

TECHNOLOGY READINESS- WHAT'S DRIVING OR LIMITING SAF PRODUCTION SCALE-UP

TOPSOE

**Ready or Not: How the World is
Preparing for CORSIA with SAF
Targets**

World Bioenergy Association in
collaboration with ASAFA

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September 3, 2026



TOPSOE AT A GLANCE: OVER 80 YEARS OF INNOVATION AND LEADERSHIP

Topsoe is a leading global provider of advanced technology and solutions for the energy transition.

Built on decades of scientific research and innovation, we are working with customers and partners to drive energy resiliency and to achieve their sustainability goals.

We offer world-leading solutions for transforming renewable resources into fuels and chemicals, and we provide technologies needed to produce low-carbon and conventional fuels and chemicals as well as ensuring clean air.

We were founded in 1940 and are headquartered in Denmark, with over 2,800 employees serving customers all around the globe.

1/3

H₂

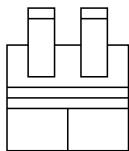
of hydrogen molecules are produced using Topsoe technology.

1/3



of the current renewable diesel and SAF operating capacity is based on Topsoe technology

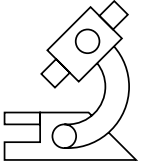




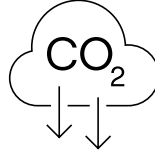
We started production in our industrial-scale Solid Oxide Electrolyzer Cell factory in Herning Denmark.

178

Our H-index is 178 with more than 1,800 scientific publications since 1950



Driven by innovation, we invested DKK 745 million in R&D in 2024.



We aim to reach Net Zero across scope 1, 2 and 3 in 2040

GLOBAL LEADER IN TECHNOLOGIES, CATALYSTS AND SERVICES

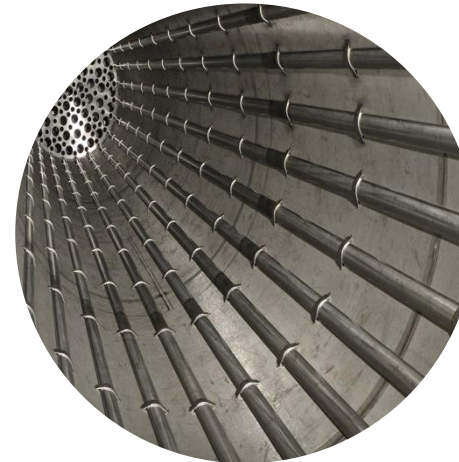
**PROCESS DESIGN,
ENGINEERING AND
LICENSING**



**HIGH-PERFORMANCE
CATALYSTS**



**PROPRIETARY
EQUIPMENT**



**SERVICE, SPARE PARTS,
CONSUMABLES AND DIGITAL
SERVICE SOLUTIONS**



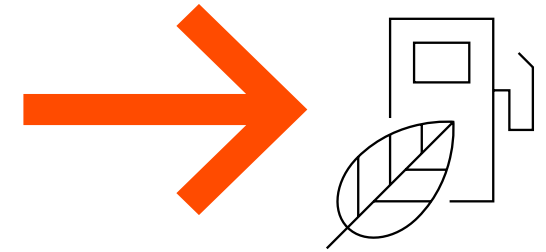
FIRST QUESTION

Where do the different SAF production pathways stand today in terms of technology maturity and commercial readiness?



