Sustainable Aviation Fuel (SAF)

A producer´s perspective

CAPHENIA

Successful SAF project development focuses on 5 areas

In contrast to fossil fuel production, every country can successfully implement SAF projects

Technology

Feedstock

Regulatory framework

Refinery / Logistics

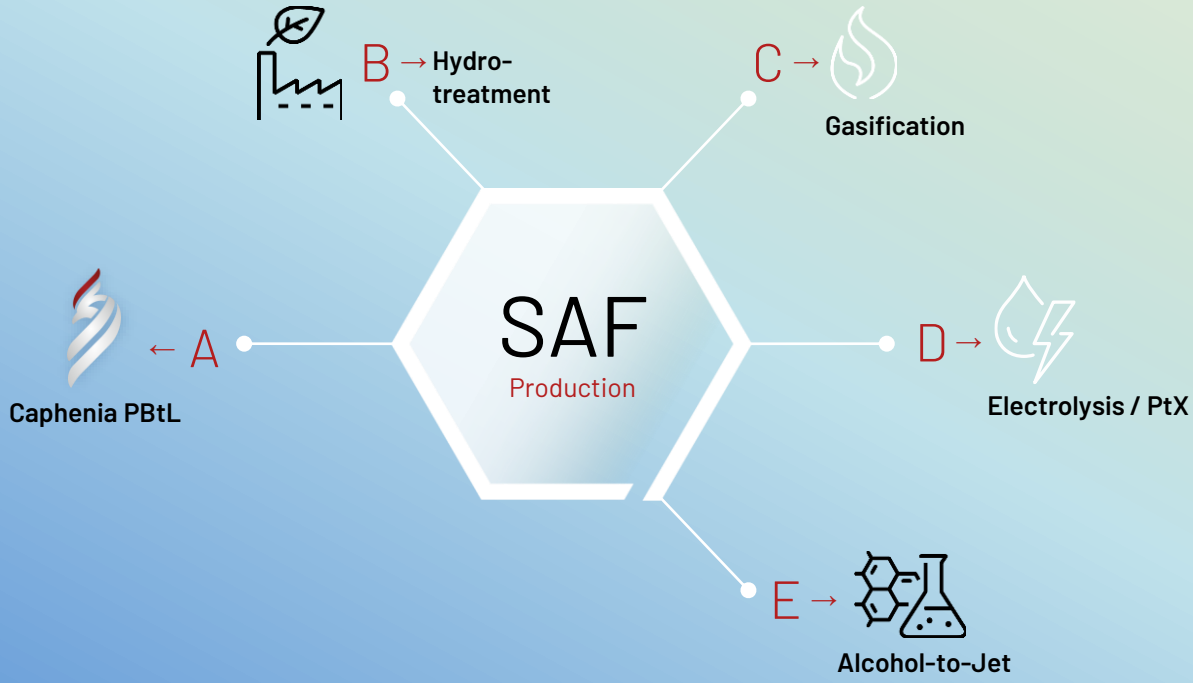
Offtake & Finance

Key to a dynamic SAF industry is technology

Dispersed energy has to be converted into liquid fuels via different technological pathways

