The path forward: Options for decarbonization in the Aviation sector (SAF)

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Oct.27, 2021

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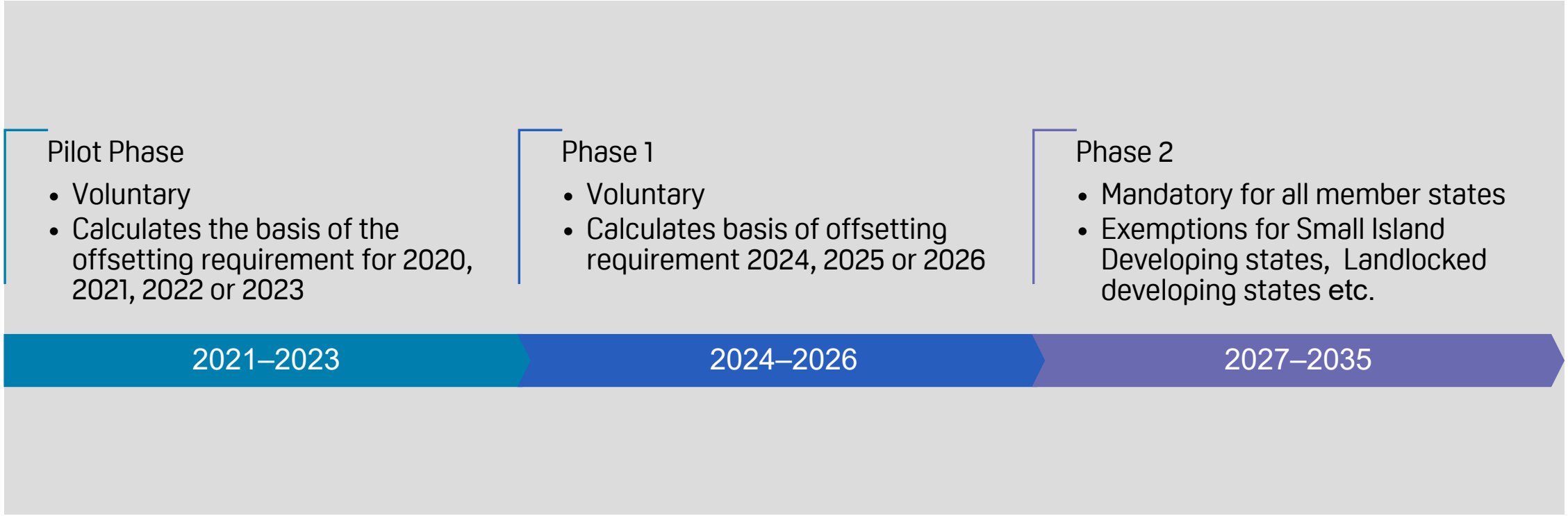
CORSIA

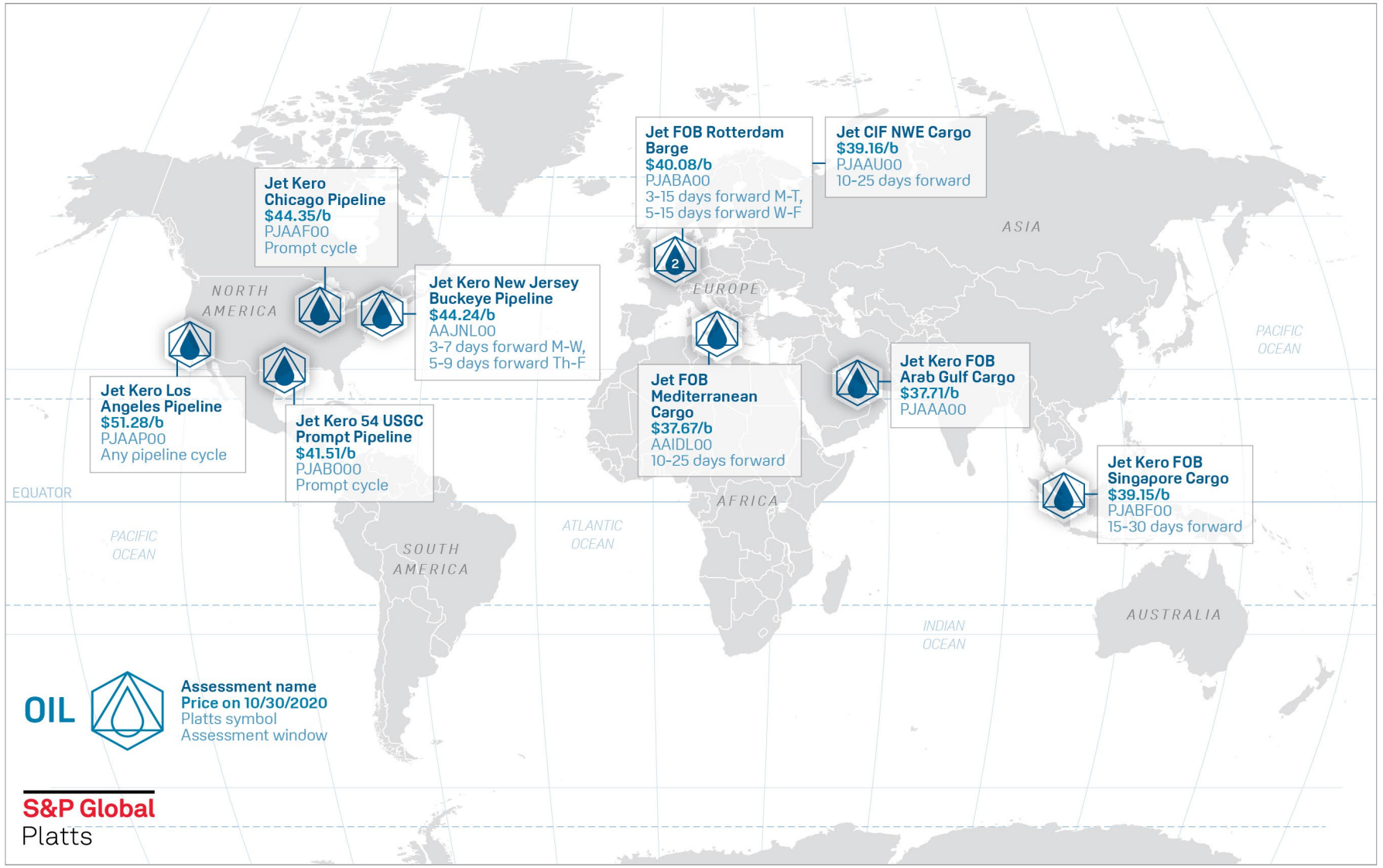
Carbon Offsetting and Reduction Scheme for International Aviation



Today's Agenda

1. Platts Sustainable Aviation fuel and Renewable Diesel / Hydrotreated Vegetable Oil prices
2. How do we derive the prices?
3. SAF and RD/HVO historical price trends
4. Challenges in the production and consumption
   How government policies are addressing these challenges
5. Who is producing SAF/HVO and how much is coming online
6. New Platts prices for deep analysis

1. Key Platts Jet Fuel Assessments & SAF prices



Source: S&P Global Platts

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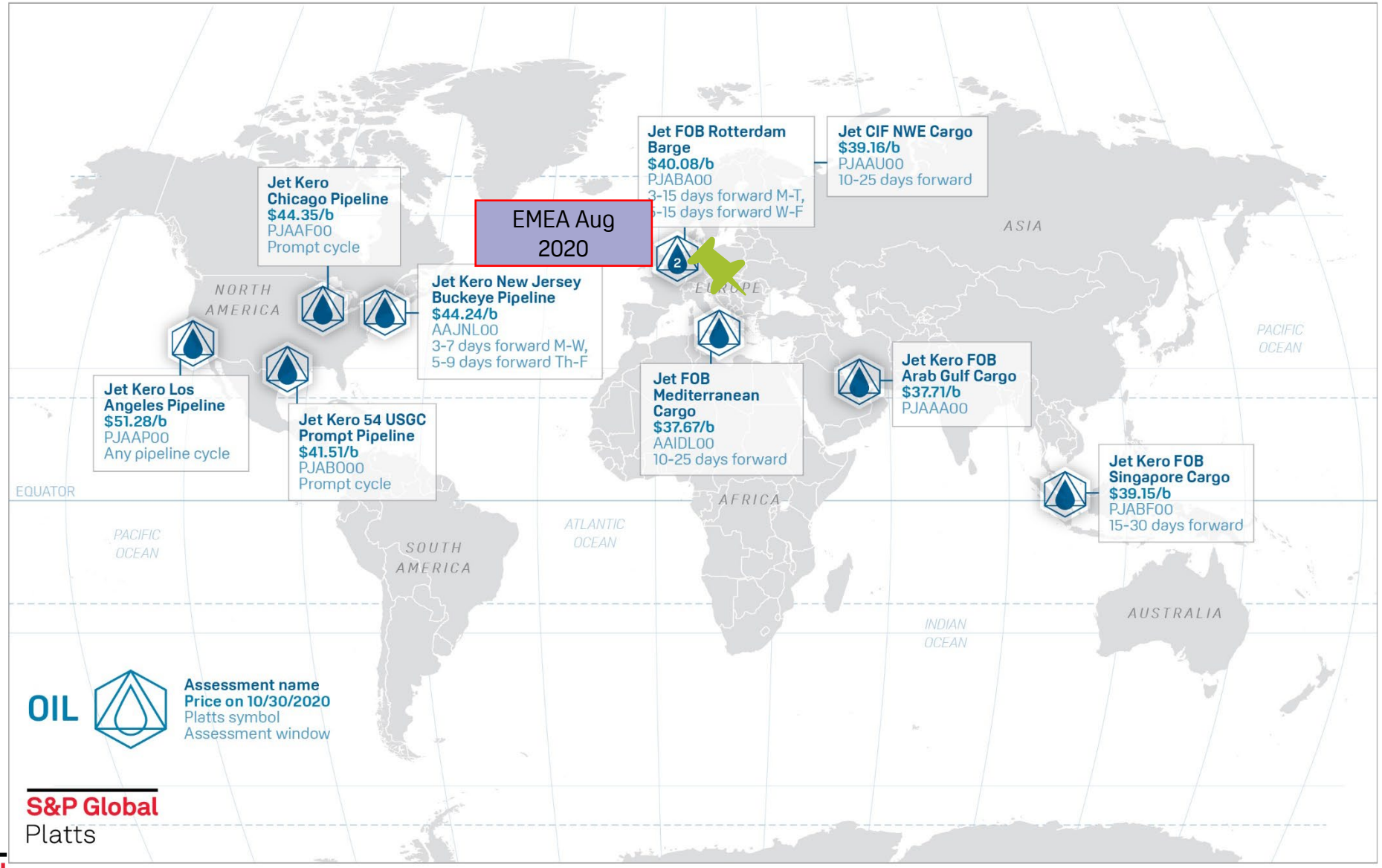

