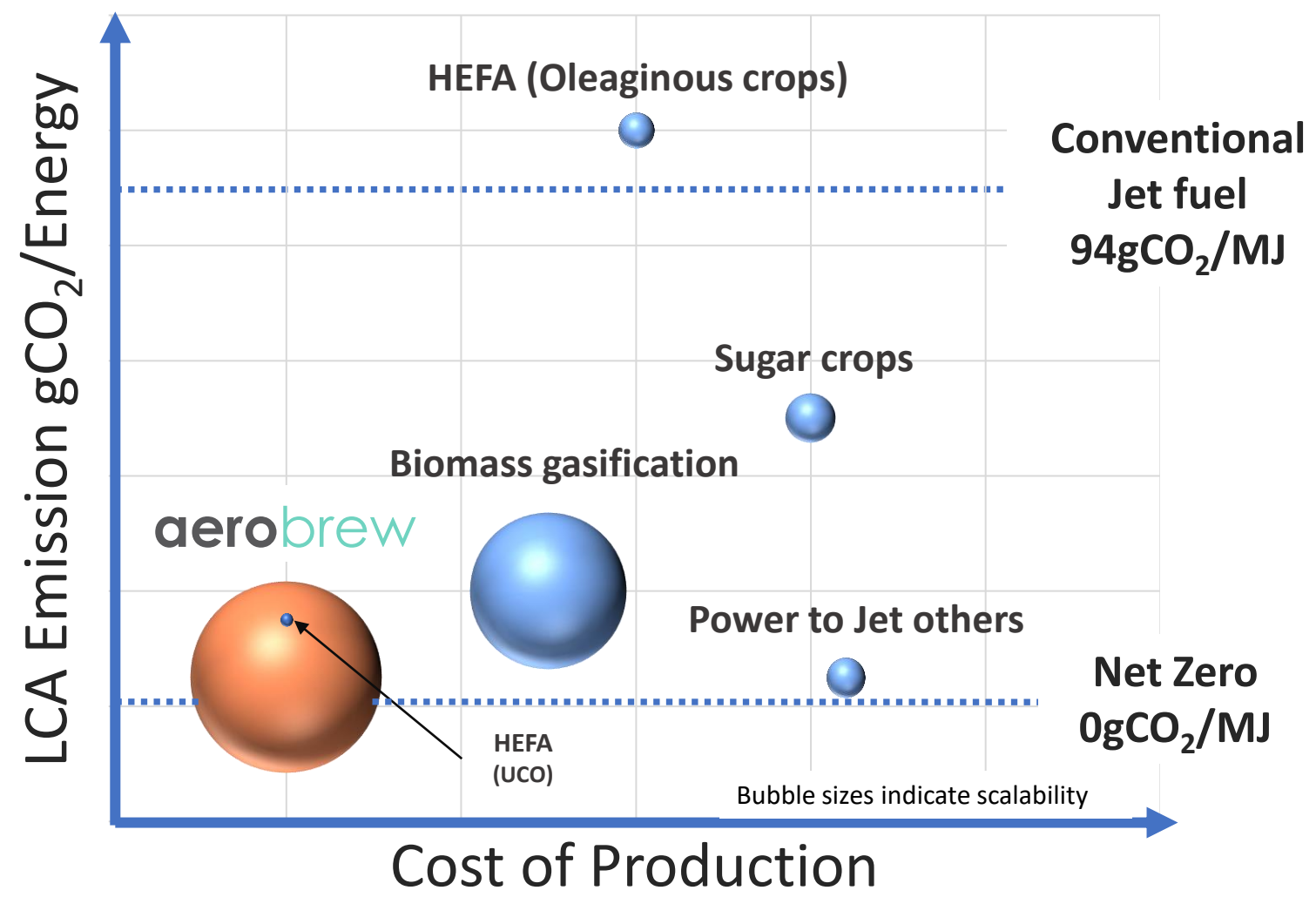
aerobrew e-SAF Production



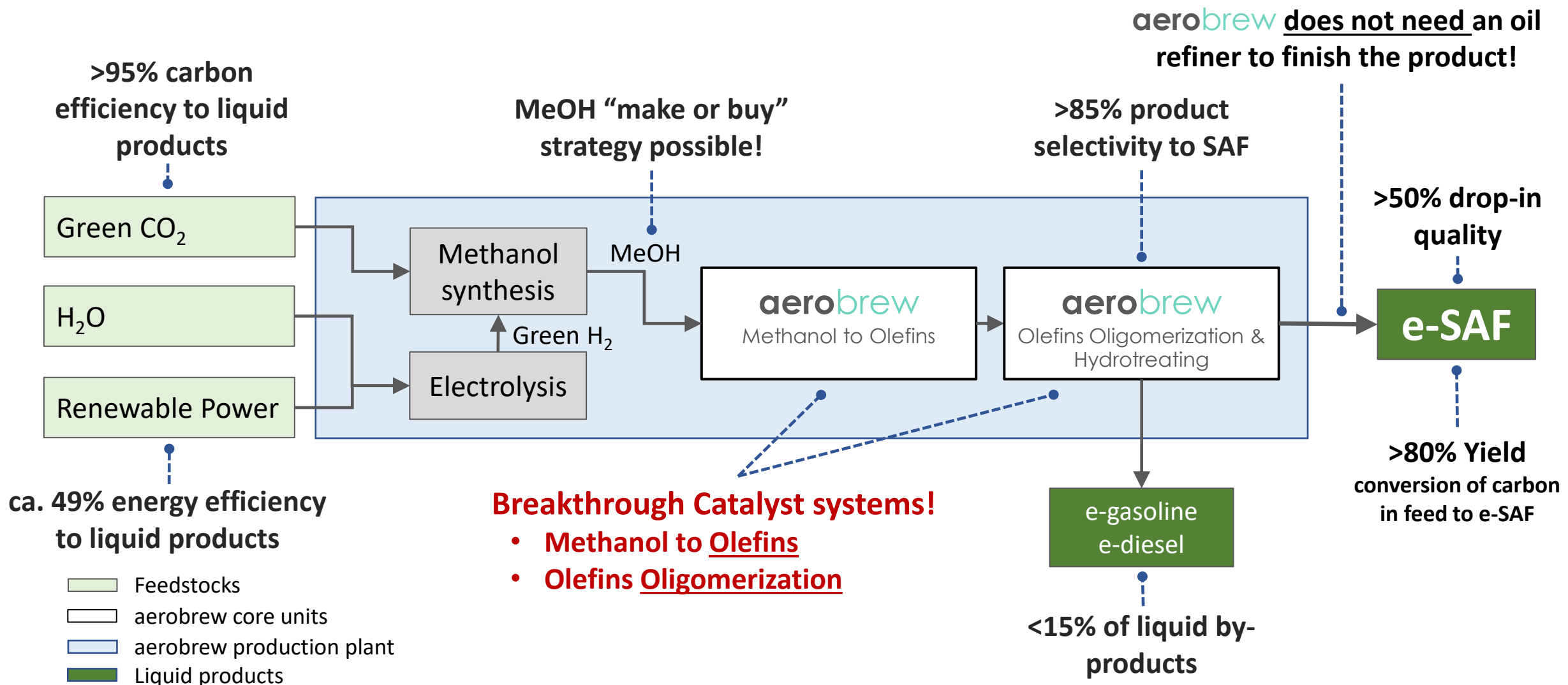
Bio & e-SAF Landscape

	Challenges	Competition		aerobrew
		Bio-SAF	e-SAF	
Sustainability	<ul style="list-style-type: none"> Food supply conflict Water consumption Lifecycle CO₂ footprint 			
Scalability	<ul style="list-style-type: none"> Large scale Technology gaps Feedstock availability 			
Performance	<ul style="list-style-type: none"> Processes simplicity Selectivity Yield 			
Affordability	<ul style="list-style-type: none"> Cost of production Economies of scale Feedstock flexibility 			

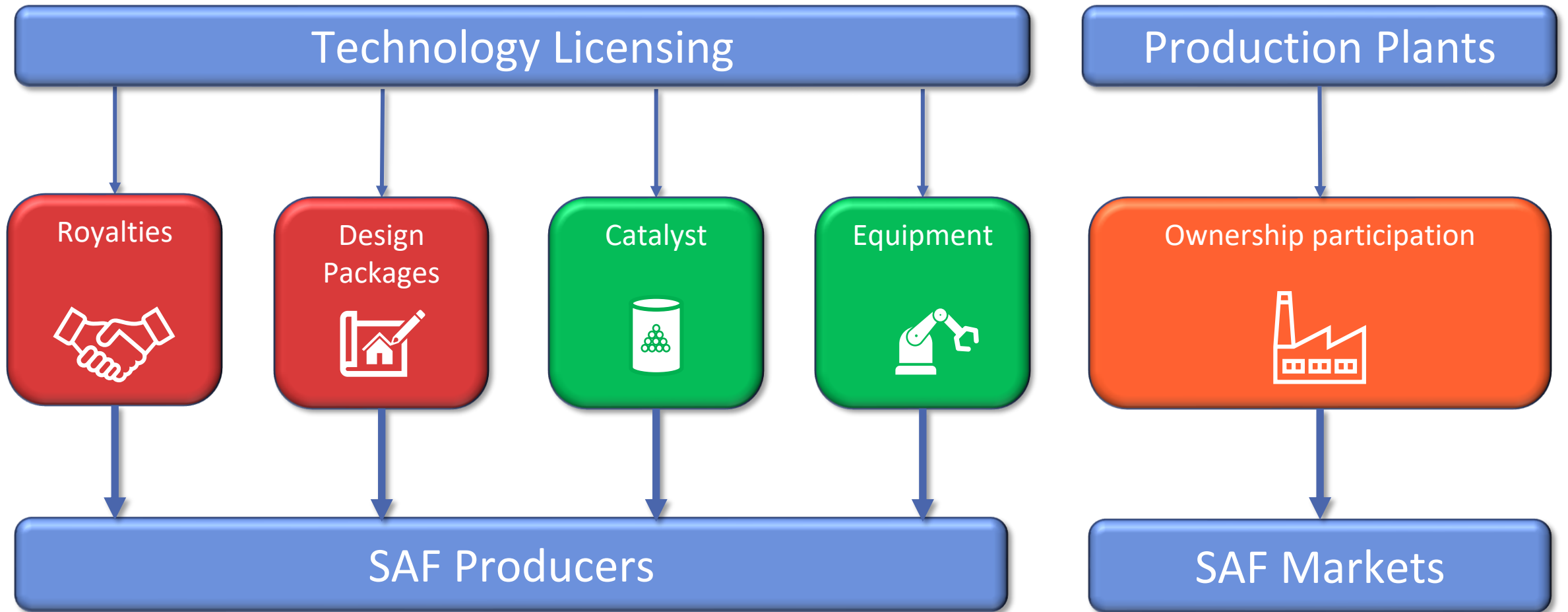
aerobrew Competitive Advantage



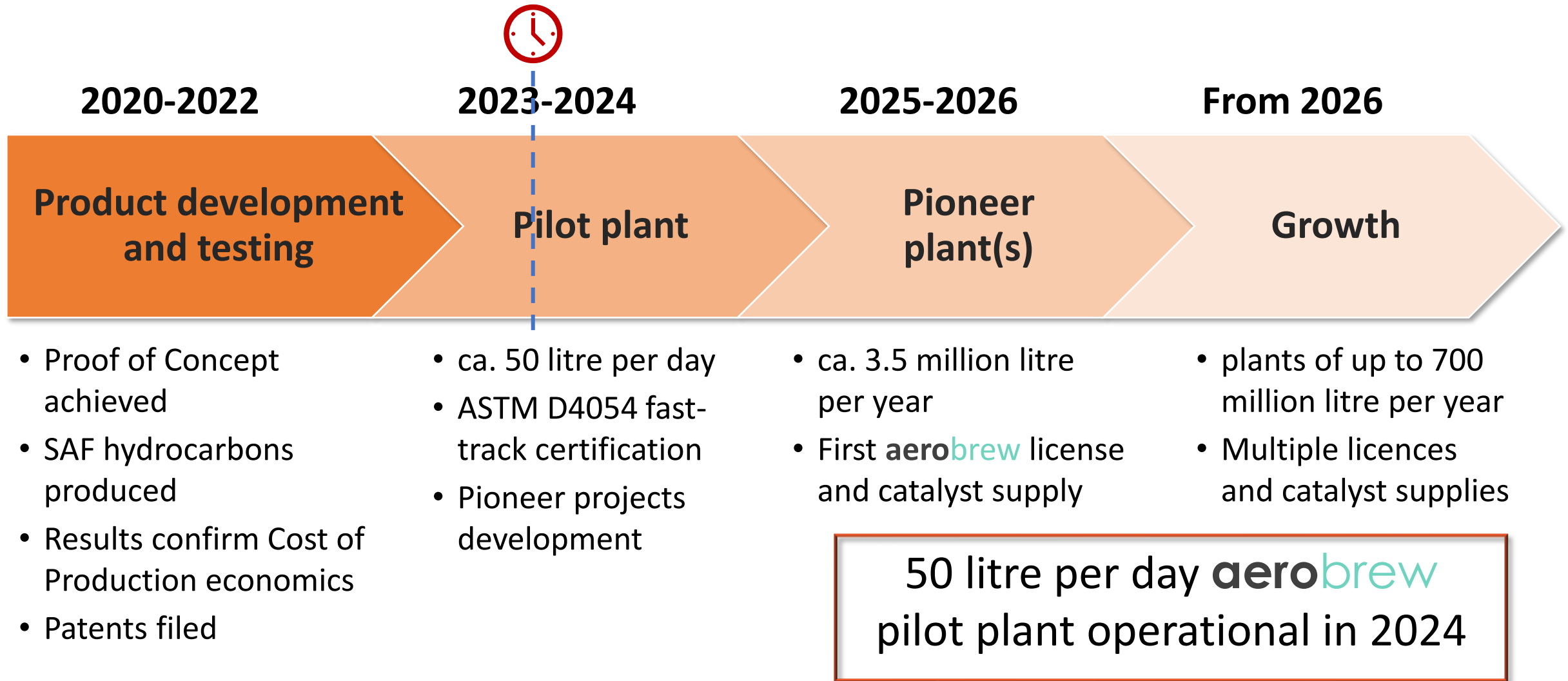
aerobrew e-SAF Production Plant



metafuels Business Model



Go to Market Plan



Swiss specifics & challenges



- Decarbonisation of aviation – Energy-dense SAF required as major part of solution:
 - SAF blending mandate anticipated (CH 60% by 2050 – FOCA, EU 70% by 2050)
 - Availability of offsets uncertain - as is the definition of high-quality offsets
- Access to SAF – Global supply is limited, with growth uncertain, as are the technologies to deliver it, international demand is high - as are prices.
- (Initially) SAF will cost more than fossil kerosene – A legislative framework needs to be developed to promote the production and use of SAF
- Technology Development – Most technologies are at early TRL stages and need support to accelerate development
- Domestic Production - Limited access to *additional*¹ low-carbon renewable energy in Switzerland could limit the local e-SAF production.
 - Import of either e-methanol, green hydrogen or e-SAF likely to be necessary

¹ to comply with EU requirements and meet GHG reduction targets versus fossil fuel benchmarks (EU 70%, CORSIA 10%)

Recommendations

- Aviation is considered the hardest-to-abate source of GHG emissions, perhaps followed by shipping - a clear political & societal focus is required, with supporting regulation
- Support the economics of SAF capacity ramp-up and bankability of early projects through:
 - Financial mechanisms to support use of SAF – as, e.g., “drop-in-tariffs”¹, analogous to “feed-in-tariffs” that have proven effective in promoting renewable power
 - Financial support for early mover projects e.g., grant funding, loan guarantees, tax credits
- Support research & technology development:
 - Expand and optimize the availability of funding specifically for SAF production technology
 - review the acceptance criteria of the existing Swiss funding tools (e.g., Innosuisse) regarding the support for basic research and early work in the field.



“I fail to understand the German discussion on e-gasoline for automotive. Access to renewable power will be limited and competing. Any available excess renewable power will anyhow have to be used to produce the required amounts of SAF.”²

¹ temporary offtake guarantees at fixed, co-funded rates

² qualitatively translated citation from a German energy expert

What's in it for Switzerland?

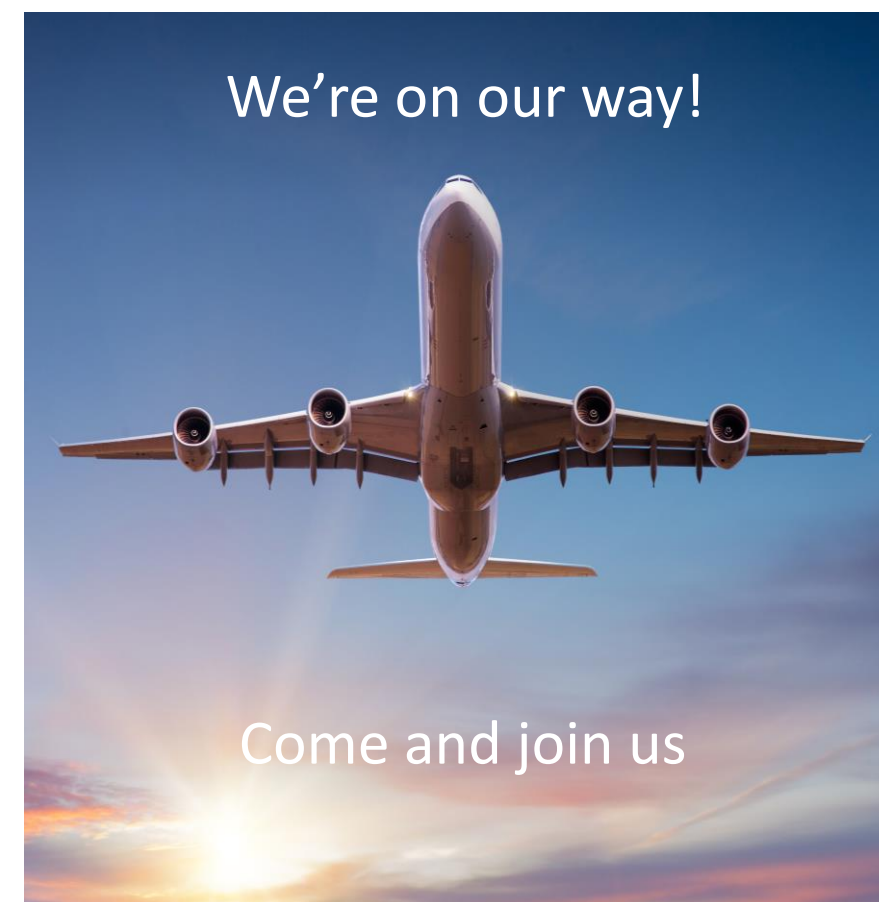
Benefits:

- Helping the transition to a sustainable future - in line with the Swiss Climate Strategy
- Contributing to reaching the Swiss GHG emission reduction commitments
- Promoting Swiss technology leadership, fostering the Swiss R&D landscape
- Executing a hi-tech/high value-added (local) business model, which creates employment, export volume, tax revenue in Switzerland.
- Securing the supply of green SAF to Swiss international airports, by
 - local SAF production from renewable power and CO₂ sources
 - enabling local SAF production from imported green methanol or green hydrogen
- Enabling independent e-SAF production for military and domestic use



aerobrew taking off

- **metafuels** soon starts to develop Pioneer Projects with a SAF capacity of ca. 3.5 million litre/year each, each consuming ca. 15 MWe of renewable electricity.
- **metafuels** is currently identifying strategic partners and anchor investors for the Pioneer Projects.
- Ideal host sites are close to renewable energy generation, CO₂ sources, H₂ plants and pipelines or methanol plants.
- To support project financing, EU's Innovation Fund grant and member state funding programs will be targeted. For US projects US, grants, tax credits, blending credits, available under the US Sustainable Skies Act/IRA will be leveraged.
- Simultaneously to engineering & executing the Pioneer Projects, world-scale projects with larger plant capacities (2- 4 million litre/day) will be initiated





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