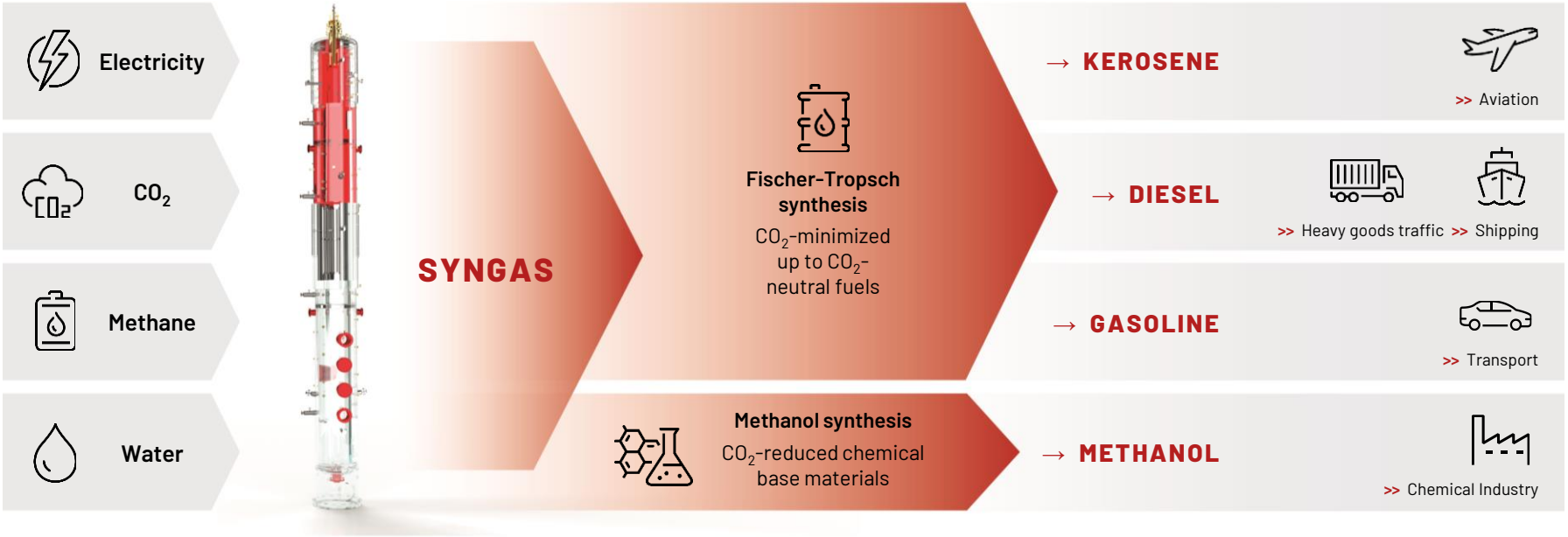
SAF production will be based on different routes

Feedstock availability determines competitiveness of pathway



CAPHENIA's Power-and-Biogas-to-Liquid (PBtL) pathway

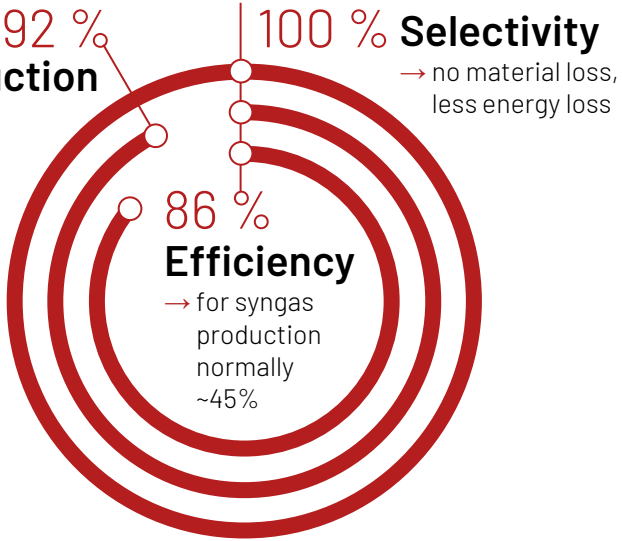
Opportunity to produce carbon-reduced or carbon-neutral fuels based on different feedstocks



Competitive advantage through innovation

In a hyper-growth market characterized by increased demand and constrained supply for renewable fuels, CAPHENIA will gain market share with its highly efficient, rapidly scalable technology.