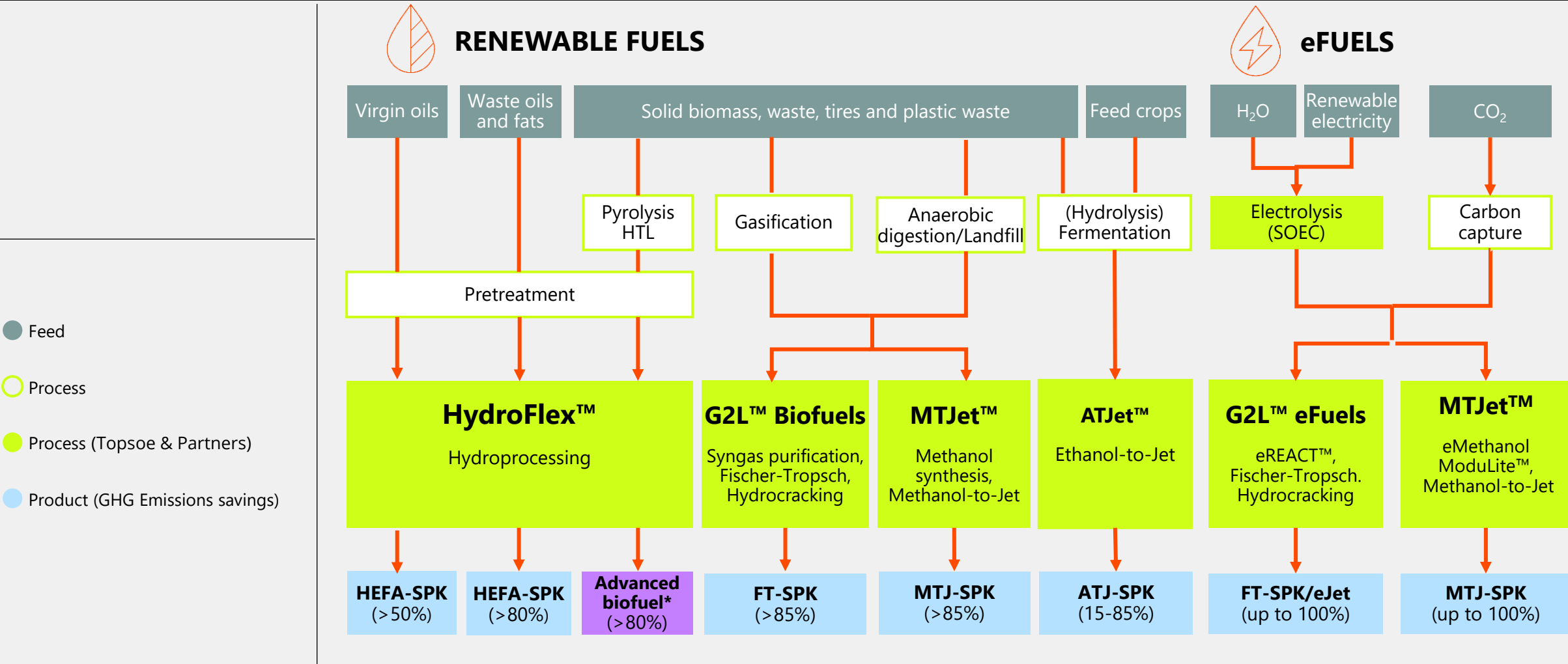
SAF CONVERSION PROCESSES APPROVAL AND BLENDING LIMITS

Each pathway represents specific opportunity and challenge



CONVERSION PROCESS	ABBREVIATION	POSSIBLE FEEDSTOCKS	BLENDING LIMIT
Fischer-Tropsch Synthetic Paraffinic Kerosene	FT-SPK	Biomass (wood waste, grass, municipal solid waste)	50%
Hydroprocessed Esters and Fatty Acids	HEFA-SPK	Oily biomass, e.g., algae, jatropha, camelina	50%
Hydroprocessed Fermented Sugars to Synthetic Isoparaffins	HFS-SIP	Bacterial conversion of sugars into hydrocarbons	10%
FT-SPK with aromatics	SPK/A	Renewable biomass, i.e., municipal solid waste, agricultural and wood waste	50%
Alcohol-to-jet Synthetic Paraffinic Kerosene	ATJ-SPK	Agricultural waste (corn shoots, grass, straw), cellulosic biomass	50%
Catalytic Hydrothermolysis Synthesized Kerosene	CH-SK, or CHJ	Vegetable or animal fats, oils and greases	50%
Co-processing		Fats, oils, and greases (FOG) from petroleum refining	5%
Hydroprocessed Hydrocarbons, Esters and Fatty Acids Synthetic Paraffinic Kerosene	HHC-SPK or HC-HEFA-SPK		10%
Power to Liquid	FT-SPK	Water, CO ₂	50%