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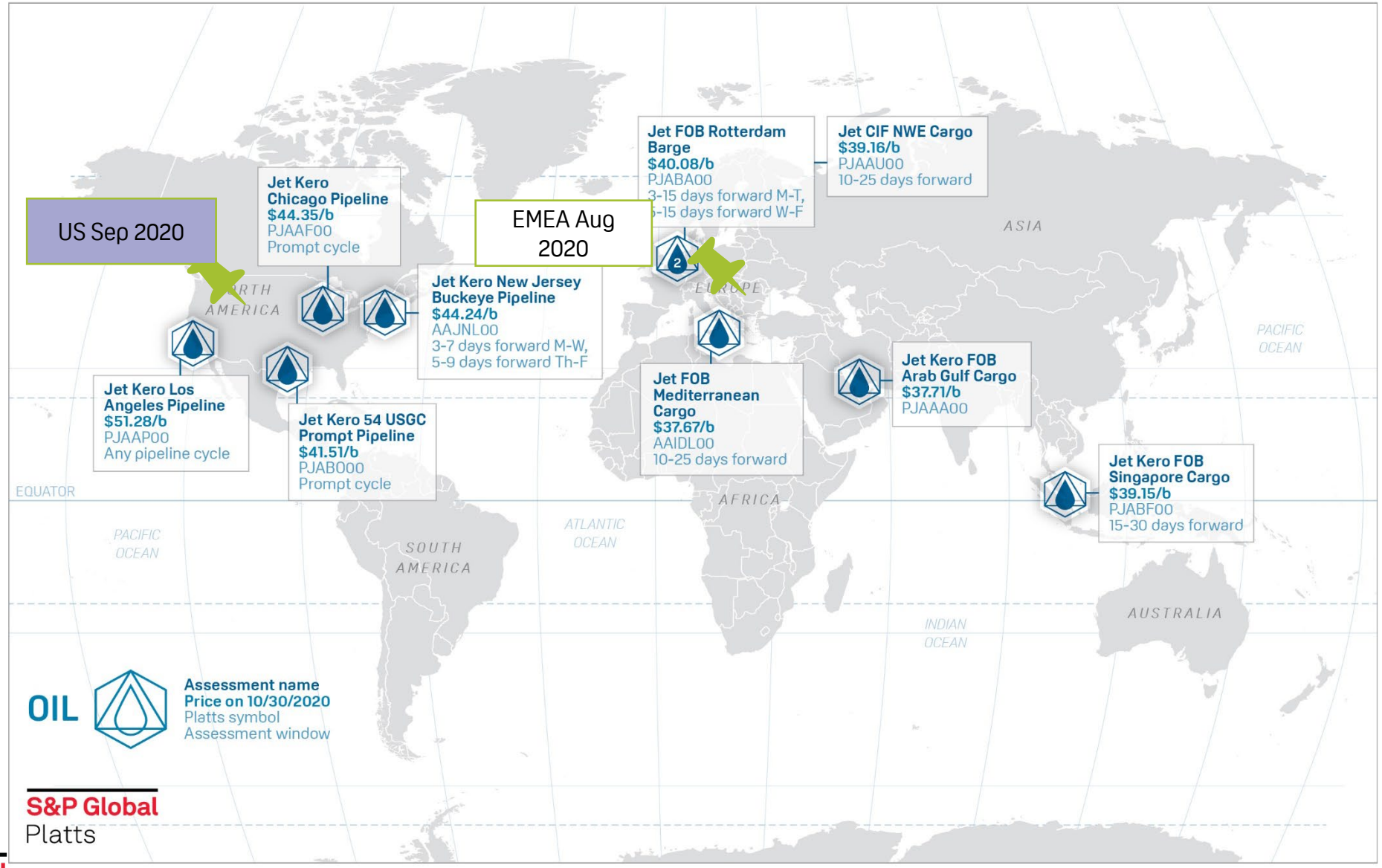

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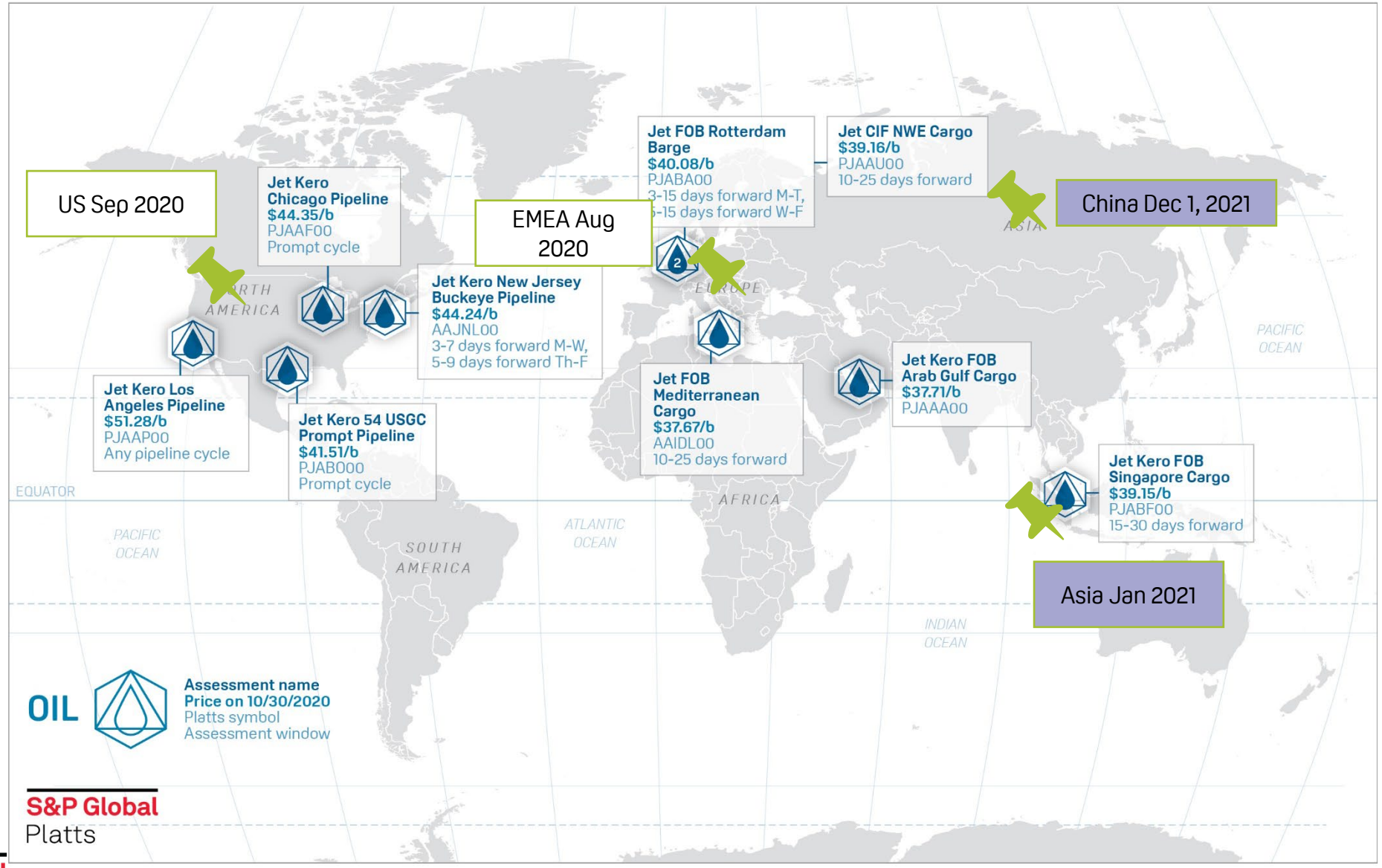

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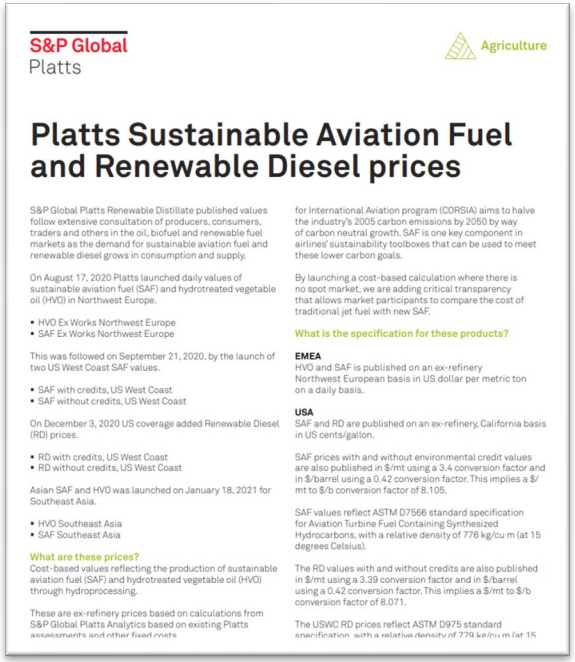

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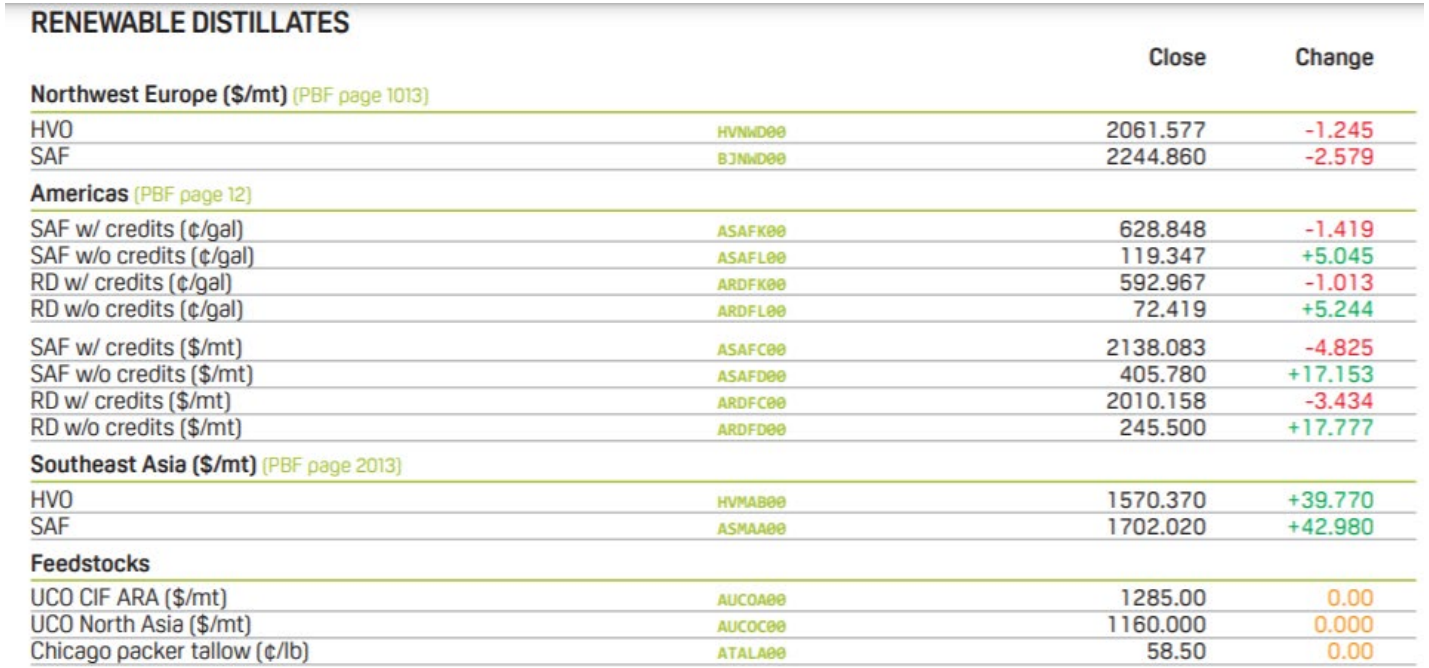