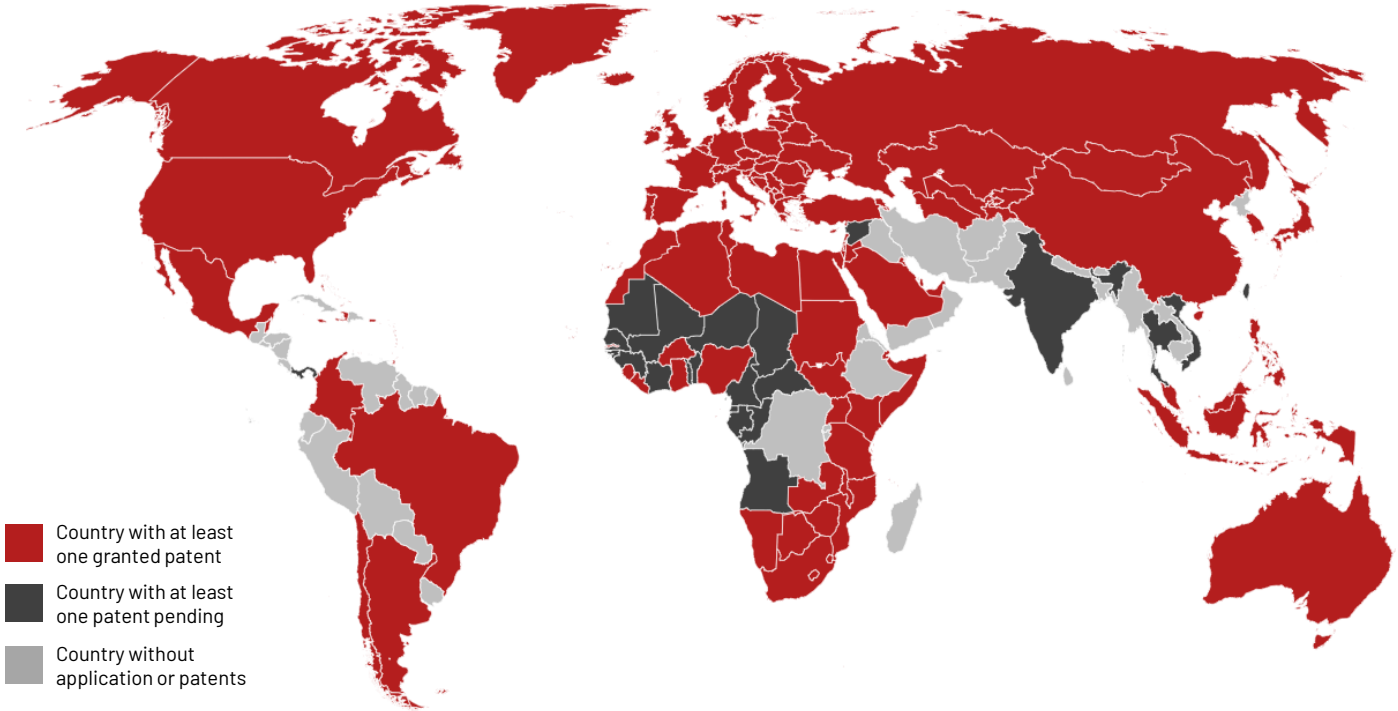
Very high feedstock availability
→ compared to other renewable fuels with limited supply (e.g. HVO / HEFA)



Easy upscaling on plant level
→ through 3-dimensional process and pressure modulation

Technology is globally protected

Our patents cover all major markets over almost the entire world including Vietnam