SAF PATHWAYS - TOPSOE PORTFOLIO

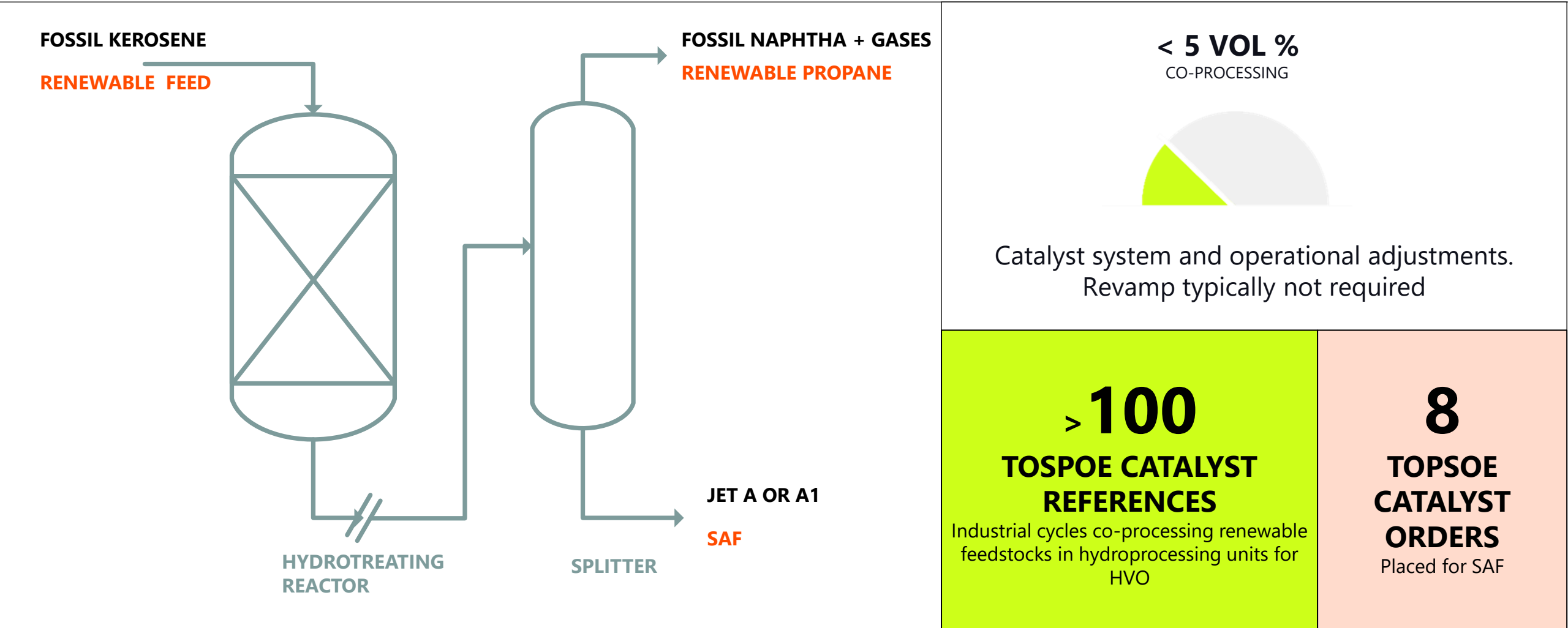


*Not approved ASTM pathways yet

Source: CORSIA, ICCT paper 2021-11, WEF+McKinsey 2020-11

SAF CAN ALSO BE PRODUCED BY CO-PROCESSING IN KEROSENE OR DIESEL HYDROTREATERS

ASTM-D1655 ALLOWS UP TO 5 VOL% CO-PROCESSING TO PRODUCE SAF



TOPSOE RENEWABLE FUEL REFERENCES AROUND THE WORLD

OVER 80 RENEWABLE FUEL PROJECTS.

- **HydroFlex™** – Operating (25)
- **G2L™ fuels** – Construction/Engineering (4)
- **HydroFlex™** – Construction/Engineering (52)

25

Operating plants*

>35%

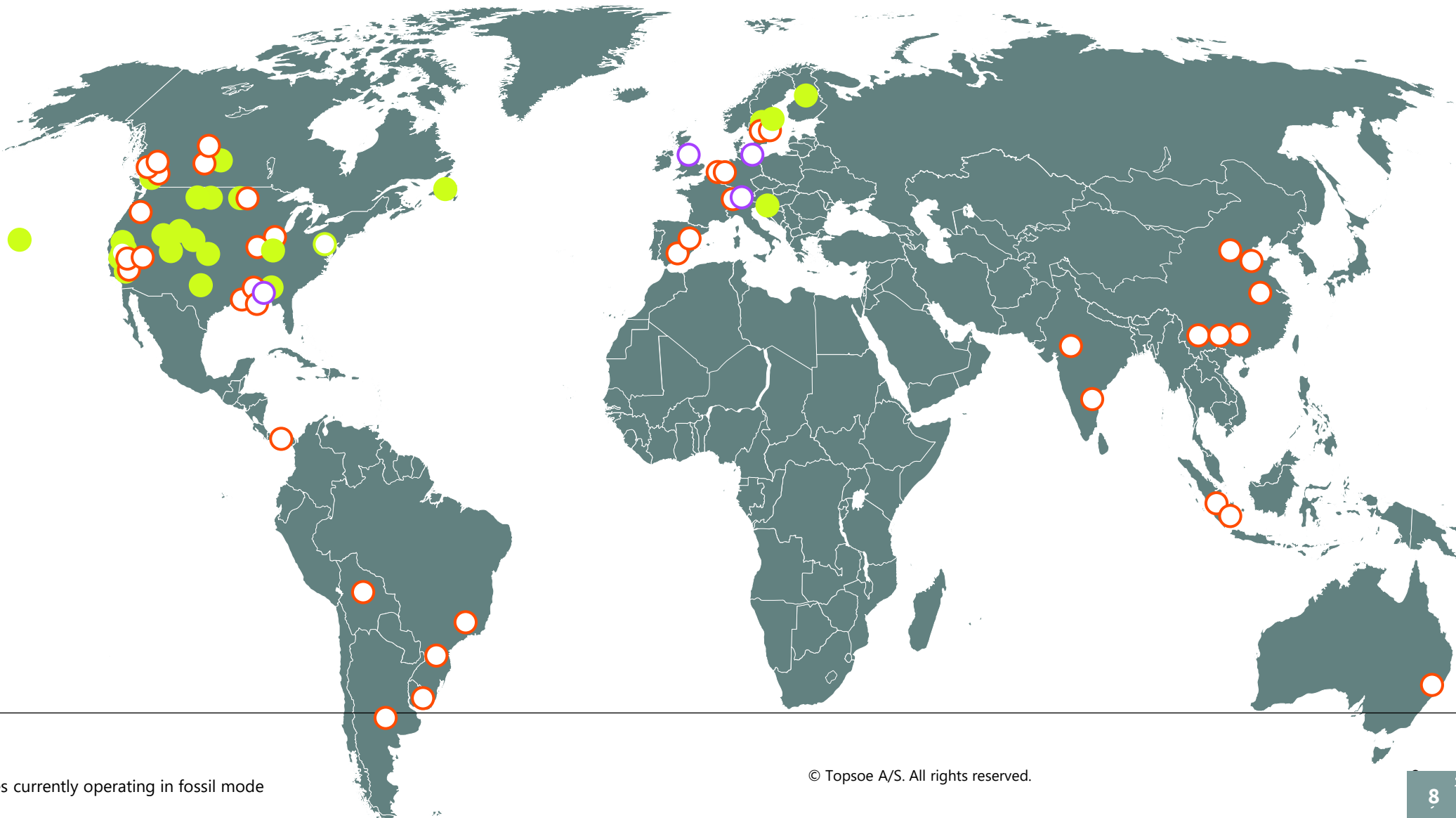
Of the renewable fuels operating capacity volume

2010

Start-up of first reference

>20

Revamps



PLANNED SASOL/TOPSOE (G2L™) FT-BASED XTL PLANTS



eFuels



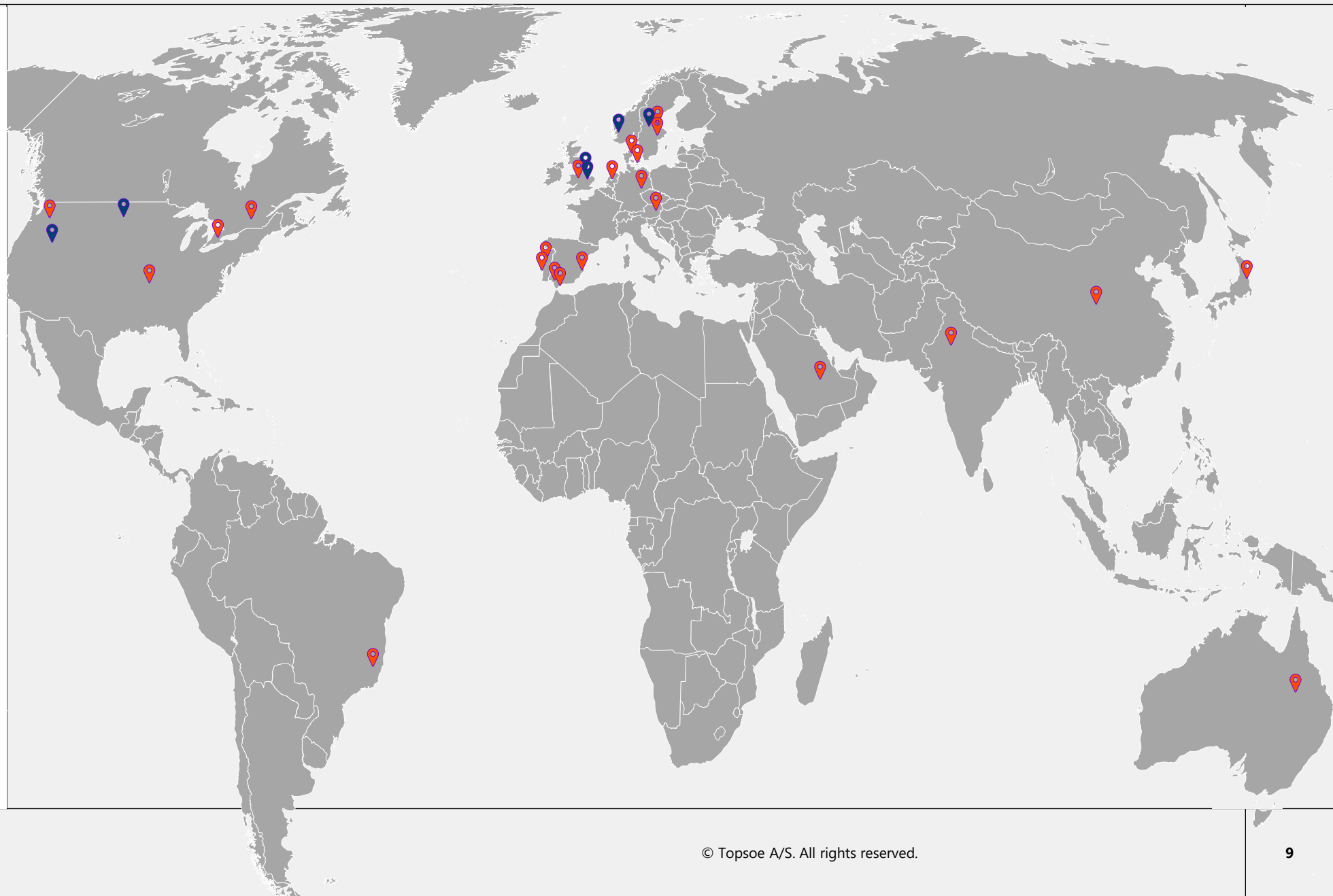
RNG / NG / Solid waste /
biomass (gasification)