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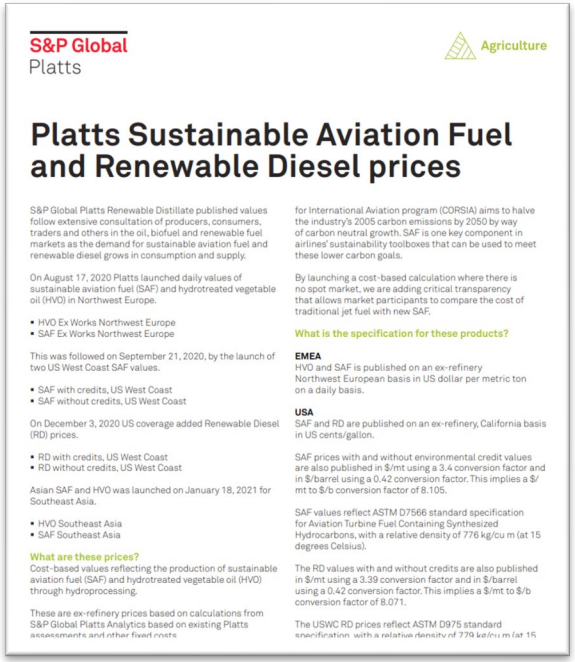

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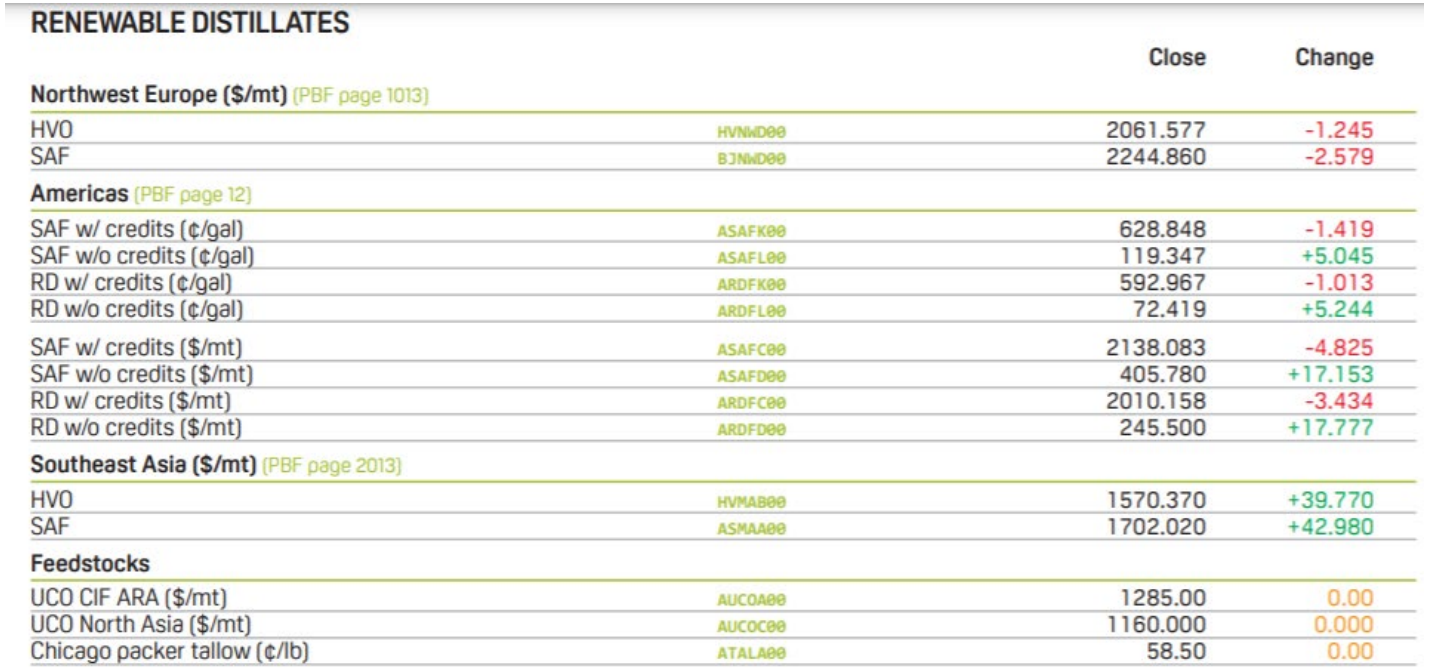

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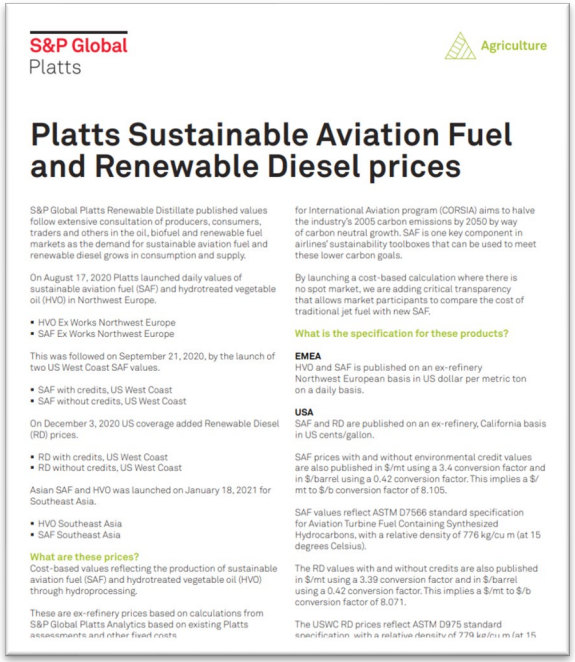

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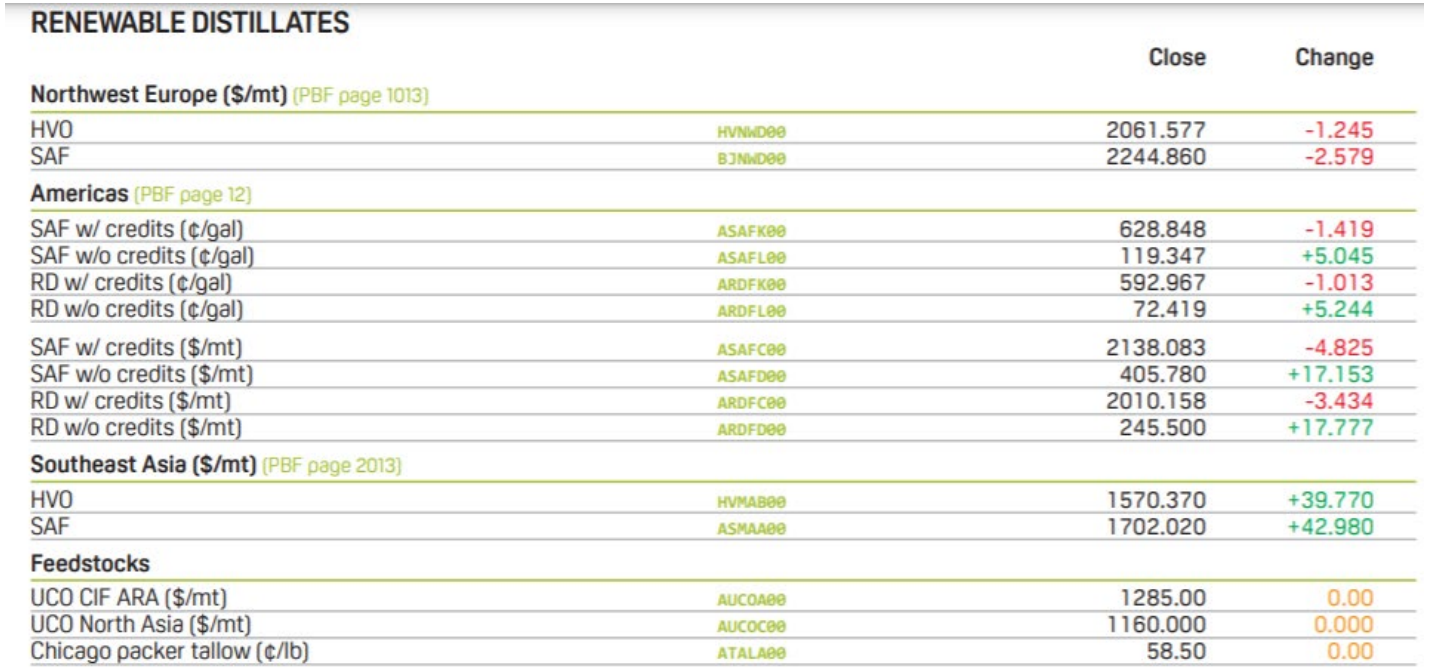

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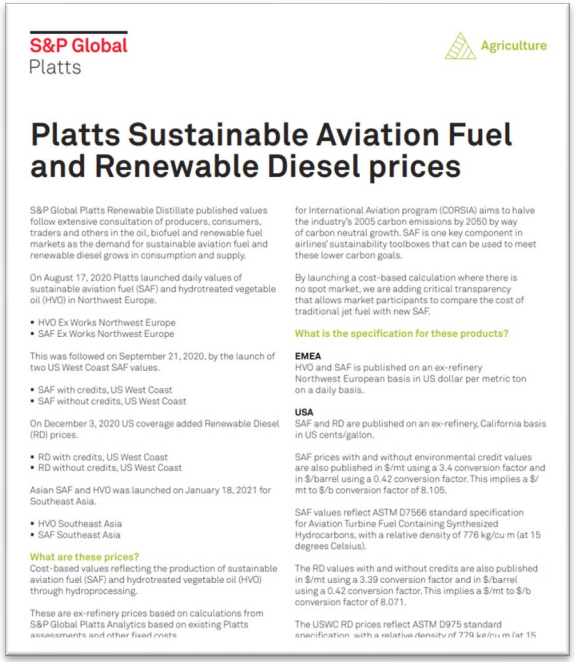