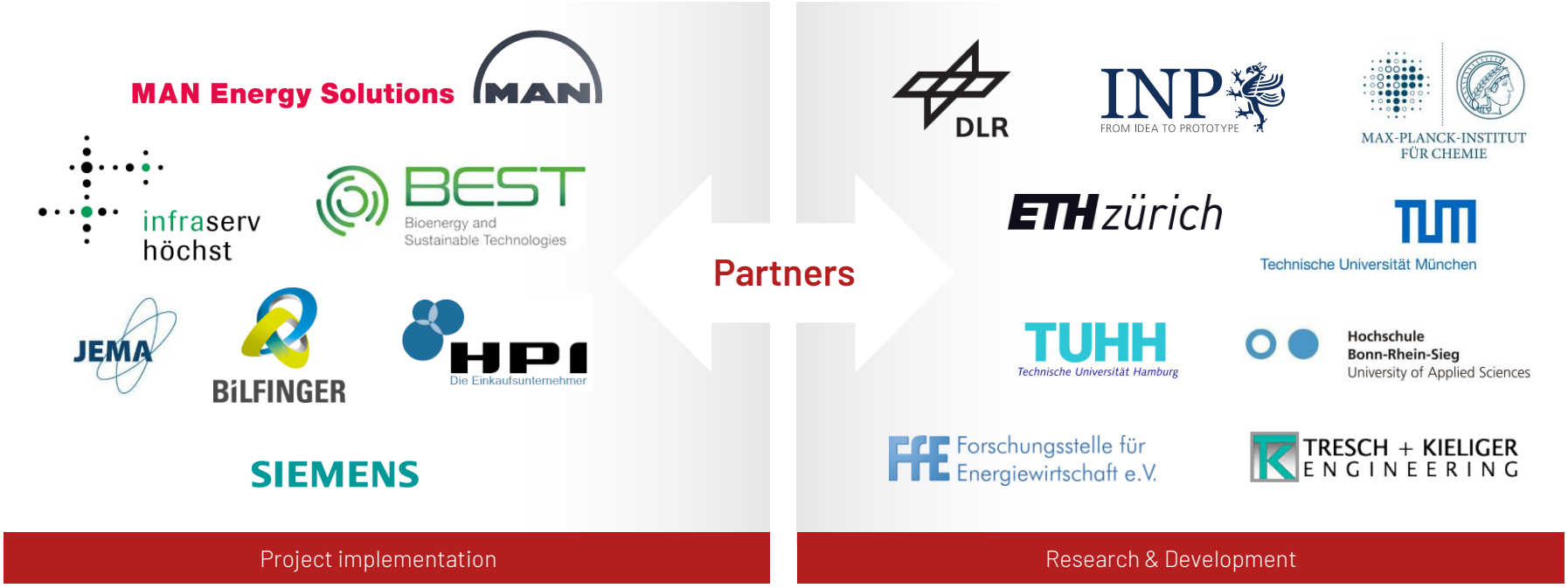
241
patents overall

199
granted

42
pending

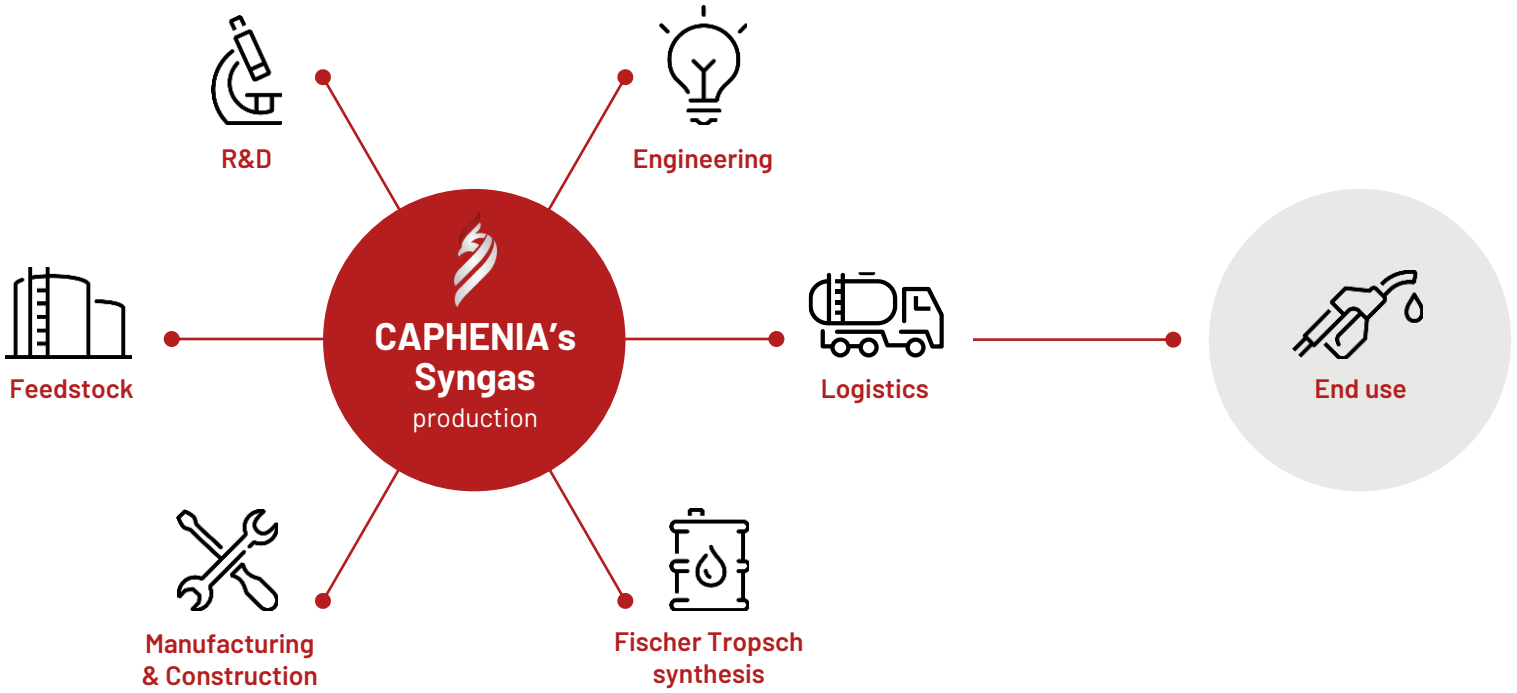
Partners

Through our partner network of industry specialists, we have access to the deepest technological expertise and have all the necessary stakeholders for seamless project implementation



CAPHENIA's Business model

Through its extensive network, CAPHENIA operates as as an integrated fuel supplier and plant operator. CAPHENIA owns the step with the highest value creation along the value chain.



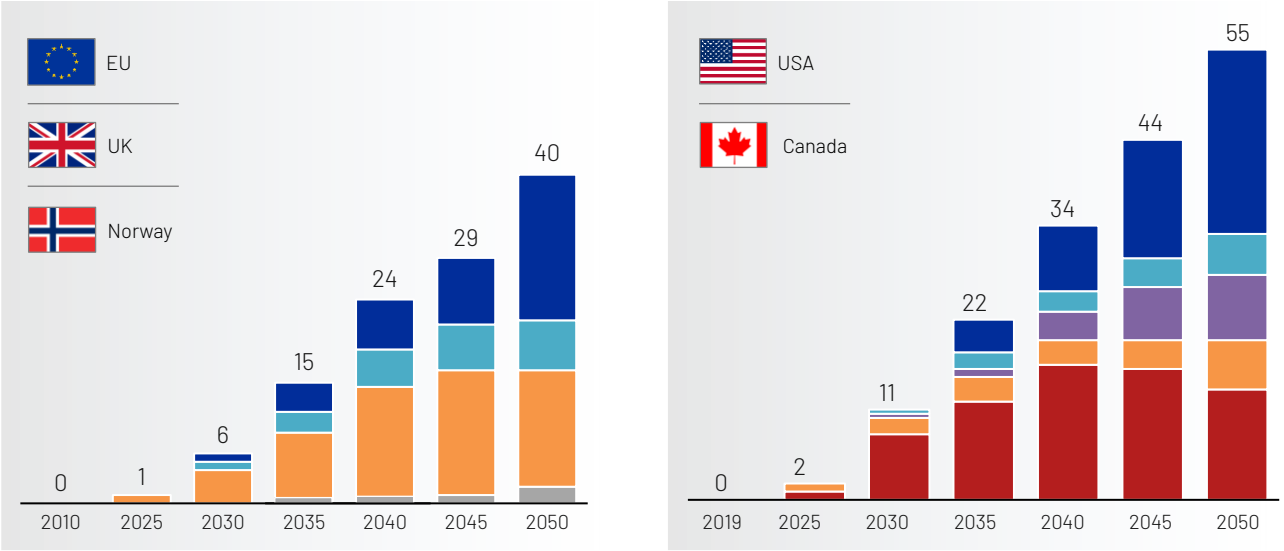
SAF production will be based on different routes

Feedstock availability determines competitiveness of pathway

Spotlight SAF

Supply mix to significantly differ by region as regulation dictates boundaries

SAF supply by pathway and feedstock, (Mta)



Feedstock use constraints and subsidies as main drivers of regional SAF supply mix differentces

In the EU, e-fuels sub-quotas determine the strong uptake of the PtL pathway from early years

Strict rules restricting the use of edible feedstocks in the EU for aviation result in high willingness to pay for waste oils, and call for innovation – new pathways could come into the mix earlier than in other regions

No restrictions on the use of edible feedstocks in North America, and strong local supply could result in higher shares in fuel mix – both through HEFA pathway from soybean oil and new advanced path-ways like Alcohol-to-Jet from 1G ethanol

High financial incentives for PtL producers from IRA package and SAF Grand challenge **will likely drive PtL growth up to EU regulated uptake**

