

FEBRUARI

19

COMMODITIES

THEORIE IN DE PRAKTIJK

Utrecht University

Utrecht | 13:00 - 17:00 uur



IEA Bioenergy

Technology Collaboration Programme



Rijksdienst voor Ondernemend
Nederland



Ministerie van Klimaat en
Groene Groei

PLATFORM
BIO
ECONOMIE



Dusita de Hoop
Future Fuels Analyst
SkyNRG

The Need and Challenges of Advanced Bio-SAF Deployment



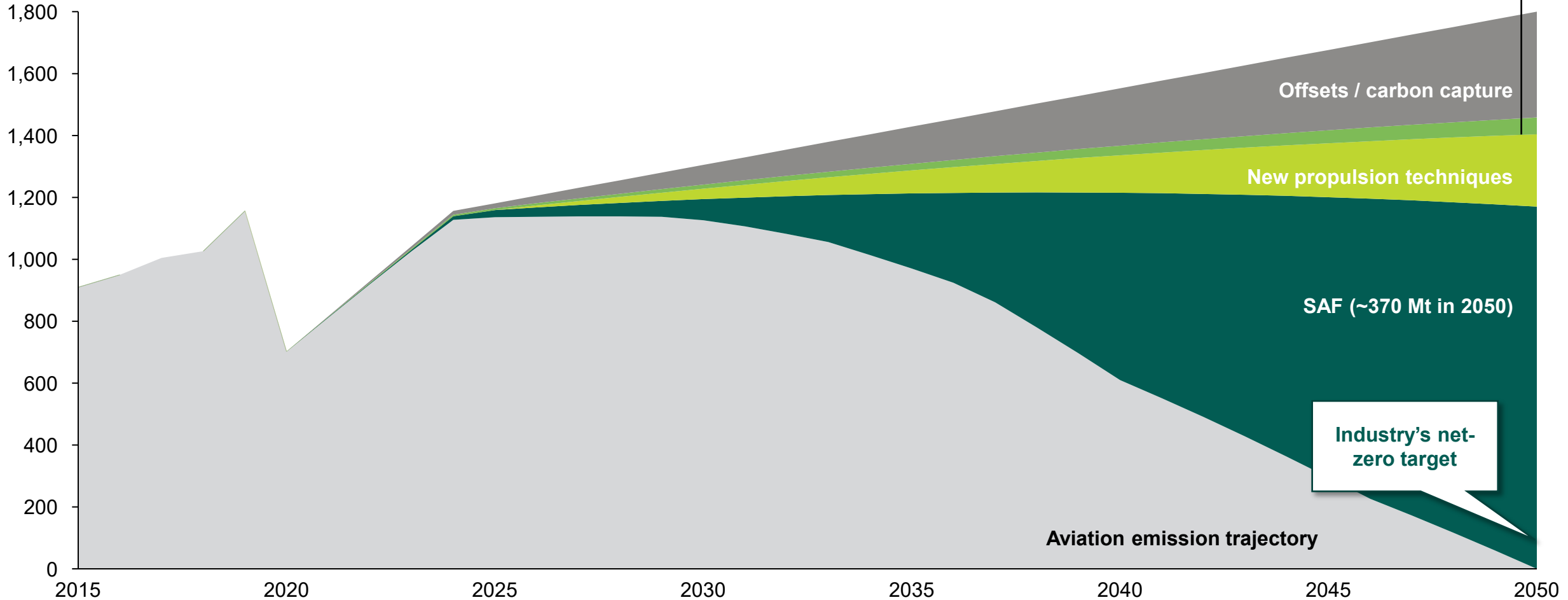
The Need and Challenges of Advanced Bio-SAF Deployment

SkyNRG
Dusita de Hoop

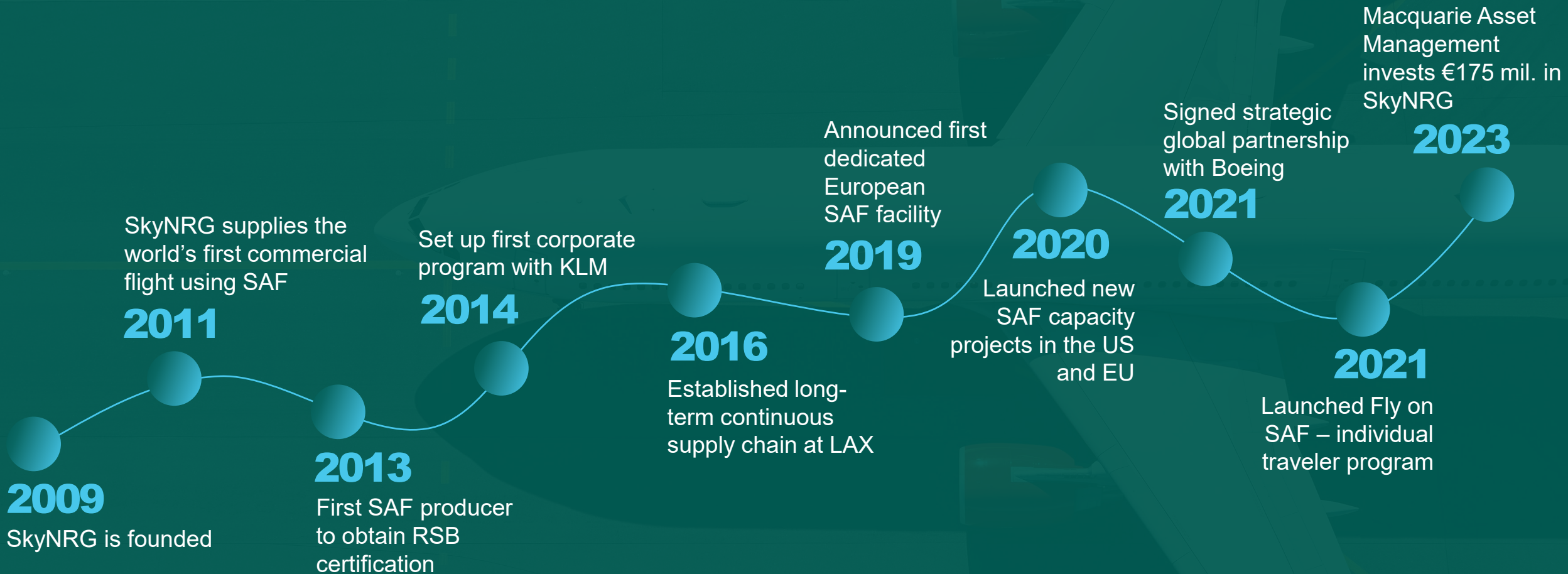
IEA Commodities: Theorie in de Praktijk
Utrecht, The Netherlands
19th February

SAF is crucial to reach net-zero industry target by 2050

Global aviation emissions (Mt CO₂)