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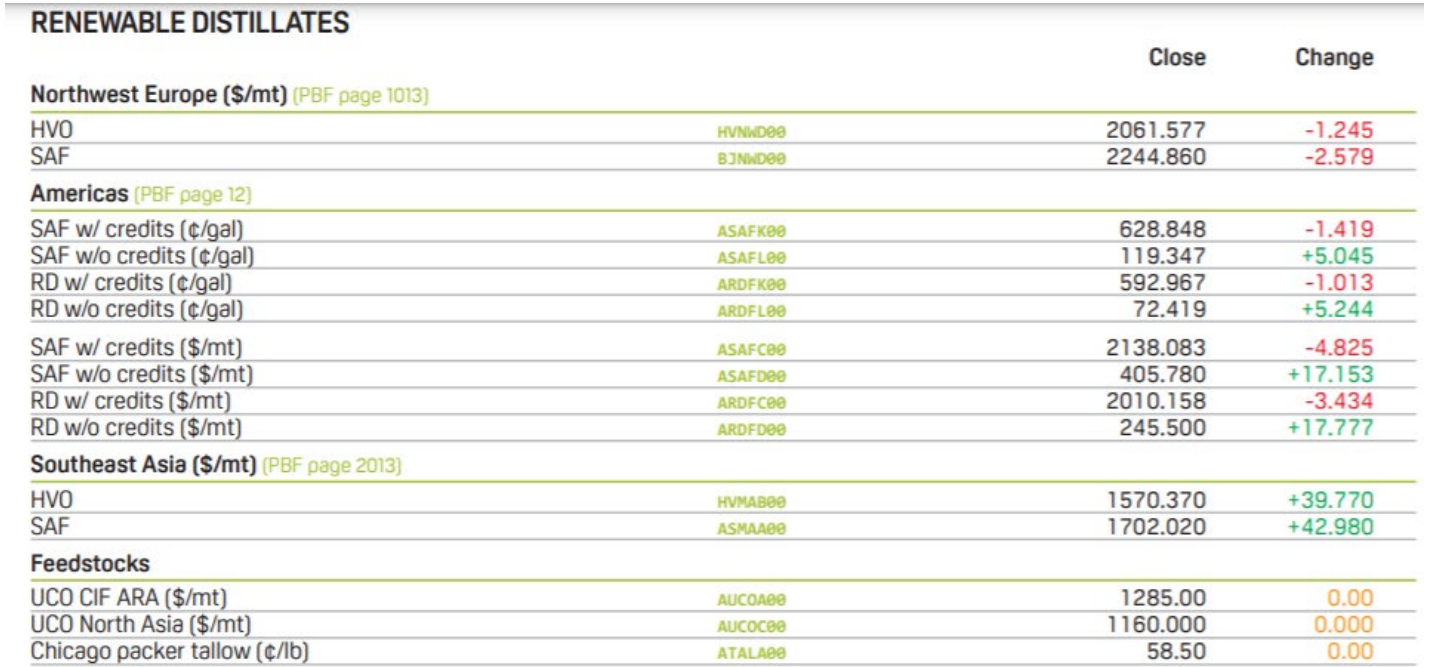

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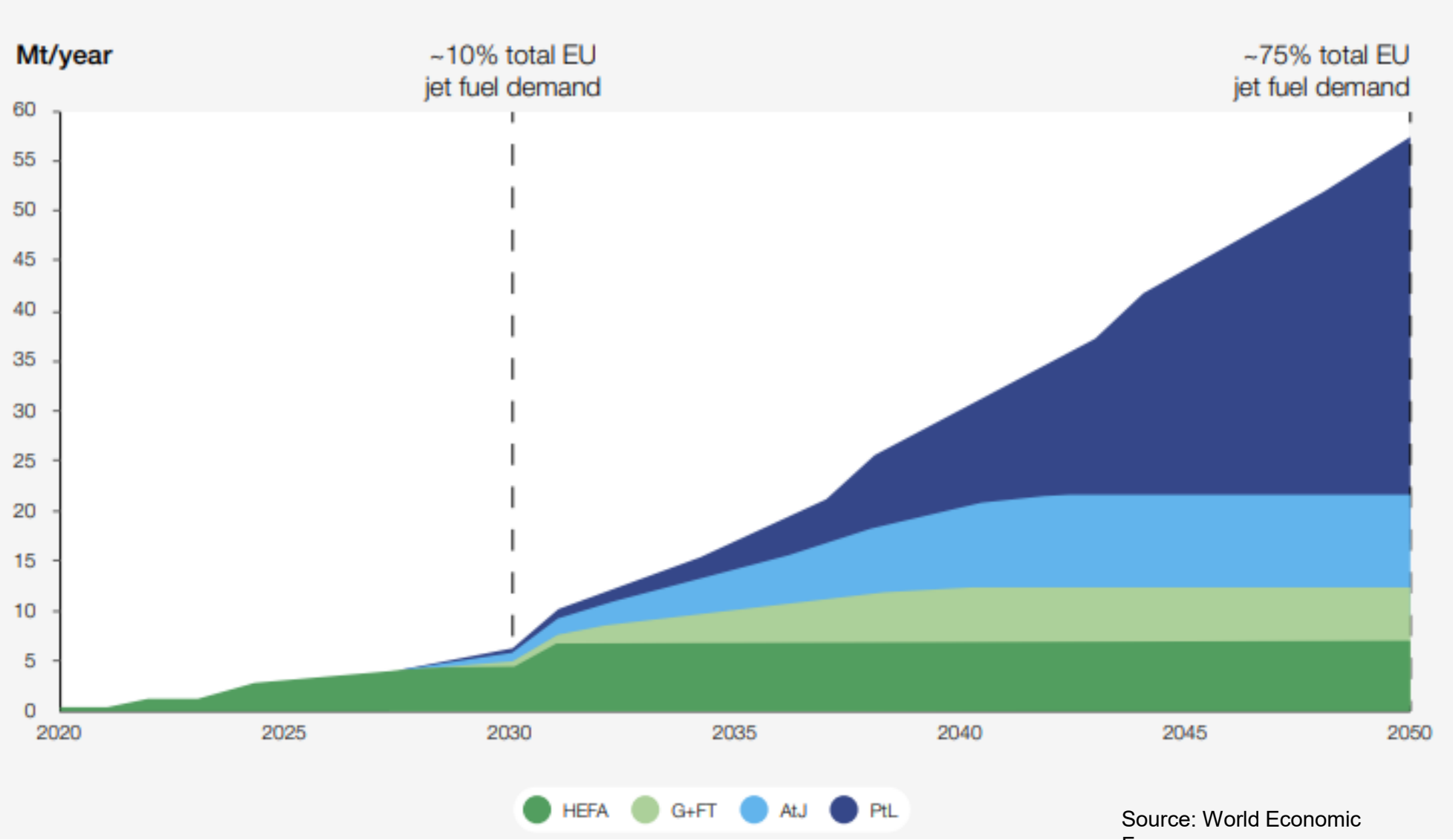
2. How do we assess ?

Pathways for SAF production
6 SAF fuels approved under ASTM D7566 with max blend levels

	Pathways	Max blending with Jet
1	HEFA SPK -Feedstocks are UCO, Veg oil, Tallow	50%
2	Fischer-Tropsch (FT) SPK - Feedstocks solid biomass resources (e.g., wood residues)	50%
3	FT-SPK /A - variation of FT SPK	50%
4	Alcohol-to-jet - Feedstocks like iso-butanol into hydrocarbons	50%
5	HFS-SIP - Feedstocks fermented sugars (SIP), formerly known as direct-sugar-to-hydrocarbon fuel	10%
6	CHJ or Catalytic hydrothermolysis (or hydrothermal liquefaction) Feedstock - soybean oil, jatropha oil, camelina oil, carinata oil, and tung oil	50%

2. How do we assess ?

Methodology changes to account for new pathway technologies



Source: World Economic Forum

Price calculation: Cost-based values reflecting production through hydroprocessing

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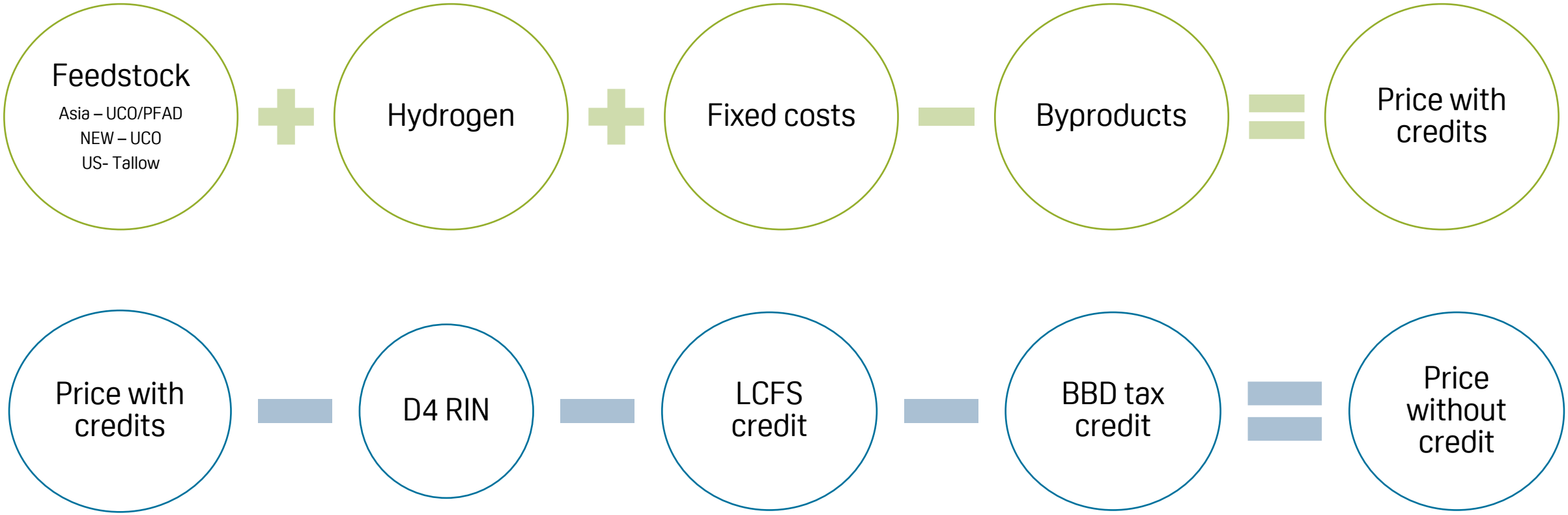