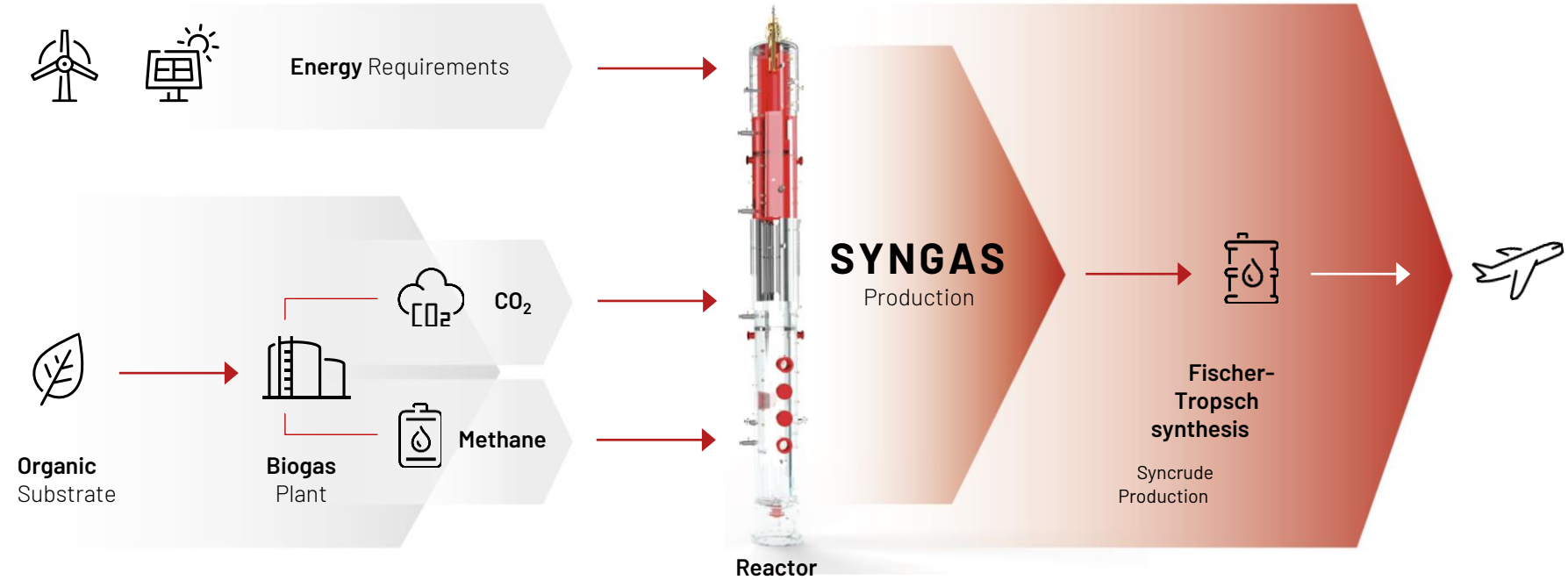
Transformation is based on a clear and stable regulatory framework

Necessity to create stable incentives to invest heavily in SAF production

Regulatory frameworks need to take innovation into account

New pathways will be invented and regulation needs to be flexible enough to include them

→ Besides organic feedstocks, countries **need to install renewable power generation capacities** (PV, wind, geothermal) to minimize carbon footprint of SAF production.



EU regulation to restrictive to create dynamic SAF development

US has more flexible regulation and is better suited to achieve its ambitious SAF goals

EU

Renewable fuel of non-biolocical origin (RFNBO)	>> Liquid drop-in fuel the energy content of which is derived from **renewable sources other than biomass**
Advanced biofuels	>> Produced from feedstock listed in **part A of Annex IX**
Biofuels	>> Produced from feedstock listed in **part B of Annex IX**
Other biofuels	>> Produced from other **biomass** (f.e. food and feed crops)

EU regulation to restrictive to create dynamic SAF development

US has more flexible regulation and is better suited to achieve its ambitious SAF goals

EU

Advanced biofuels (Annex IX part A)

- Purposely grown lignocellulosic cover crop (e.g., switchgrass)
- Lipids (e.g., tall oil)
- Municipal waste (e.g., Municipal solid waste)
- Agriculture residues (e.g., manure)
- Forestry waste/ by-products (e.g., direct forestry waste)
- Industry waste (e.g., food processing waste)
- Purposely grown oil plants (e.g., camelina)