Since 2009 we have built a leading position in the SAF industry



SkyNRG is a leader in Sustainable Aviation Fuel



We develop SAF capacity and partner in sourcing SAF with third parties



We supply SAF to aircraft operators



We provide SAF solutions for corporate and individual travelers



We provide advisory services on SAF



We are recognized as a sustainability leader

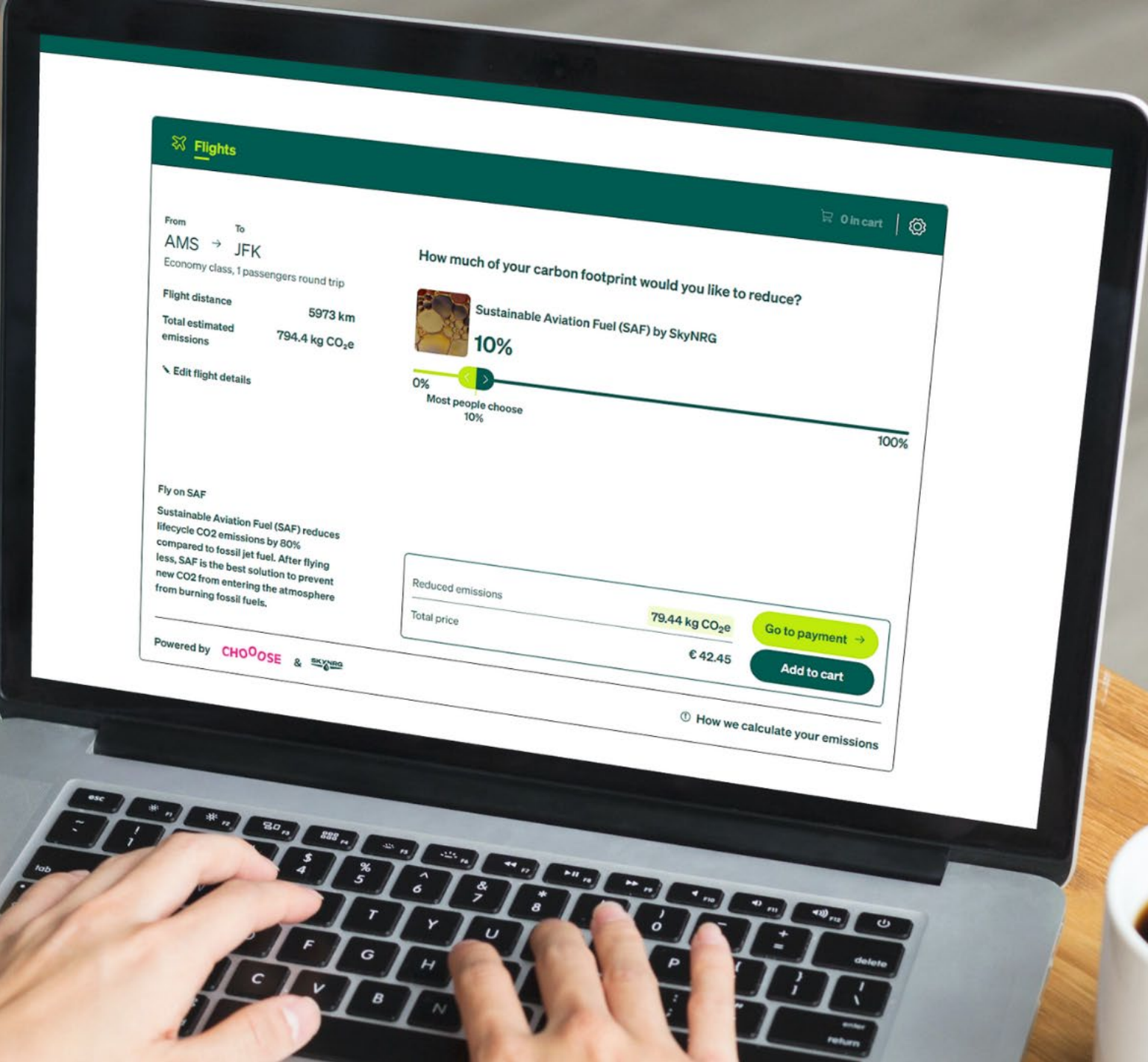
WANT TO FLY ON SAF?

It's possible!

SkyNRG's **Fly on SAF calculator** generates a user-friendly display for customers to reduce their footprint as they please*.

If you're a business that wants to reduce emissions, SkyNRG can also help you reach your sustainability goals.

**We use ICAO's trusted data and methodology for calculations*



SAF can be produced from three types of feedstock



Fats and oils

Biomass

Power + CO₂

HEFA | Co-processing

Gasification + Fischer-Tropsch | Alcohol-to-Jet

eSAF

FEEDSTOCK AVAILABILITY



TECHNOLOGY READINESS



The ReFuel EU mandates enables a steady SAF demand

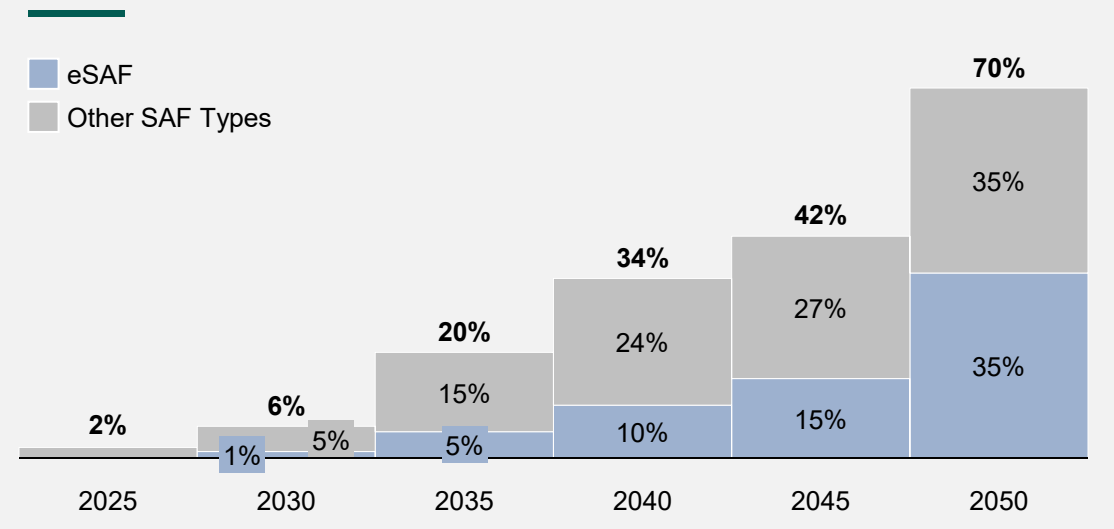
ReFuelEU mandate kicked in 2025

- **Mandated share of SAF** in the jet fuel supply to European airports
- **Significant penalties** in place for non-compliance
- **Sub-target for e-SAF** in place

Strict sustainability and feedstock requirements

- **Excluded feedstocks:**
Food and feed crops, soy or palm derivatives
- **Accepted feedstocks:**
 - **Advanced biofuels:** Part A Annex IX (advanced technologies)
 - **Other biofuels:** Part B Annex IX (mature technologies)