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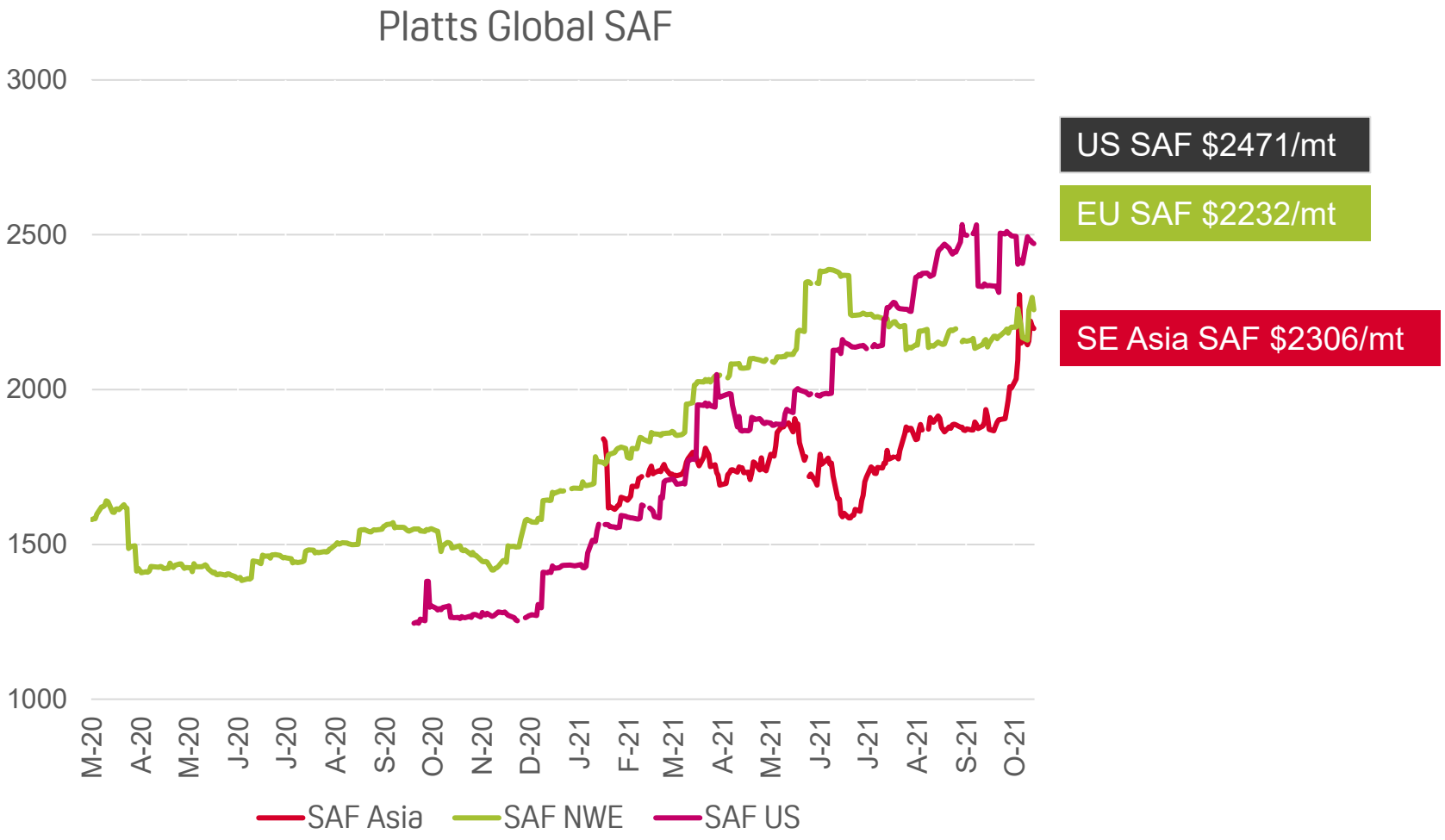

US SAF $2471/mt

EU SAF $2232/mt

SE Asia SAF $2306/mt

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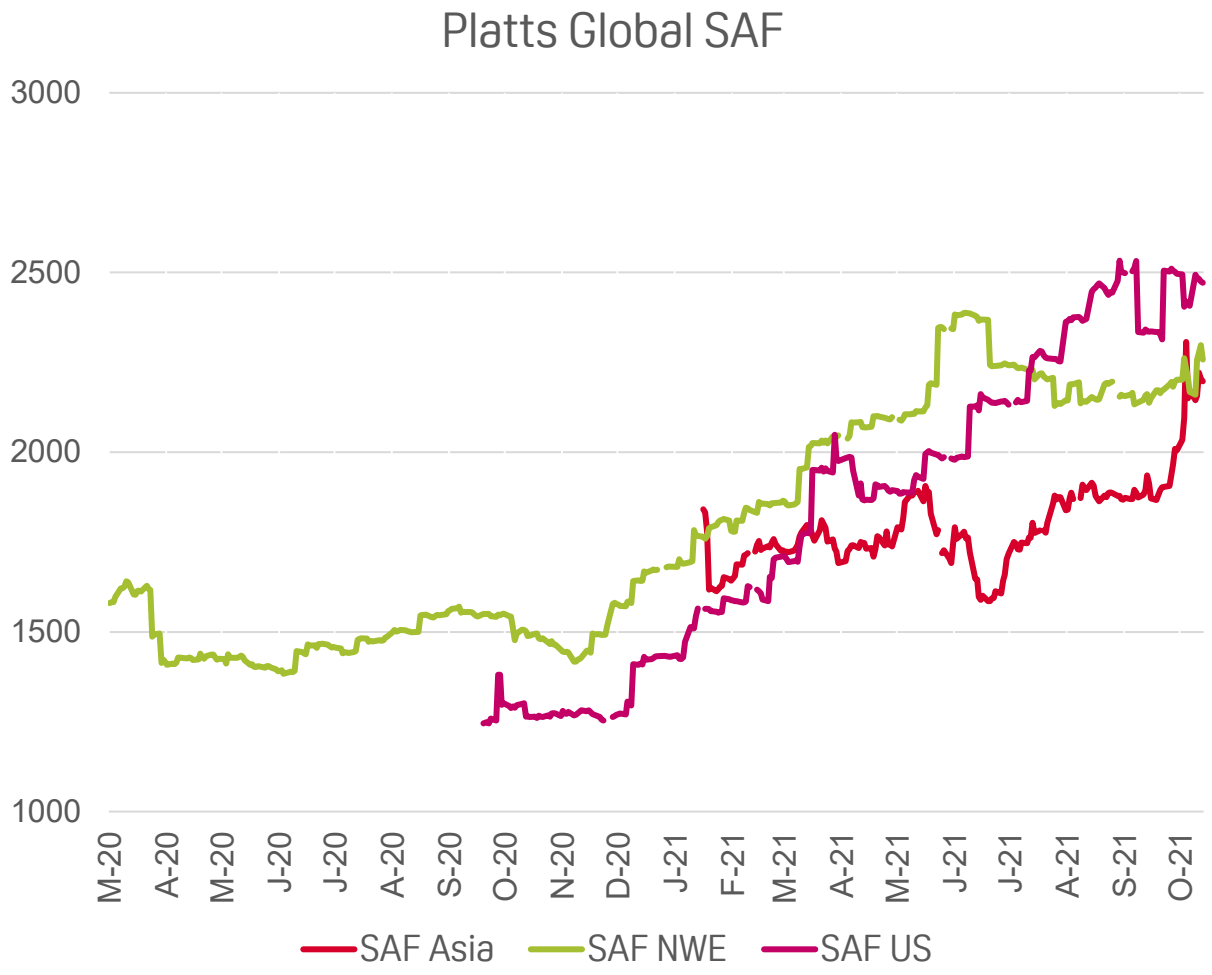

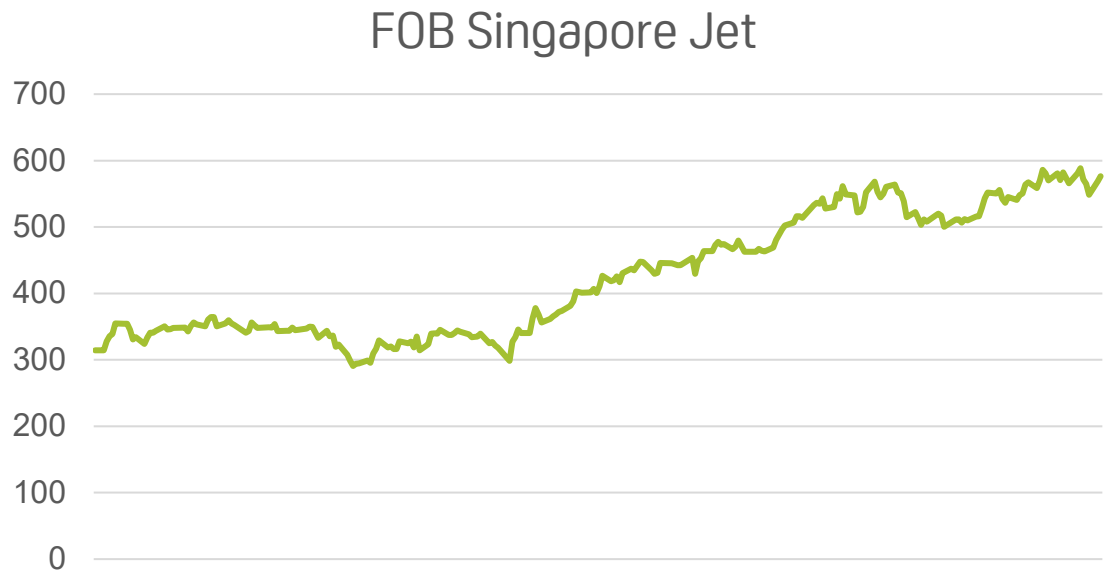

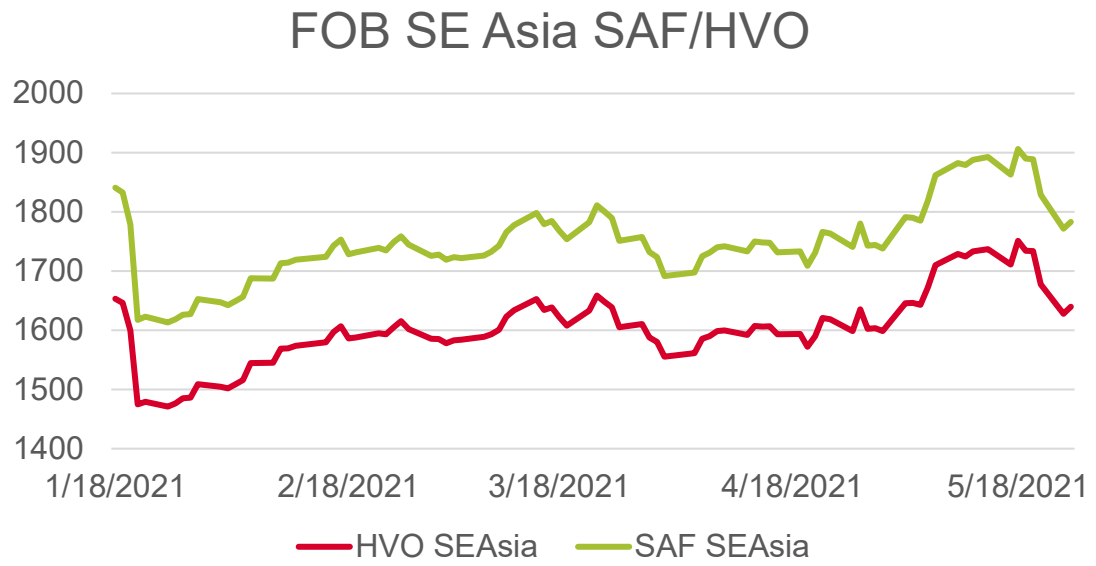

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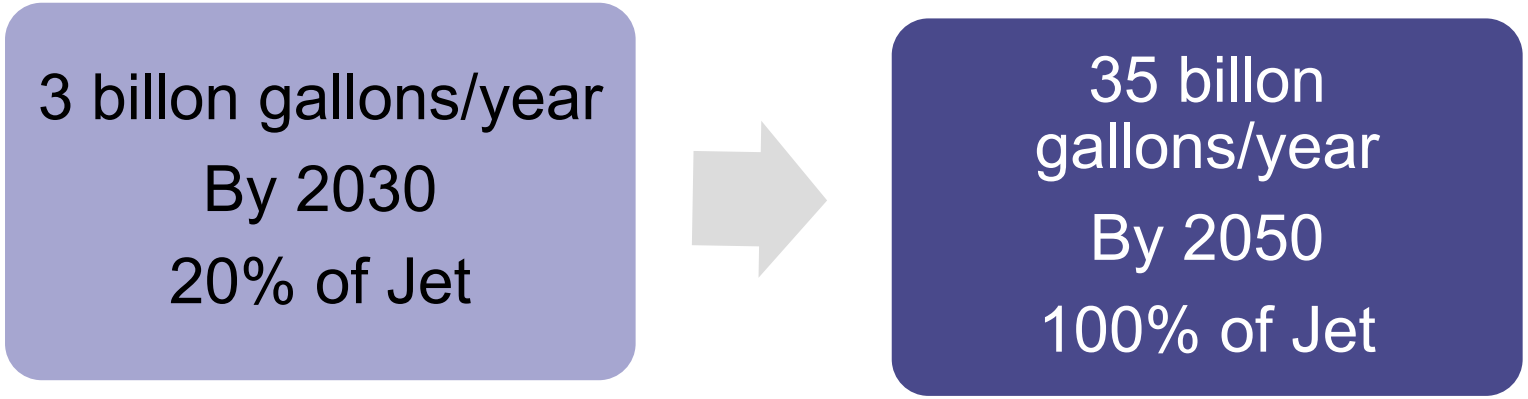
4. Challenges to SAF production/consumption

- High cost of production
- Lower value renewable credits (US) for SAF
- Feedstock availability
- Technology roadblocks

Argument: Higher cost of production

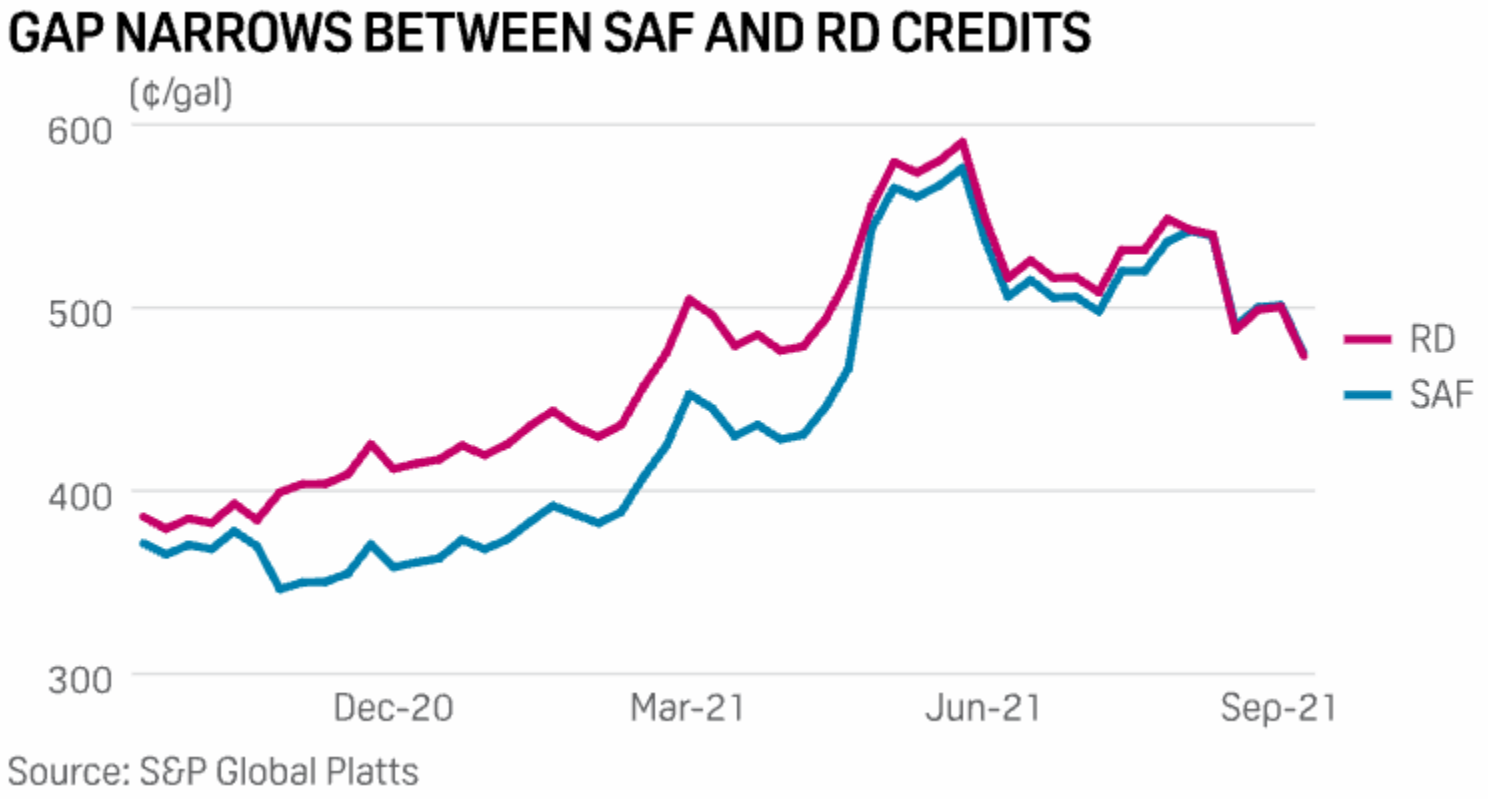
US SAF policy Sept 2021 supportive of production

1. $1.50-2.00 gal/federal tax credit proposal by Biden Administration
2. $4.3 billion in funding for producers



Argument: SAF has lower value renewable credits

RD credits expire end 2022



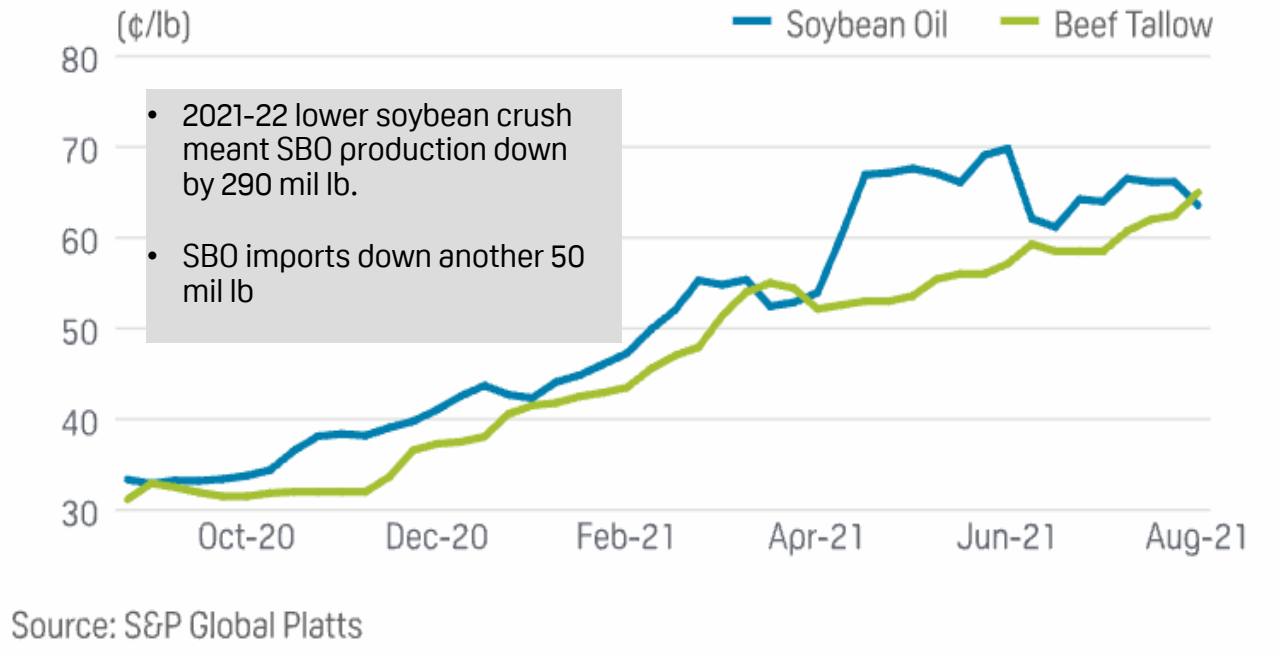
- SAF generates 1.6 D4 RINs
- RD generates **1.7** D4 RINs
- RD RIN premium over SAF rose 18% Q-o-Q

  Q3 2021 =16.55 cents/RIN

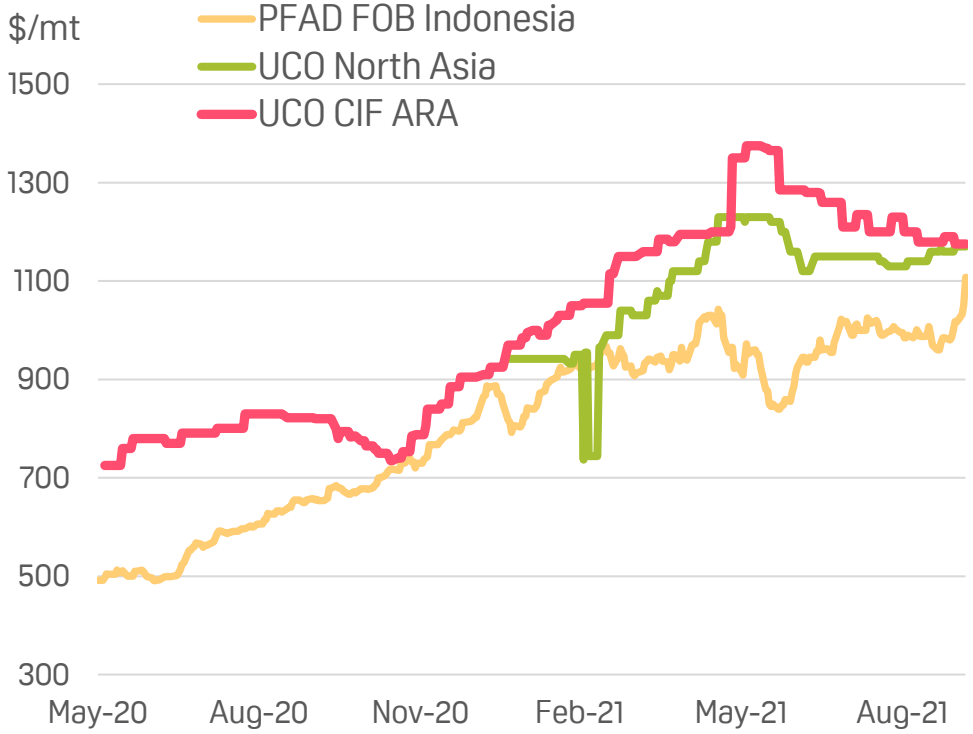
  Q2 2021 =14.02 cents/RIN

Feedstock availability

Feedstock costs rise as planned projects rise

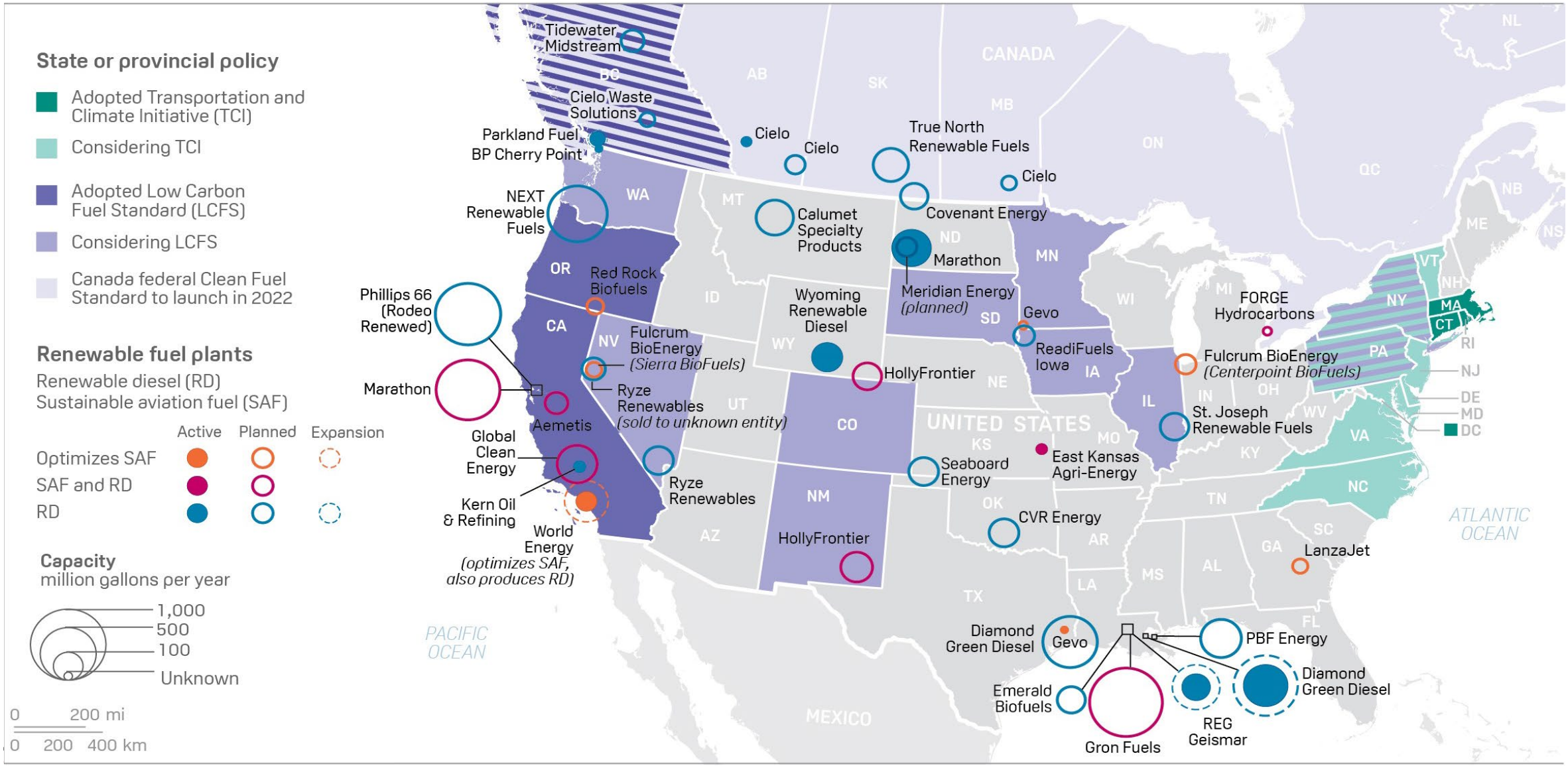


Source: S&P Global Platts



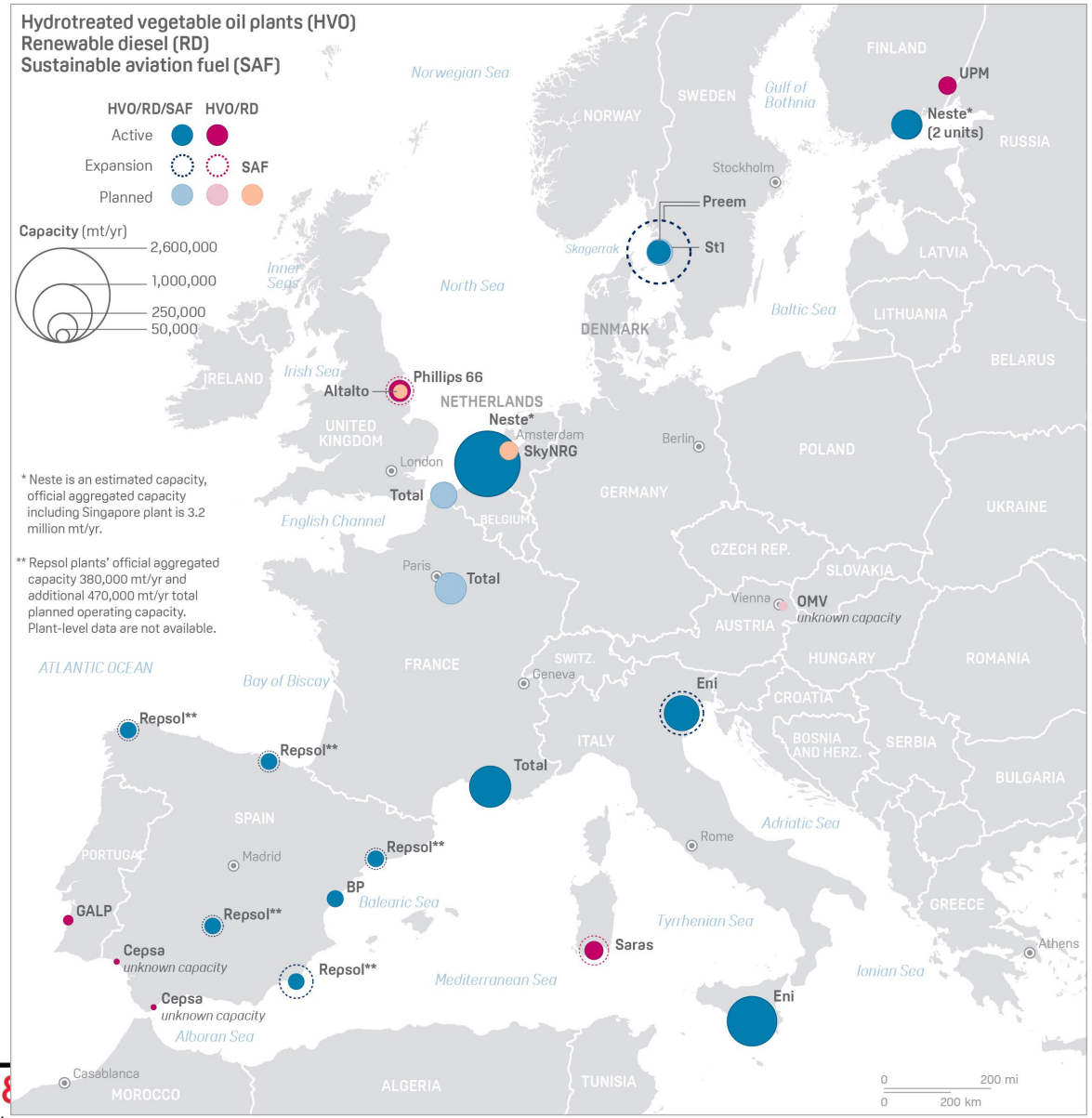
S&P Global
Platts

Who is producing? US SAF/HVO production current and planned



Source: S&P Global Platts; EIA

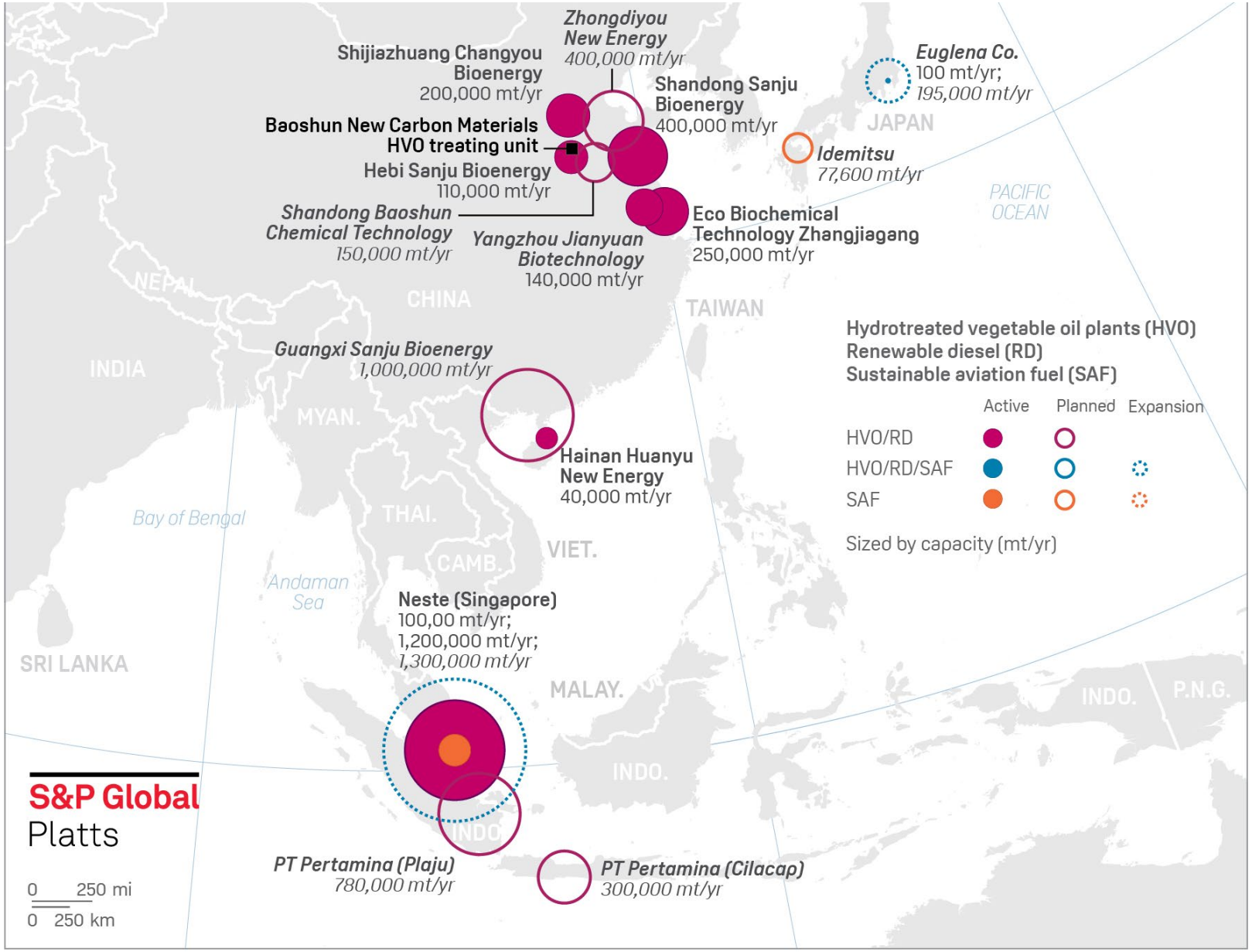
EU SAF/HVO production current and planned



Source: S&P Global Platts

Fit for 55 *Jul 14, 2021*	Mandate % of SAF in jet 2-5% by 2025, 10% SAF by 2030, 25% by 2035, 50% 2040 63% 2050 Minimum tax rate for jet Capacity production incentives
Destination 2050–A Route to Net Zero European Aviation.	Cut 25% emission by 2030 Reach net zero CO2 emissions by 2050
Norway	0.5% advance biofuel with jet from 2020 30% by 2030

Asia SAF/HVO production current and planned



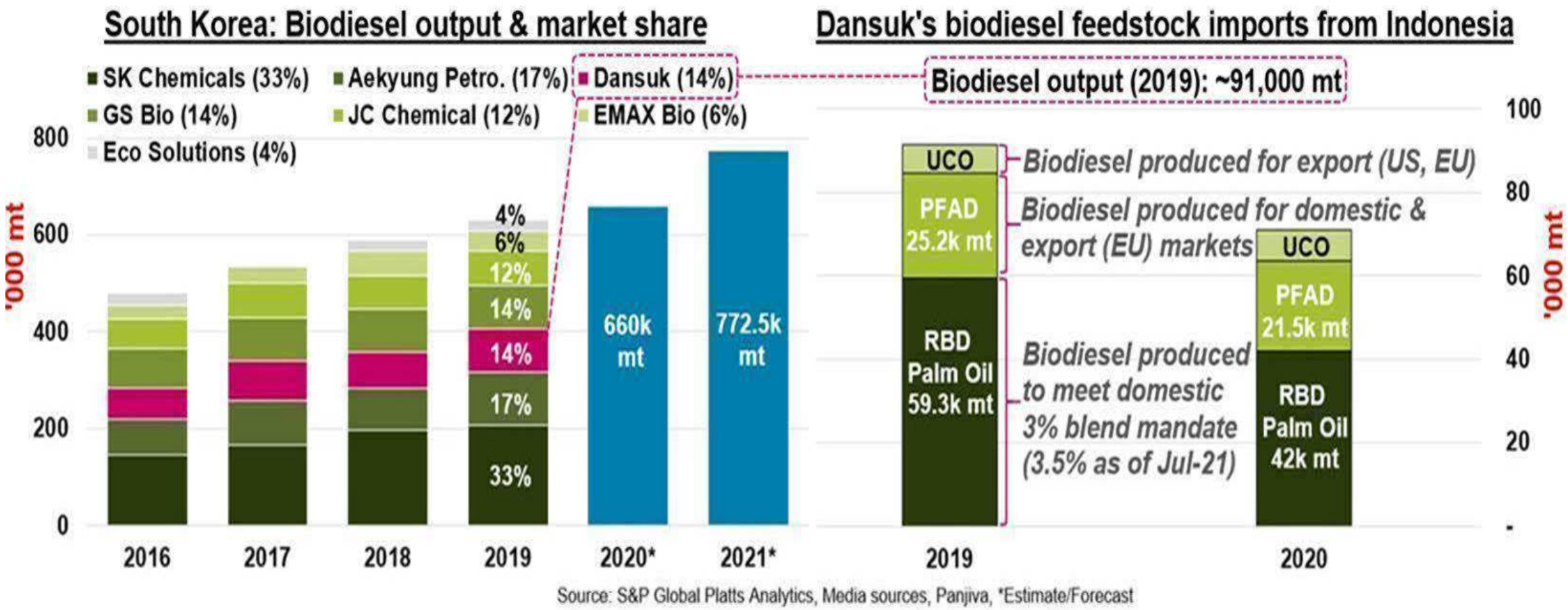
Source: S&P Global Platts Analytics

S&P Global
Platts

INDONESIA'S PLANNED RENEWABLE DIESEL PRODUCTION AND ESTIMATED CAPACITY

Source: S&P Global Platts Analytics

South Korea’s HVO ambitions



Source: S&P Global Platts Analytics, Media sources, Panjiva, *Estimate/Forecast

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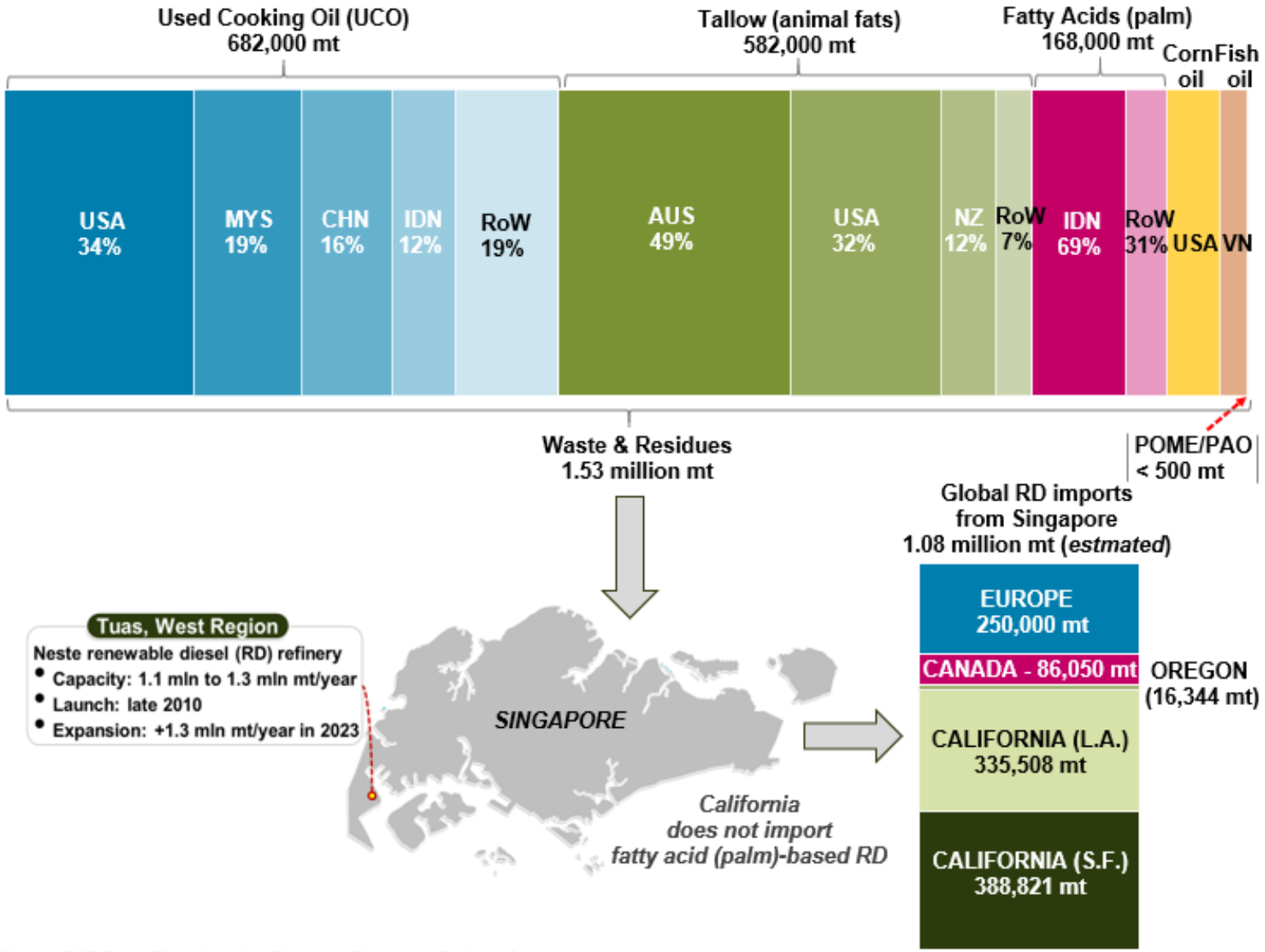
Singaporean waste/residues imports & Global RD imports from Singapore, 2020



Source: S&P Global Platts Analytics, Enterprise Singapore, Statistics Canada

6. New Platts prices to determine the cost to reduce carbon emissions using biofuels

36 new global prices launched Sept. 2, 2021

What is the cost to reduce carbon emissions using biofuels

36 new global prices launched Sept. 2, 2021

- Spreads and Ratios of Platts biofuels vs fossil-based fuels. – 20 assessments
  - EU ethanol-gasoline spread
  - Asia SAF-Jet
  - D4/D5 spread

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- US values per point of carbon intensity per gallon of fuel under the California Low Carbon Fuel Standard - 8 assessments
  - BD CI Value per point
  - CARB Diesel CI Value per point
  - USWC SAF CI Value per point etc

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  - USWC SAF CI Value per point etc

- EU cost of reducing GHGs using biofuels under EU Renewable Energy Directive. – 8 assessments
  - EU HVO GHG savings
  - EU PME GHG savings
  - EU RME GHG savings etc

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Conclusions

1. Platts SAF/HVO prices are global
2. Prices are cost-based HEFA-SPK model with daily Platts assessments in related markets
3. SAF and RD/HVO historical trends shows arbitrages between regions due to feedstock prices
4. Keeping tabs on global policy that will counter the challenges of SAF production
5. Tracking and engaging with the producers and buyers of SAF/HVO for spot production/consumption and targets
6. New Platts prices for deep analysis available

Thank you for your time

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