USA

Advanced biofuels

- Compliance with biomass requirements (e.g., no palm oil)
- Almost all biogenic sources can be used as long as carbon footprint reduction is larger than 50%

Final upgrading and blending of fuels

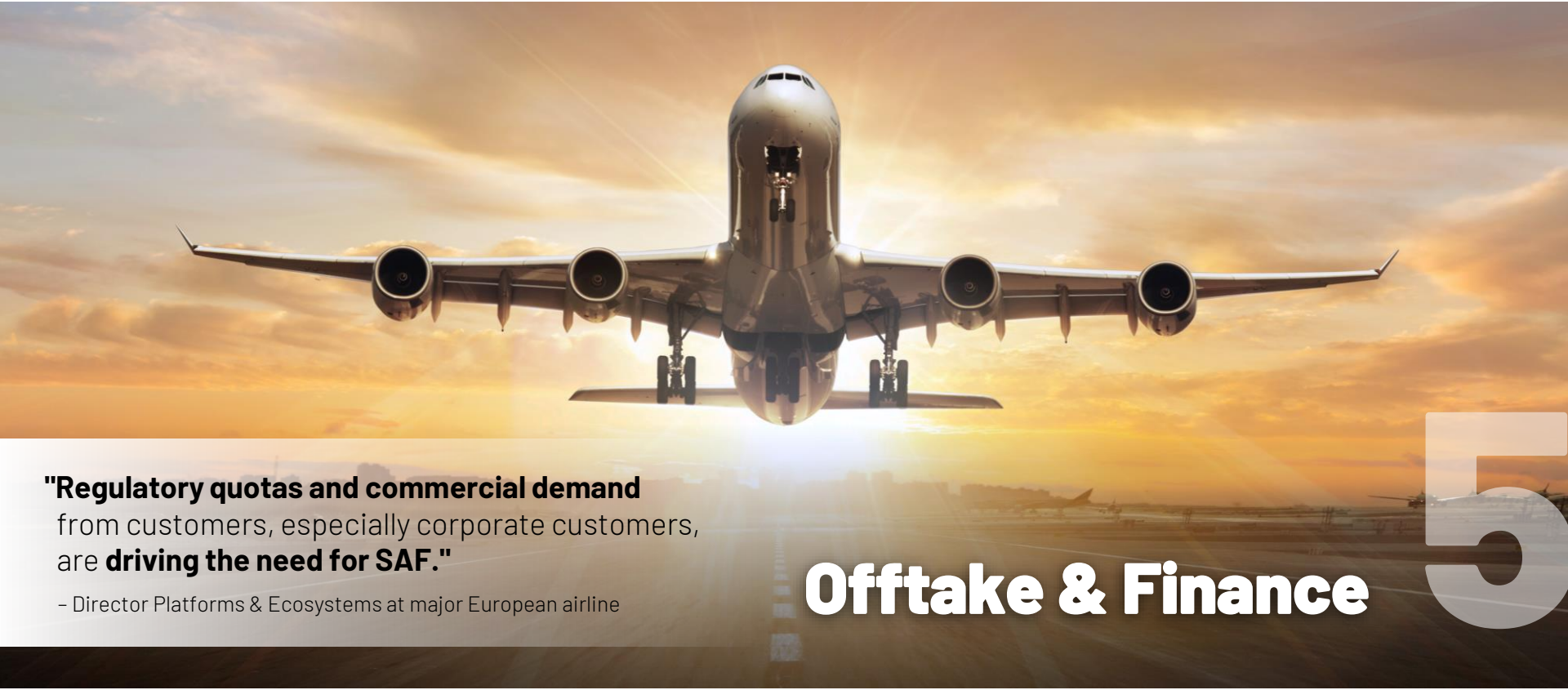
Syncrude refining as essential part of the SAF value chain

CAPHENIA has the step in the value chain with the highest value creation

Through its extensive network, CAPHENIA can provide all steps along the value chain apart from Refining and Blending as well as Logistics and Transport

Mandates for SAF demand create massive profit potentials

Development of SAF ecosystem ensures dramatic value add in Asian countries



"Regulatory quotas and commercial demand from customers, especially corporate customers, are **driving the need for SAF."**