Minimum SAF share ReFuelEU



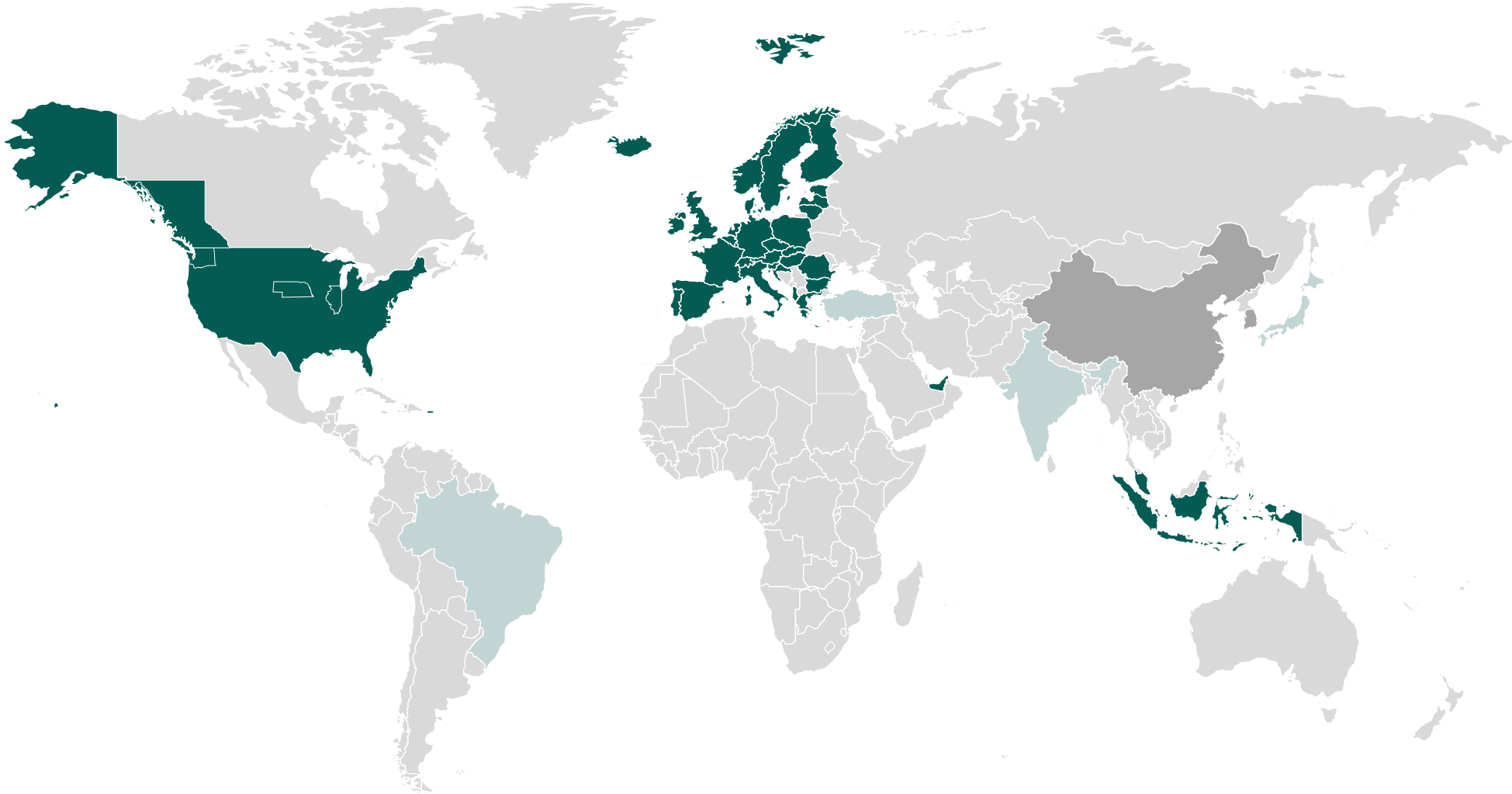
Part A Annex IX examples

- Animal manure and sewage sludge
- Bagasse
- Biomass fraction from municipal waste
- Biomass fraction industrial waste
- Intermediate and cover crops grown on severely degraded land
- Straw and husks
- Waste and residues from forestry
- Non-food cellulosic material
- Other ligno-cellulosic material

Part B Annex IX examples

- Animal fats categories 1 & 2
- Used cooking oil (UCO)
- Intermediate and cover crops grown on severely degraded land (not used for aviation)
- Crops grown on severely degraded land (not used for aviation)

SAF mandates and targets are developing across the globe



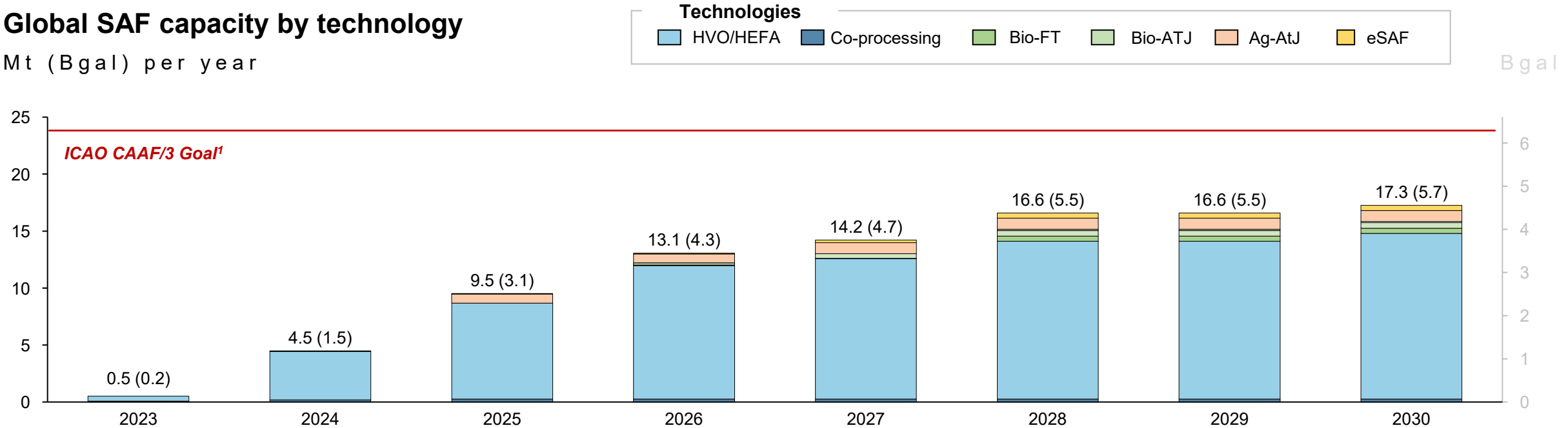
As of May 2024

Announced
 Proposed
 Under discussion

Global SAF production capacity could grow to ~17 Mt by 2030

Global SAF capacity by technology

Mt (Bgal) per year



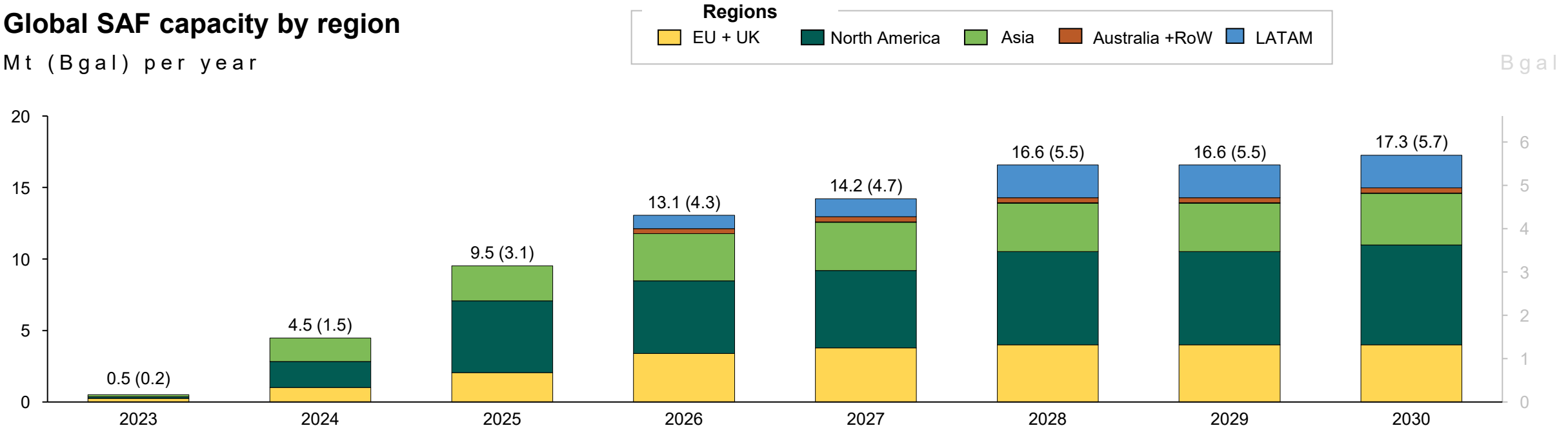
Commentary

- ▶ All facilities have to succeed to be on track for net-zero pathway
- ▶ Capacity announcements still dominated by HEFA: ~85% of total
- ▶ Alcohol-to-Jet picking up (mainly US), now at 8% of 2030 capacity
- ▶ Co-processing activity is not publicly announced
- ▶ ~10 Mt of SAF capacity relies on agricultural crops for feedstock
- ▶ Minimal advance bio-SAF and e-SAF facilities

North America responsible for 40% of expected SAF capacity by 2030

Global SAF capacity by region

Mt (Bgal) per year



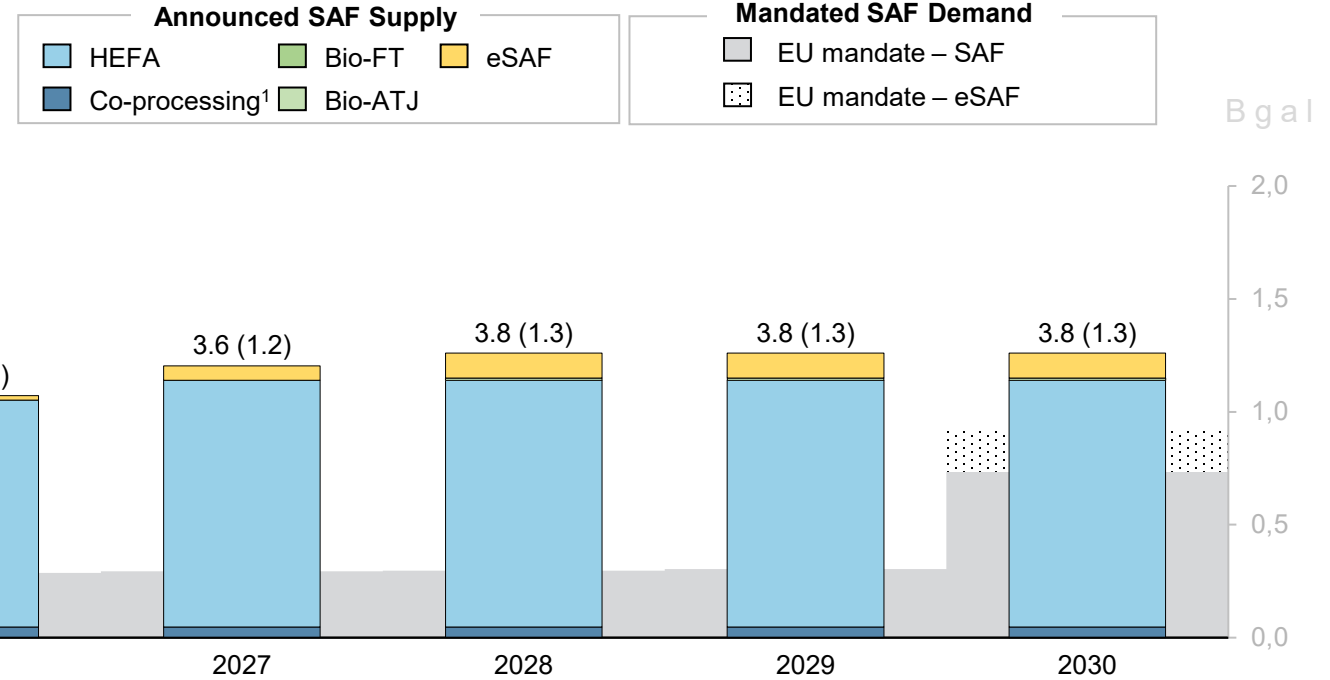
Commentary

- ▶ North America claims majority of SAF capacity announced
- ▶ Larger avg. plant sizes in NA compared to other regions: different feedstock focus
- ▶ Asia-Pacific quickly claiming significant share of capacity
- ▶ Increasing UCO feedstock pressure for regions dependent on imports
- ▶ Close to 2030, LATAM also emerges as major SAF production hub

EU is expected to meet its 2030 blending targets for SAF with HEFA

EU SAF capacity by technology

Mt (Bgal) per year



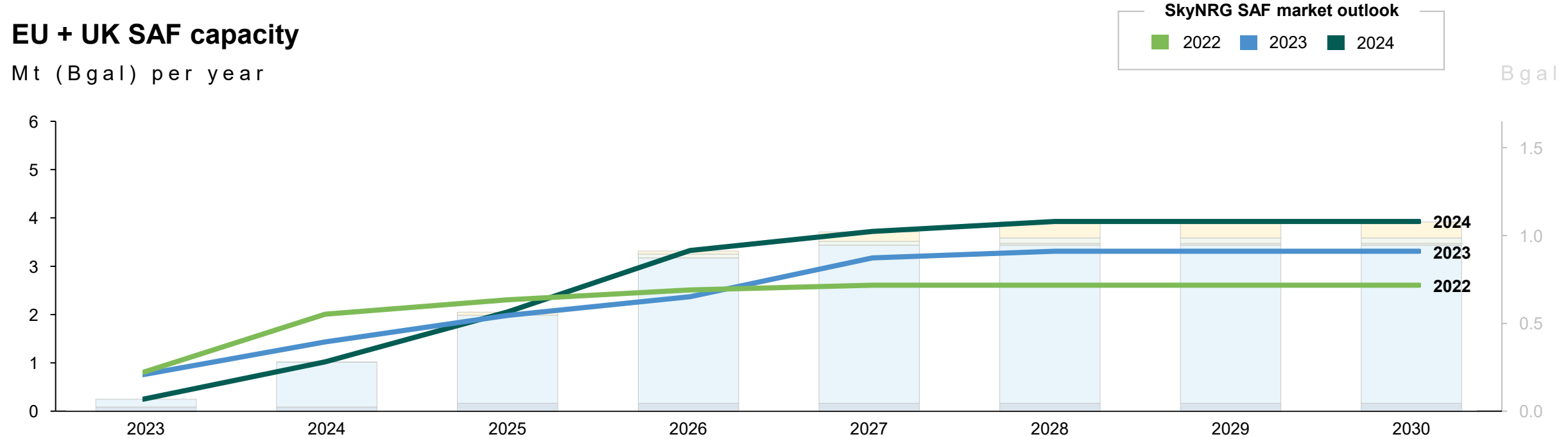
Commentary

- ▶ 73% of announcements need to succeed to fill 2030 demand
- ▶ More than 90% of all facilities use waste oils and fats as feedstock
- ▶ Limited demand for advanced bio-SAF in current design
- ▶ To meet e-SAF sub-mandate, e-SAF projects need to progressed
- ▶ Co-processing could change supply structure of EU market
- ▶ Not the whole picture: global market means imports

Looking back, we identify an ongoing trend of delays in the sector

EU + UK SAF capacity

Mt (Bgal) per year



Commentary

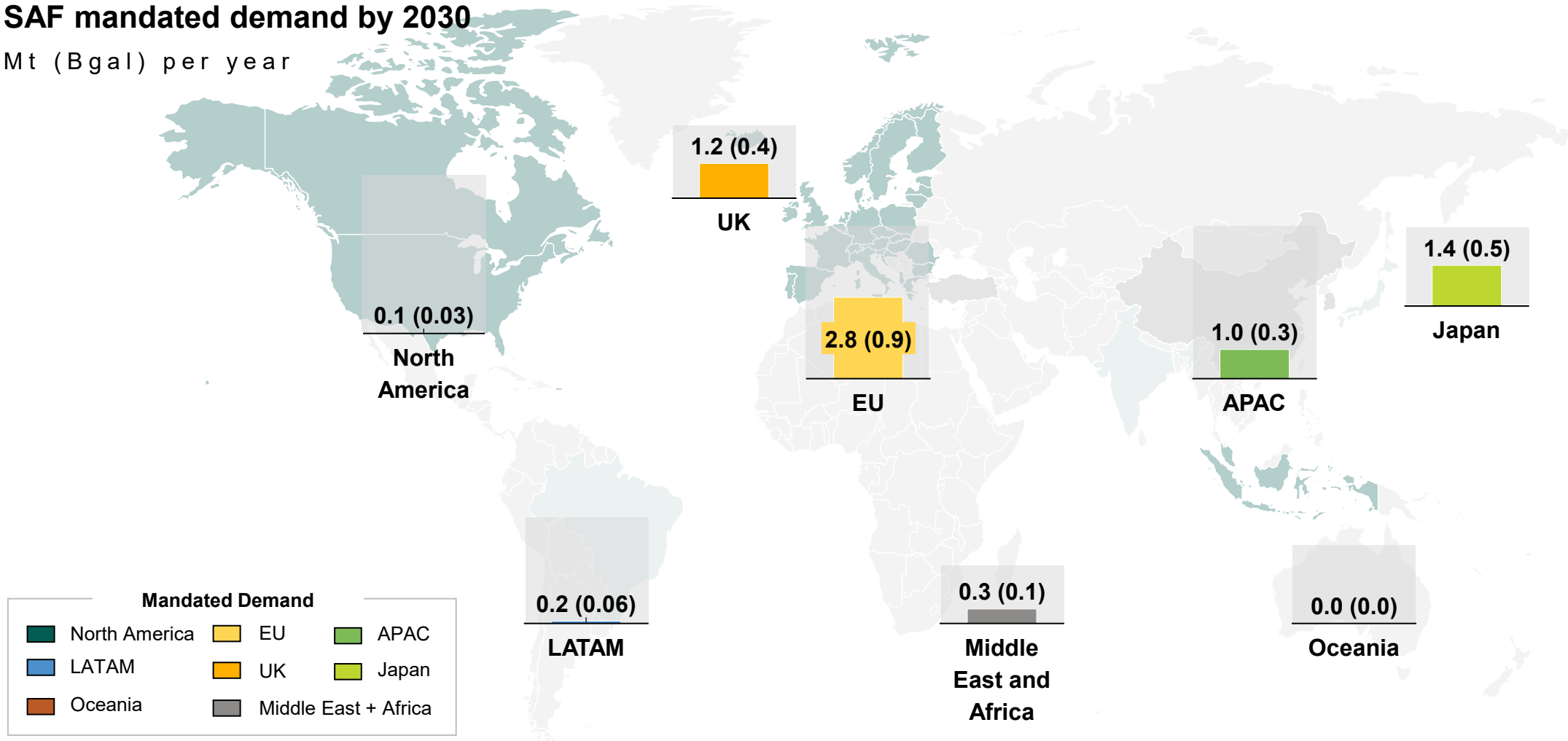
- ▶ Every year since 2022, capacity curve is pushed back
- ▶ Lots of major changes since publishing of the 2024 Market Outlook

- ▶ Reasons for delay:
 1. Awaiting policy certainty
 2. Market saturation
 3. Financing difficulties

Mandates and targets now add up to 16 Mt (5.3 Bgal) SAF demand by 2030

SAF mandated demand by 2030

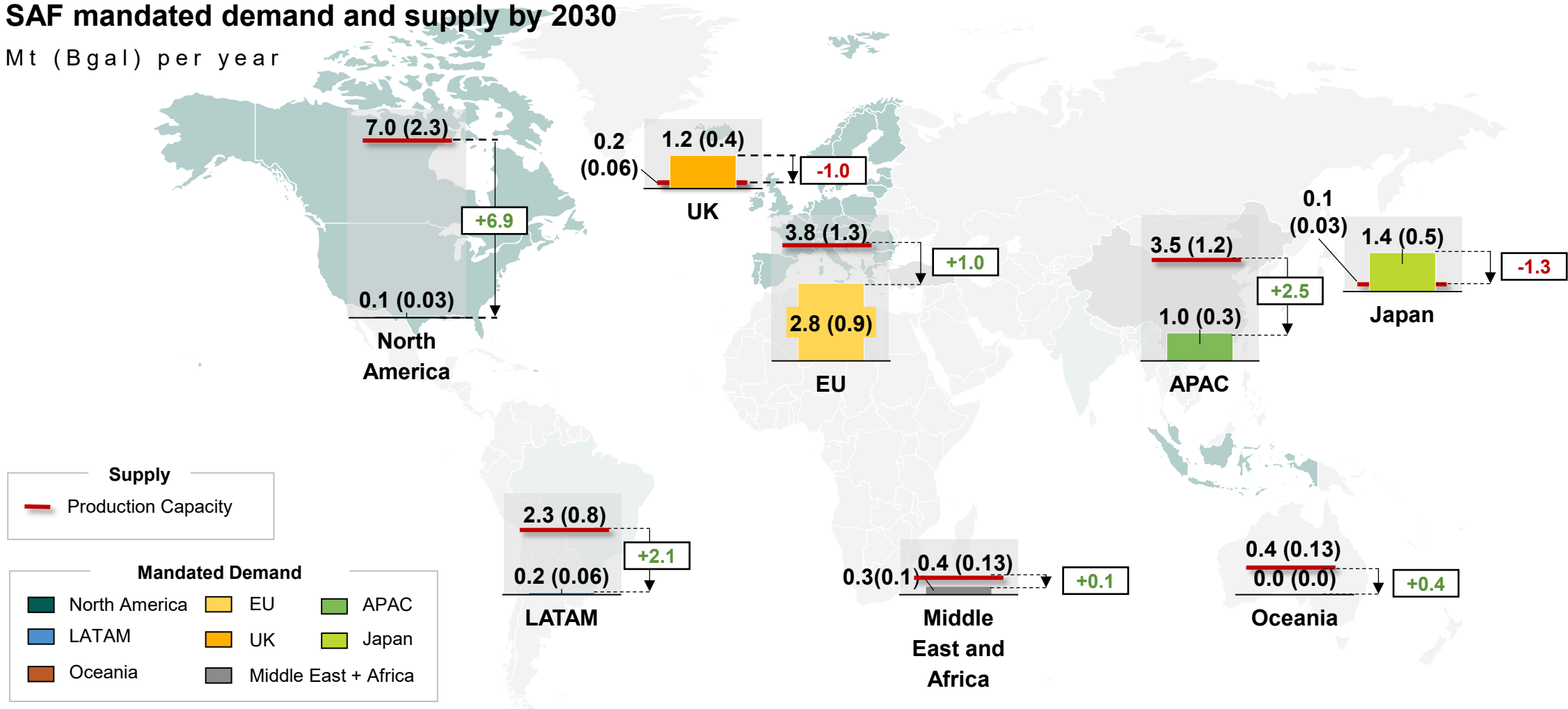
Mt (Bgal) per year



Geographical imbalance between SAF capacity and regulatory demand

SAF mandated demand and supply by 2030

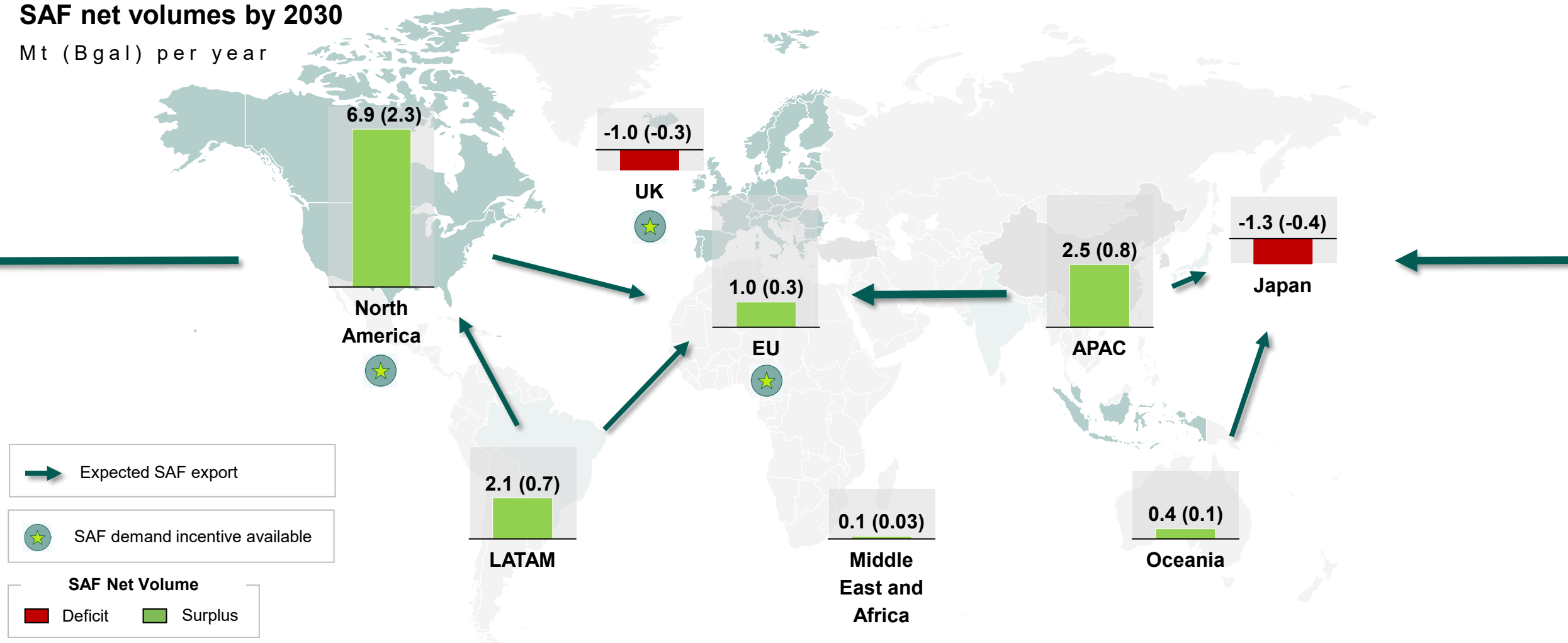
Mt (Bgal) per year



Surplus likely to be used for other regulatory markets or voluntary market

SAF net volumes by 2030

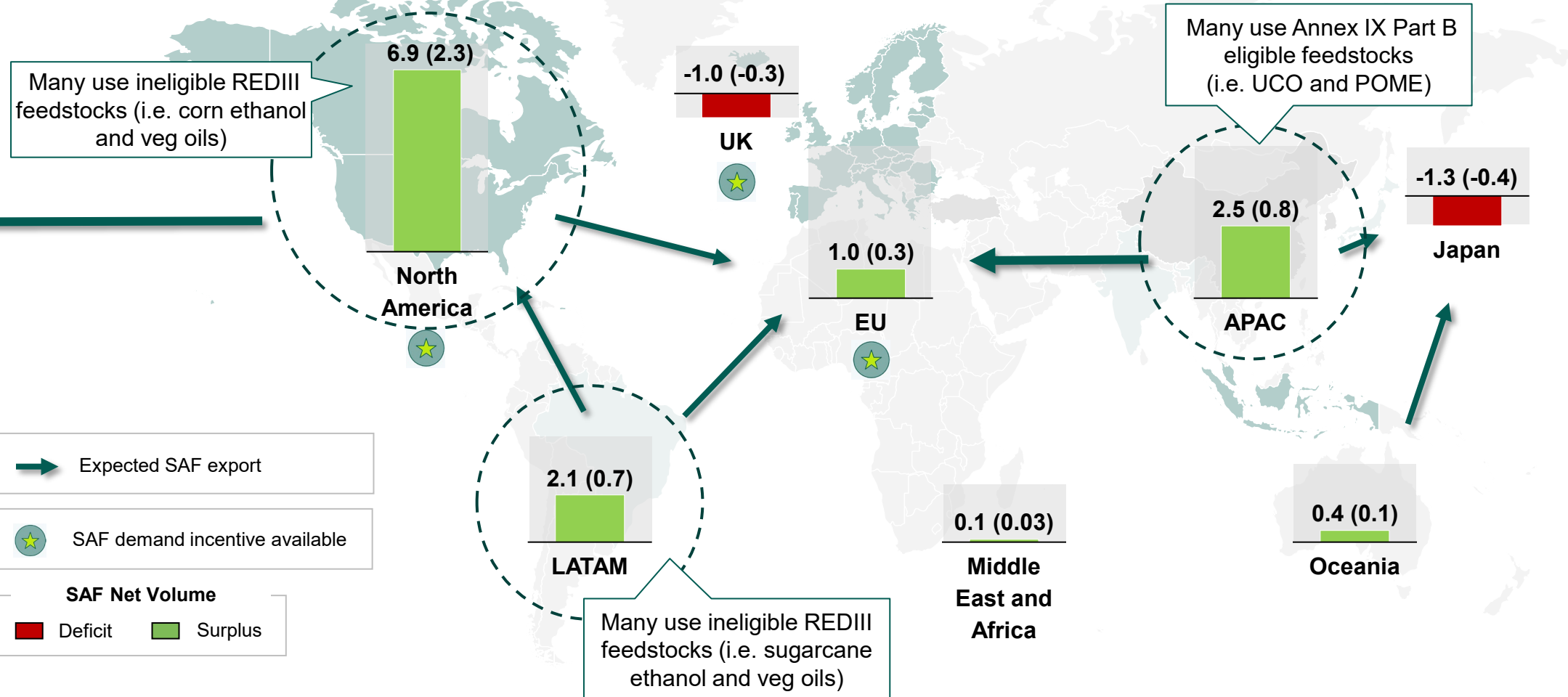
Mt (Bgal) per year



Asian SAF are RED III eligible and are likely to be exported to the EU

SAF net volumes by 2030

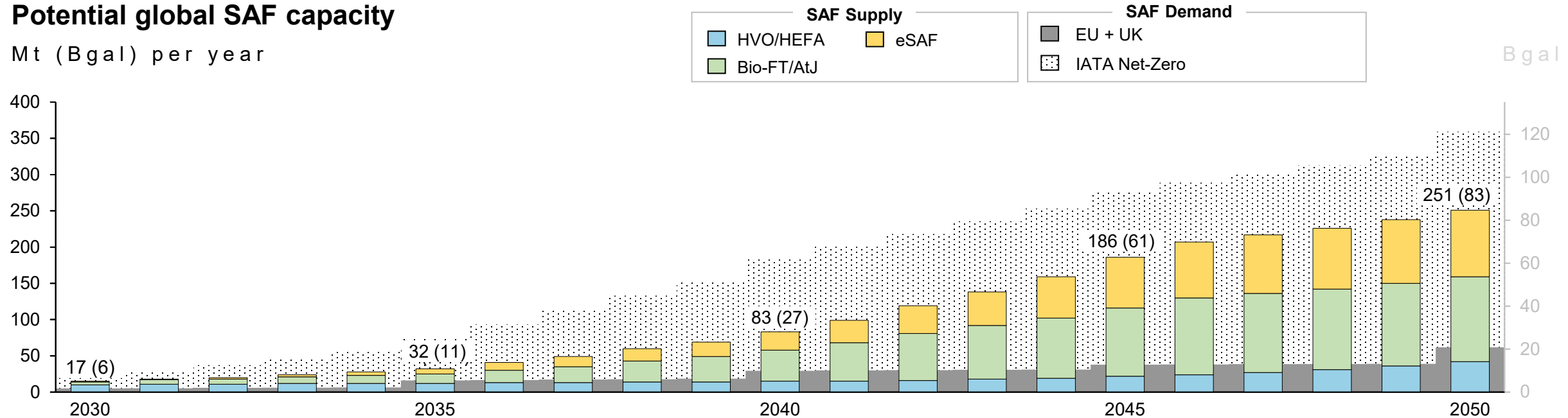
Mt (Bgal) per year



Advanced bio-SAF production is essential for EU long-term energy security

Potential global SAF capacity

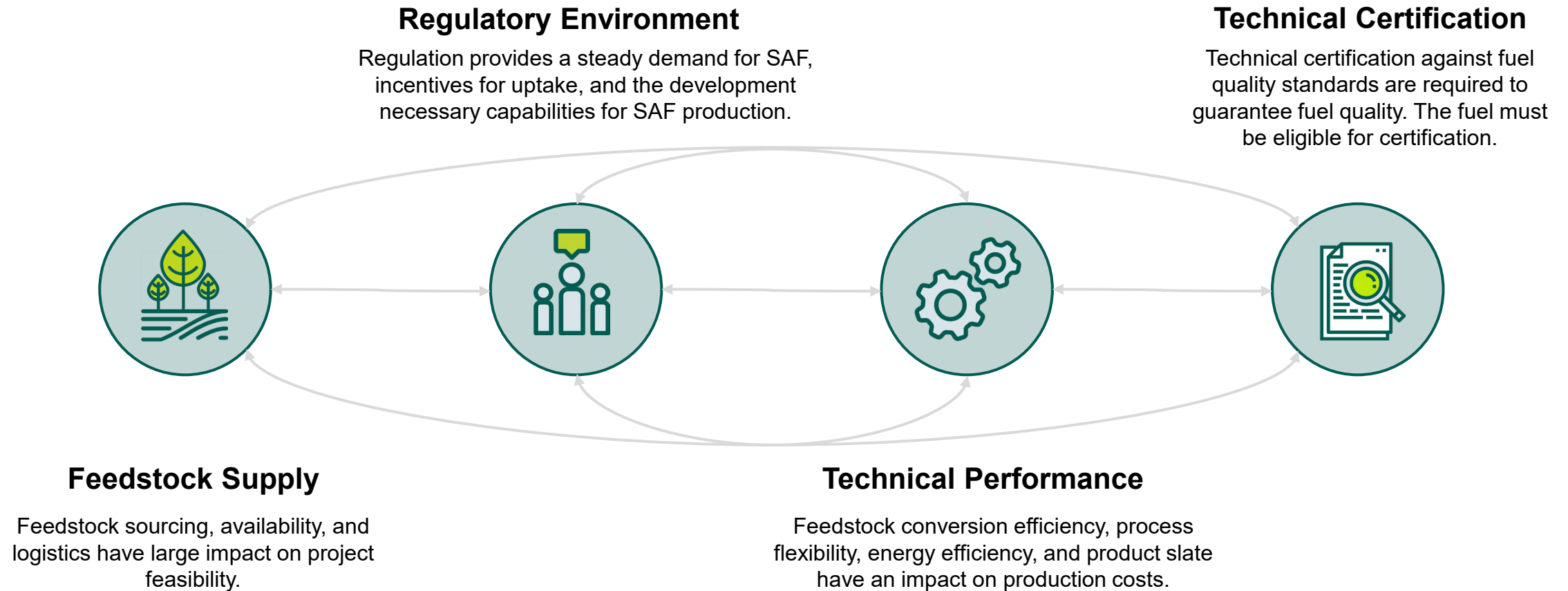
Mt (Bgal) per year



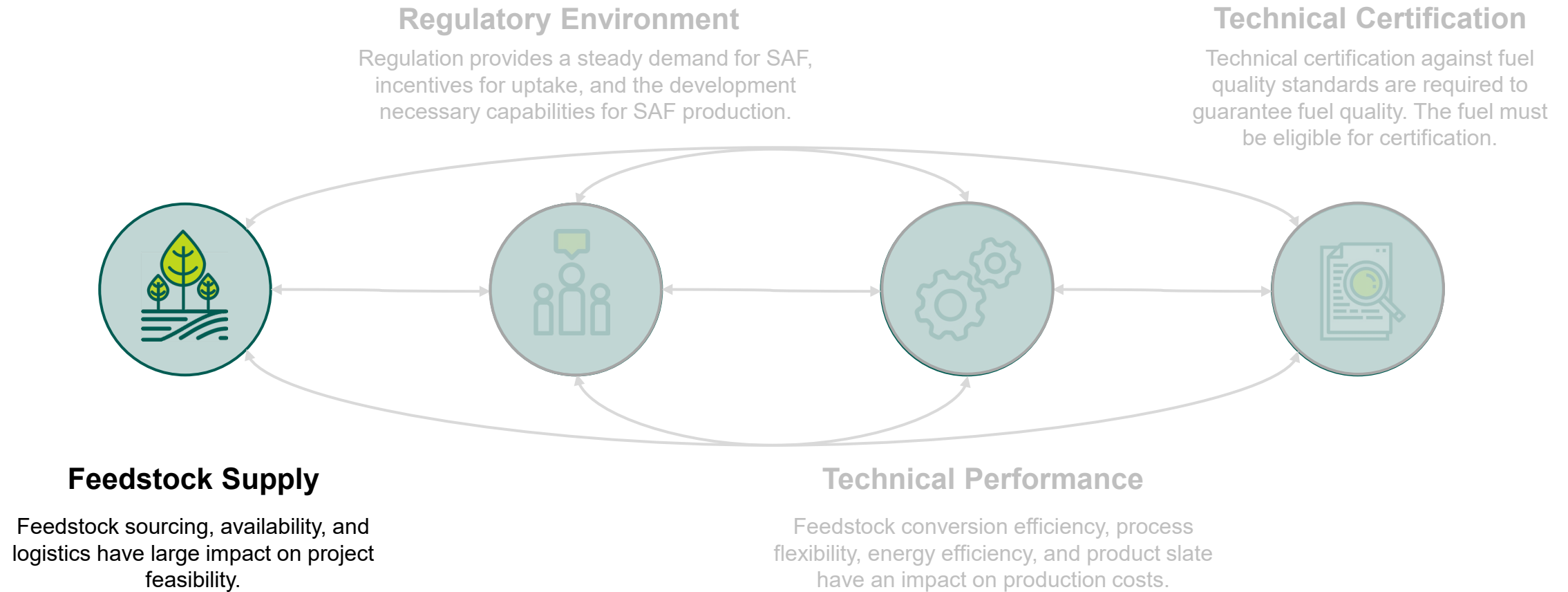
Commentary

- ▶ The EU is reliant on imports of waste oils and fats.
- ▶ HEFA from waste oils and fat and new bio-oil supply is constrained to ~40 Mt by 2050.
- ▶ Scaling up advanced bio-SAF production is key to unlocking EU long-term energy security
- ▶ Biomass for SAF constrained at 20% of the global potential (~1500 Mtpa) assumed
- ▶ First significant volumes of advanced bio-SAF won't materialize without policy support and technology development

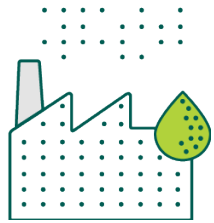
Scale up of advanced bio-SAF requires multiple moving gears to fall in place



Scale up of advanced bio-SAF requires multiple moving gears to fall in place



Biofuel production requires sufficient biomass supply



Feedstock Supply and Use

Economies of scale have a large impact on SAF business cases



Volume and Logistics

- ▶ Biomass often has low energy density impacting logistical feasibility.
- ▶ Biomass is often available at low concentration and can be seasonal.

Heterogeneity

- ▶ There are large variations in biomass composition and trace elements.
- ▶ Pretreatment, handling, and processing requirements often limited feed flexibility.

Collection and handling

- ▶ Development of biomass supply chains and management practices are needed.

Sustainability

- ▶ Biomass supply often involves sustainability trade-offs.
- ▶ Assurance of good biomass management practices on both biomass produced and imported are needed.

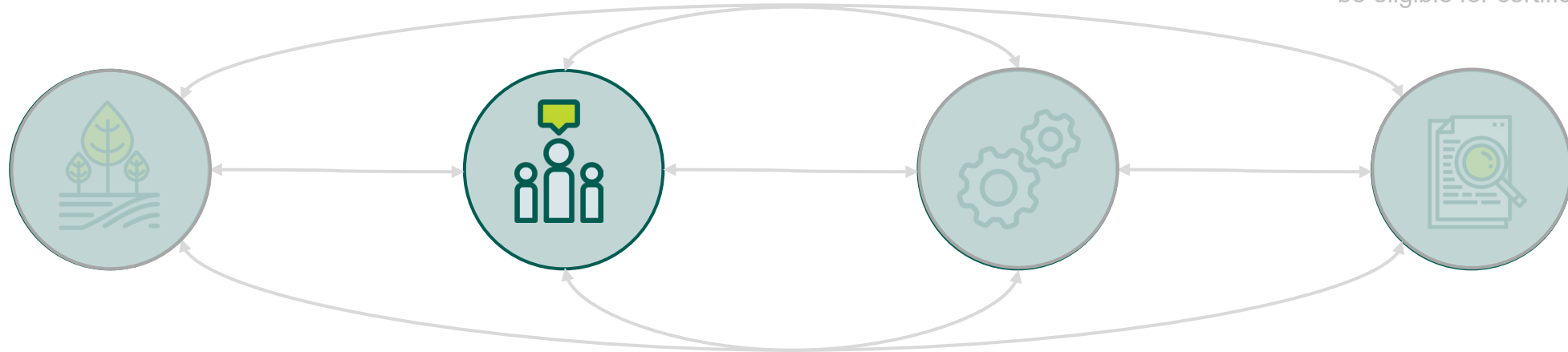
Scale up of advanced bio-SAF requires multiple moving gears to fall in place

Regulatory Environment

Regulation provides a steady demand for SAF, incentives for uptake, and the development necessary capabilities for SAF production.

Technical Certification

Technical certification against fuel quality standards are required to guarantee fuel quality. The fuel must be eligible for certification.



Feedstock Supply

Feedstock sourcing, availability, and logistics have large impact on project feasibility.

Technical Performance

Feedstock conversion efficiency, process flexibility, energy efficiency, and product slate have an impact on production costs.

Scale up of advanced bio-SAF require more than mandates

Long-term policy certainty and clarity provides investment confidence.

Demand

ReFuelEU Aviation combines bio-SAF and advanced bio-SAF under the same mandate.

A sub mandate can enable a steady demand of advanced bio-SAF.



Supply

De-risking investments and providing financial incentives for production are key for a strong business case. (i.e. HBEs in the Netherlands)

Financial instruments to realize offtakes of more complex bio-advanced SAF supply chains. Contract for difference schemes, for example, can help with this.



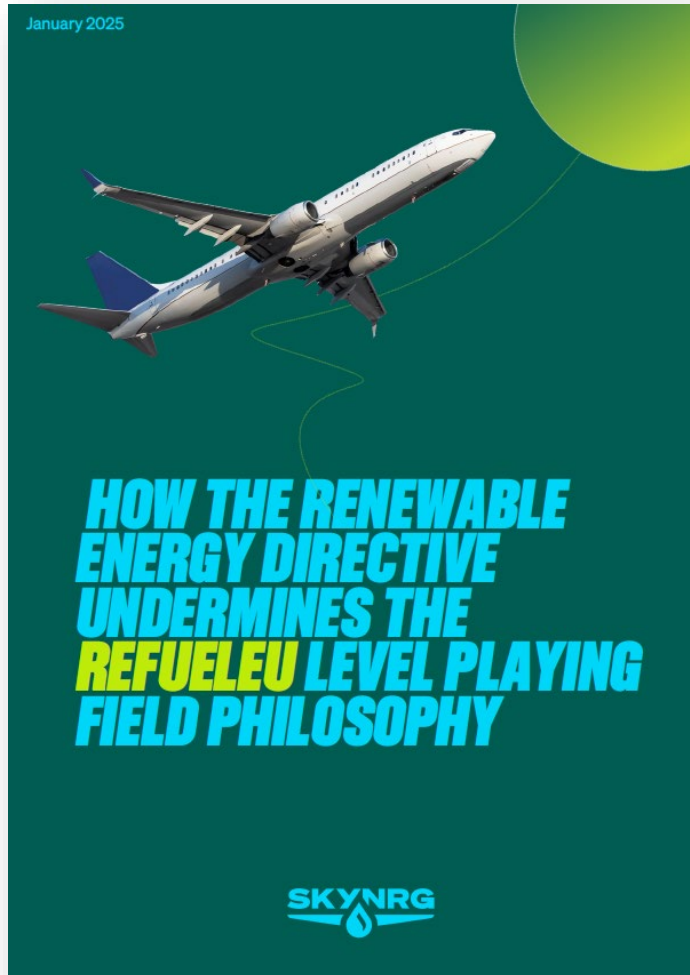
Market Uptake

EU-ETS incentivizes market uptake by airline operators. Up to 20 million free allowances are given until 2030 to off-set the cost difference between CAF and SAF.

Long-term extension of EU ETS allowances.



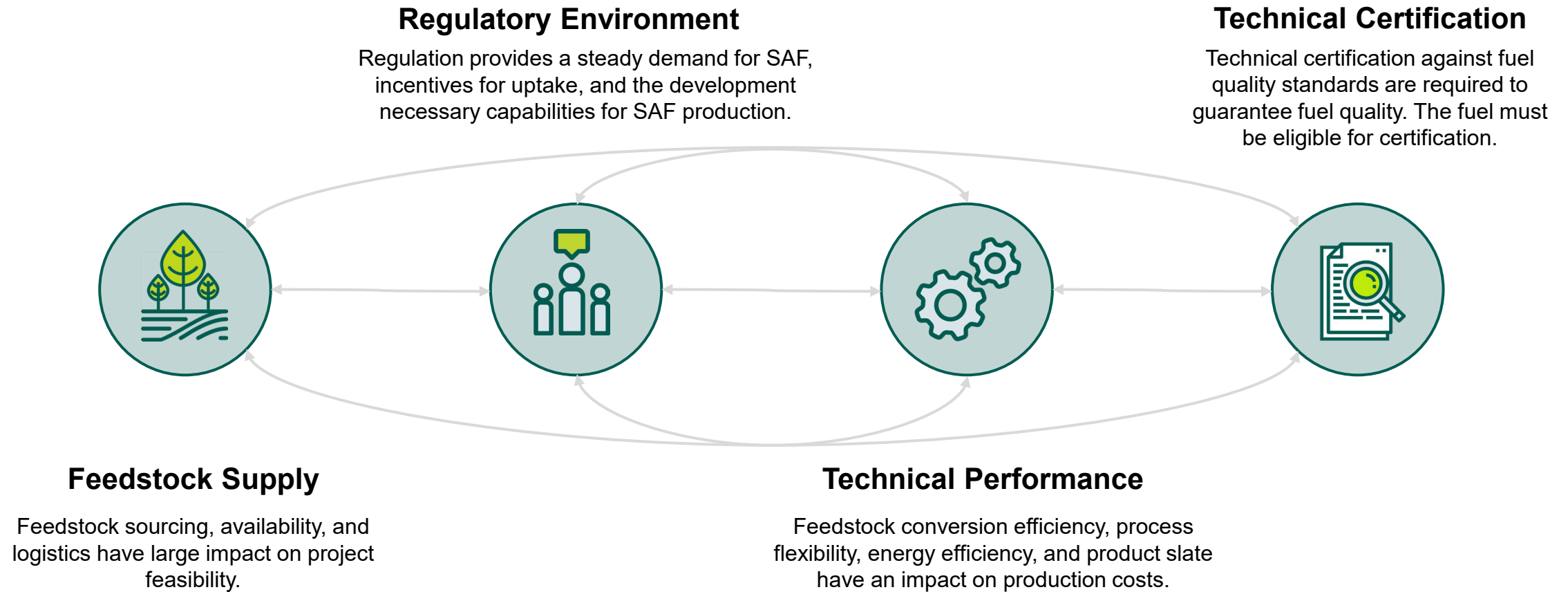
SAF production faces an uneven playing field among member states



The RED fails to create a level playing field for SAF Supply

ReFuelEU Aviation aims to promote Sustainable Aviation Fuel (SAF) but the RED fails to ensure a level playing field, as supply and pricing vary across Member States due to different feedstock interpretation.

Scale up of advanced bio-SAF requires multiple moving gears to fall in place



Towards 2030 and 2050: how to unlock advanced bio-SAF volumes?



Improve certainty of demand

Sub-mandates can help create level-playing field



Maintain EU competitiveness

Policy support to encourage domestic renewable fuel production and help bridge the premium price gap



Support technology scale-up

Improve/expand financial instruments and incentives to reduce investment risks for SAF producers and technology developers

Want to Learn More?

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