PROJECT STATUS

FEED: 3 eFuels
Denmark, Germany, USA

FEED: 1 Biomass gasification
UK

Pre-FEED: 22
Global



*Limited list of projects at various planning stages

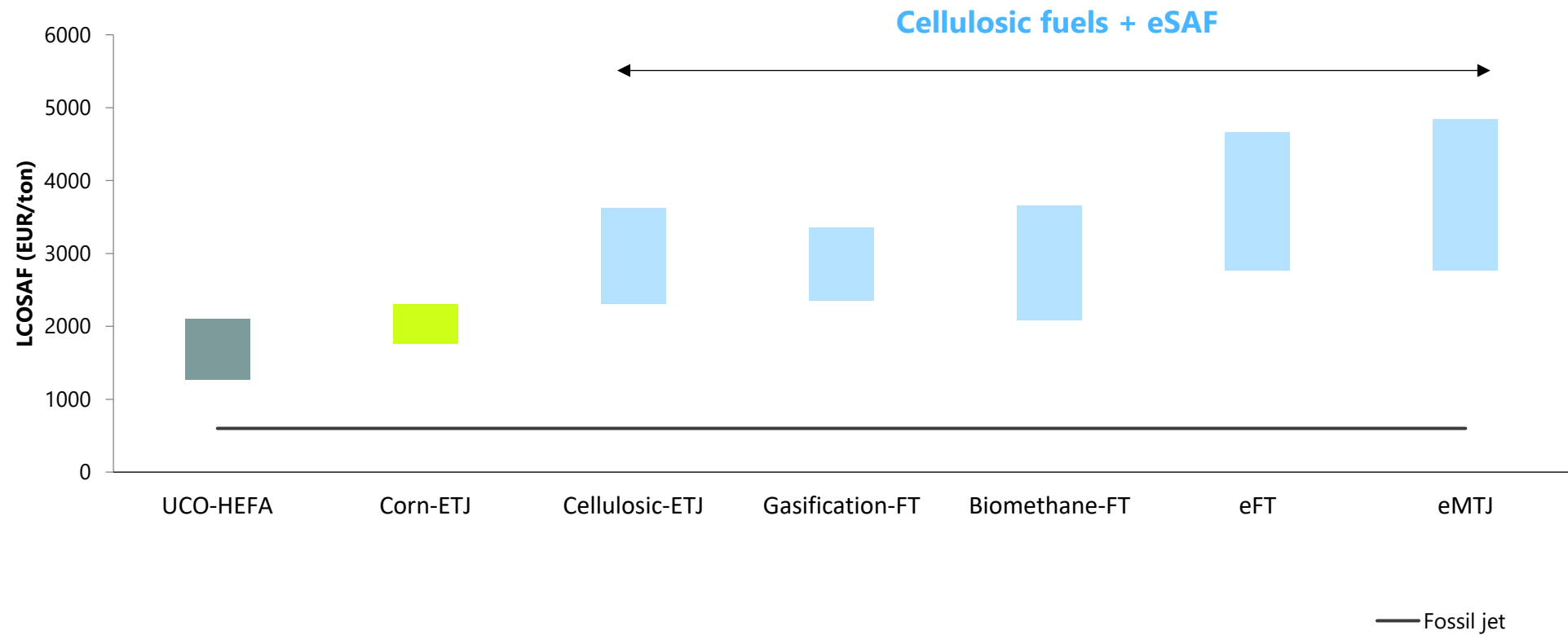
SECOND QUESTION

What determines how quickly a technology can move from proven to deployed at scale?

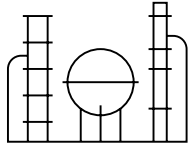


SAF IS AND WILL REMAIN MORE EXPENSIVE THAN FOSSIL JET FUEL

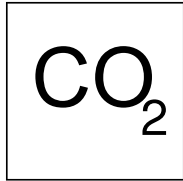
LEVELIZED COST OF SAF (LCOSAF)
EUR/TON SAF



MAKING SAF PROJECTS BANKABLE: THE NEED FOR TOTAL VALUE CHAIN COLLABORATION



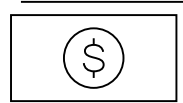
**SAF
Technology**



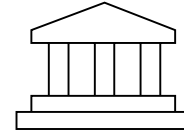
**Carbon
Intensity,
Sustainability,
Certification**



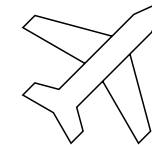
**Logistics and
Infrastructure**



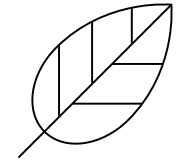
**Project
financing,
Investment**



Policy



**Offtake
agreement**



Feedstocks

THIRD QUESTION

What does this mean for how realistic near-term SAF targets are from a pure technology standpoint?



TAKE-HOME MESSAGES

- **SAF scaling is a system challenge, not a technology challenge**
 - Offtake, feedstocks, certification, infrastructure and financing matter more than reactors
- **HEFA enabled SAF — other pathways will scale it**
 - HEFA remains essential and will grow, but significant growth requires complementary pathways
- **ETJ is about diversification**
 - It expands the SAF supply base beyond fats, oils and greases and will be the most cost-efficient solution after HEFA for many years
- **FT and MTJ are both viable — context decides**
 - If cost, yield, centralized plants and full value chain control are a priority, FT is the way to go now



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THANK YOU

TOPSOE
Making Energy Transition