– Director Platforms & Ecosystems at major European airline

Offtake & Finance

5

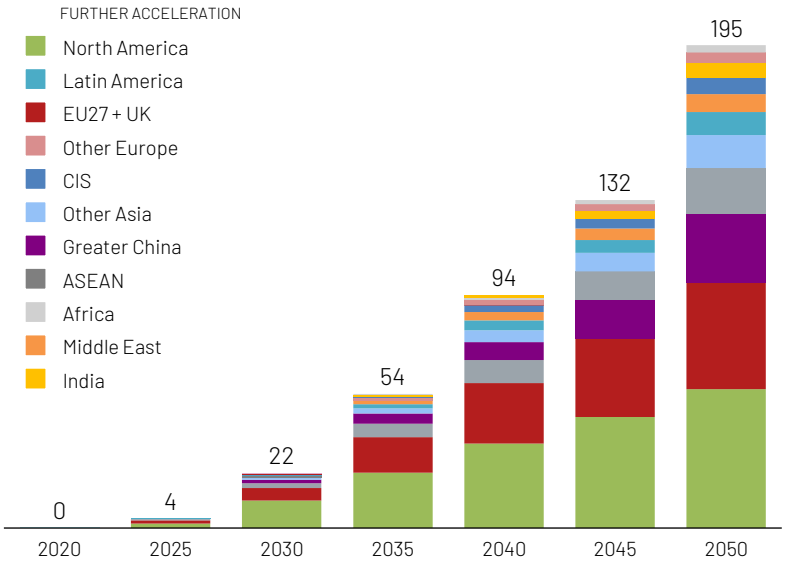
Demand for SAF largely driven by blend mandates in EU and ambition in the US

In other regions, SAF expected to also play a substantial role to enable decarbonization

SAF mandates (not exhaustive)

EU[1]	2% SAF blends by 2025[2]
USA	3 bn gal of SAF by 2030
Finland	30% SAF blends by 2030
Norway (incl. in other Europe)	30% SAF blends by 2030
UK	10% SAF blends by 2030
Netherlands	14% SAF blends by 2030
Indonesia (incl. in ASEAN)	5% SAF blends by 2027

SAF demand by region, in Mta



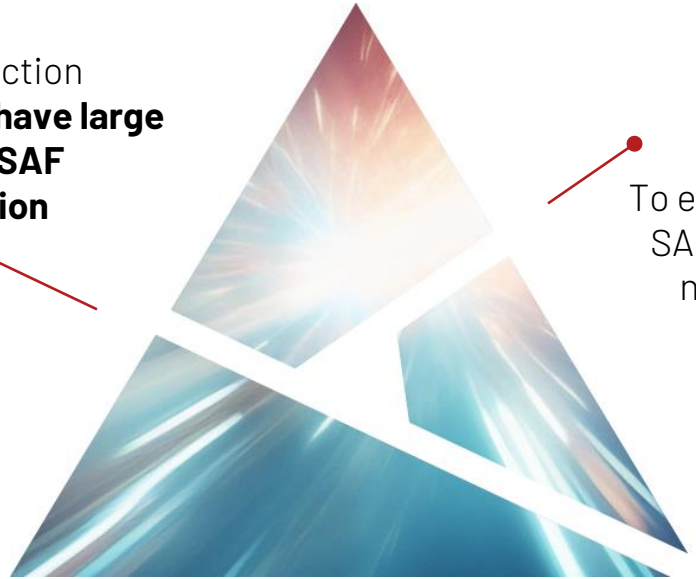
Growth in SAF demand largely driven by Europe and US, due to concrete mandates for SAF blending at all EU airports and high ambition on the supply side in the US supported by financial incentives.

Few other countries have an existing or proposed mandate or ambition for SAF blending.

SAF is the major lever available to decarbonize the aviation sector at scale and needed to realize the net zero ambition; therefore, the longer-term demand for SAF is also expected to come from rest of the world.

1. EU27 + UK
2. 2% by 2025, 6% by 2030, 70% by 2050 from ReFuelEU proposal

Contrary to fossil fuel production
almost all countries have large potentials for SAF production



To establish a dynamic SAF ecosystem countries need to develop **the full value chain including the refining / upgrading and logistics to airports / export hubs**

Asian countries can create massive local profits
by leveraging its organic feedstock potentials

CAPHENIA

Turning CO_2 into fuel

Supported by:

Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag