جامعة خليفة
Khalifa University

How will Sustainable Aviation Fuel help us reach our common Net-Zero 2050 target?

The case for SAF in the UAE.

March 2023

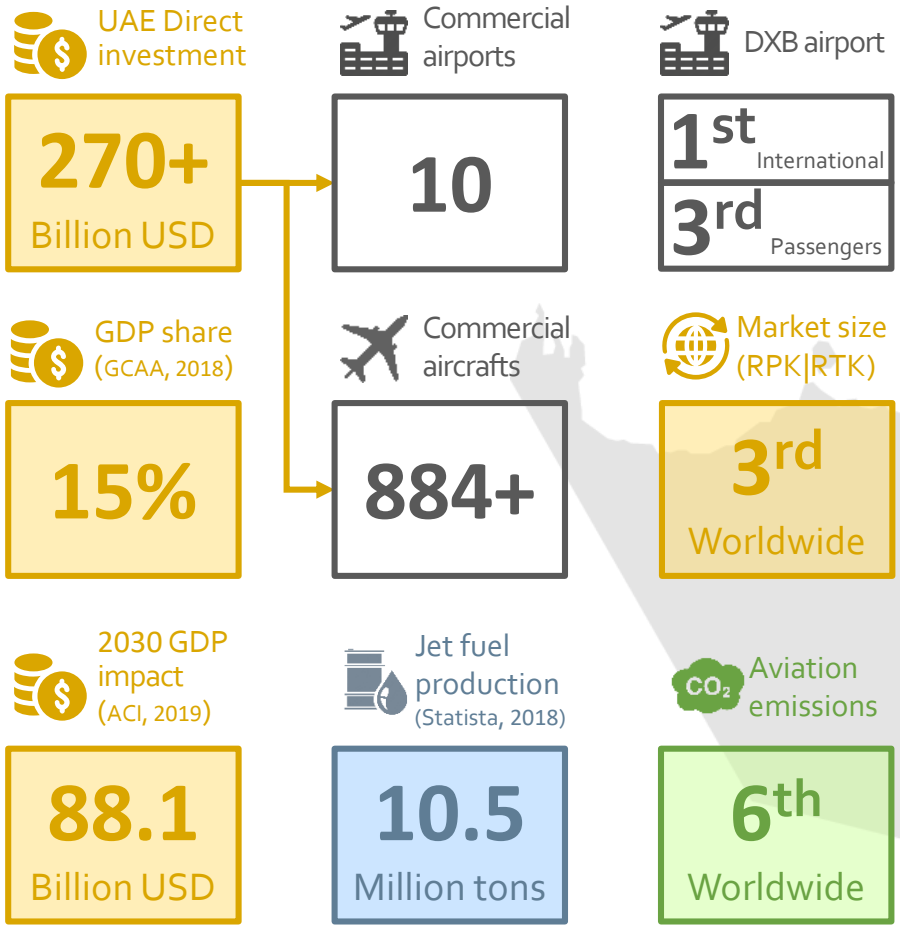
The need to decarbonize the aviation sector

The **decarbonization** of the **Global Aviation industry** will require coordinated efforts from **multiple relevant stakeholders**

- Technology providers
- Market & Financial
- Institutional stakeholders
- End users
- Environmental drivers

Aviation and energy are key sectors in the UAE

Aviation is a major economic sector in the UAE:

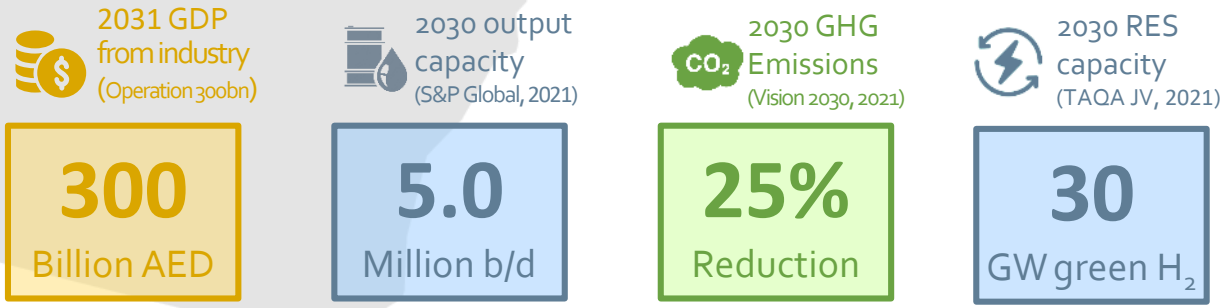


The UAE is a global energy leader actively pursuing decarbonization:

The **UAE Net Zero by 2050 Strategic Initiative** focuses on **clean energy solutions** and will invest over **AED 600 billion** in the renewable energy sector.

The **UAE Hydrogen Leadership Roadmap** announced during the UN COP26 Meeting envisions the creation of a **blue and green hydrogen industrial ecosystem** in the country capable of capturing **25% of the global hydrogen trade by 2030**.

The O&G sector is key in the UAE's climate vision:



* All figures before the COVID-19 pandemic:

Alternative aviation fuels

- ICAO has defined (Annex 16 – Volume IV) the following as CORSIA Eligible Fuels (CEFs):

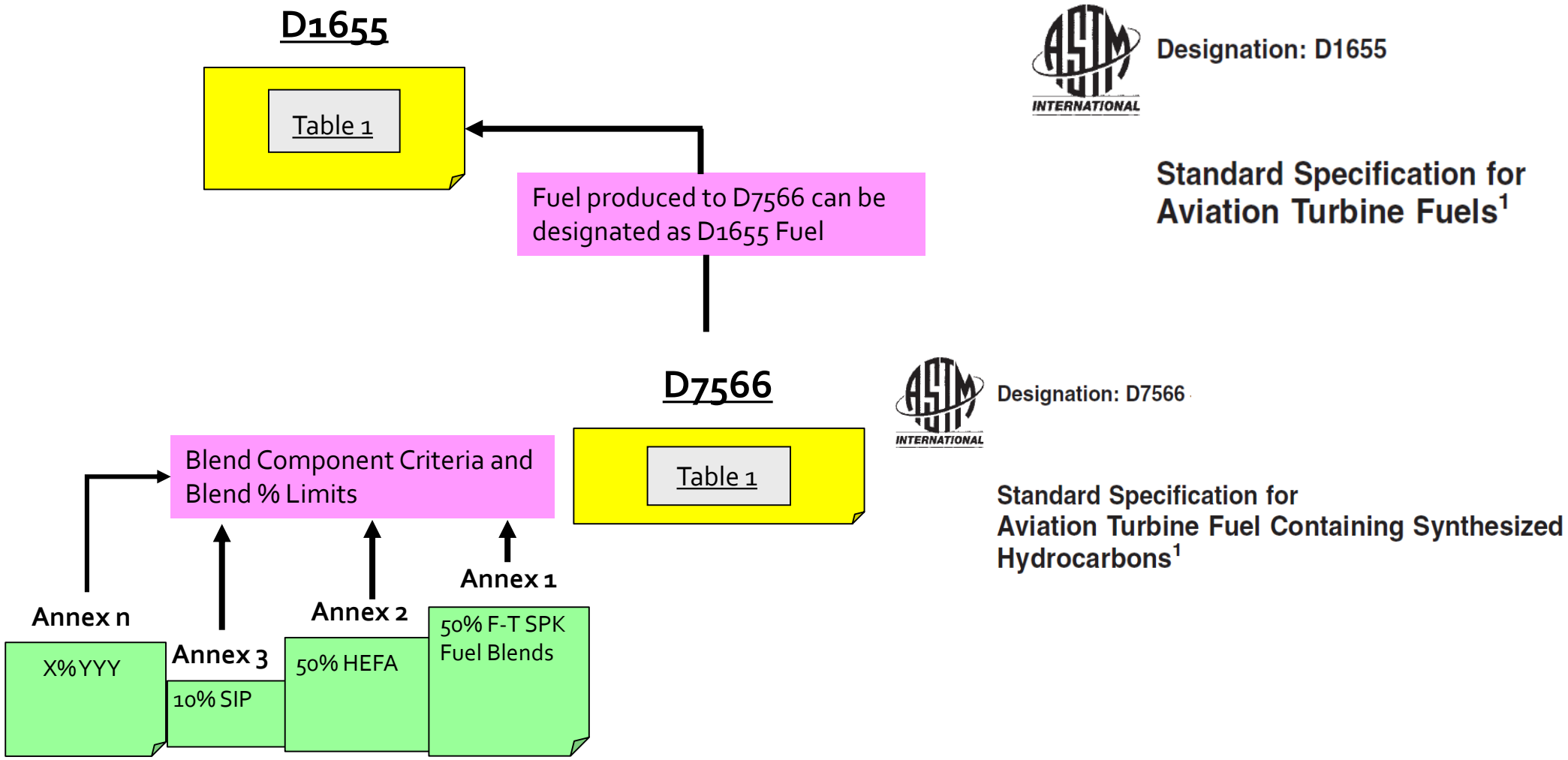
CORSIA eligible fuel. A CORSIA sustainable aviation fuel or a CORSIA lower carbon aviation fuel, which an operator may use to reduce their offsetting requirements.

CORSIA lower carbon aviation fuel. A fossil-based aviation fuel that meets the CORSIA Sustainability Criteria under this Volume.

CORSIA sustainable aviation fuel. A renewable or waste-derived aviation fuel that meets the CORSIA Sustainability Criteria under this Volume.

- To comply with CORSIA, aircraft operators have 3 options:
  - Buy CORSIA Eligible Emissions Units in the market
  - Use Sustainable Aviation Fuel (SAF)
  - Use Low Carbon Aviation Fuel (LCAF)

Fuel certification

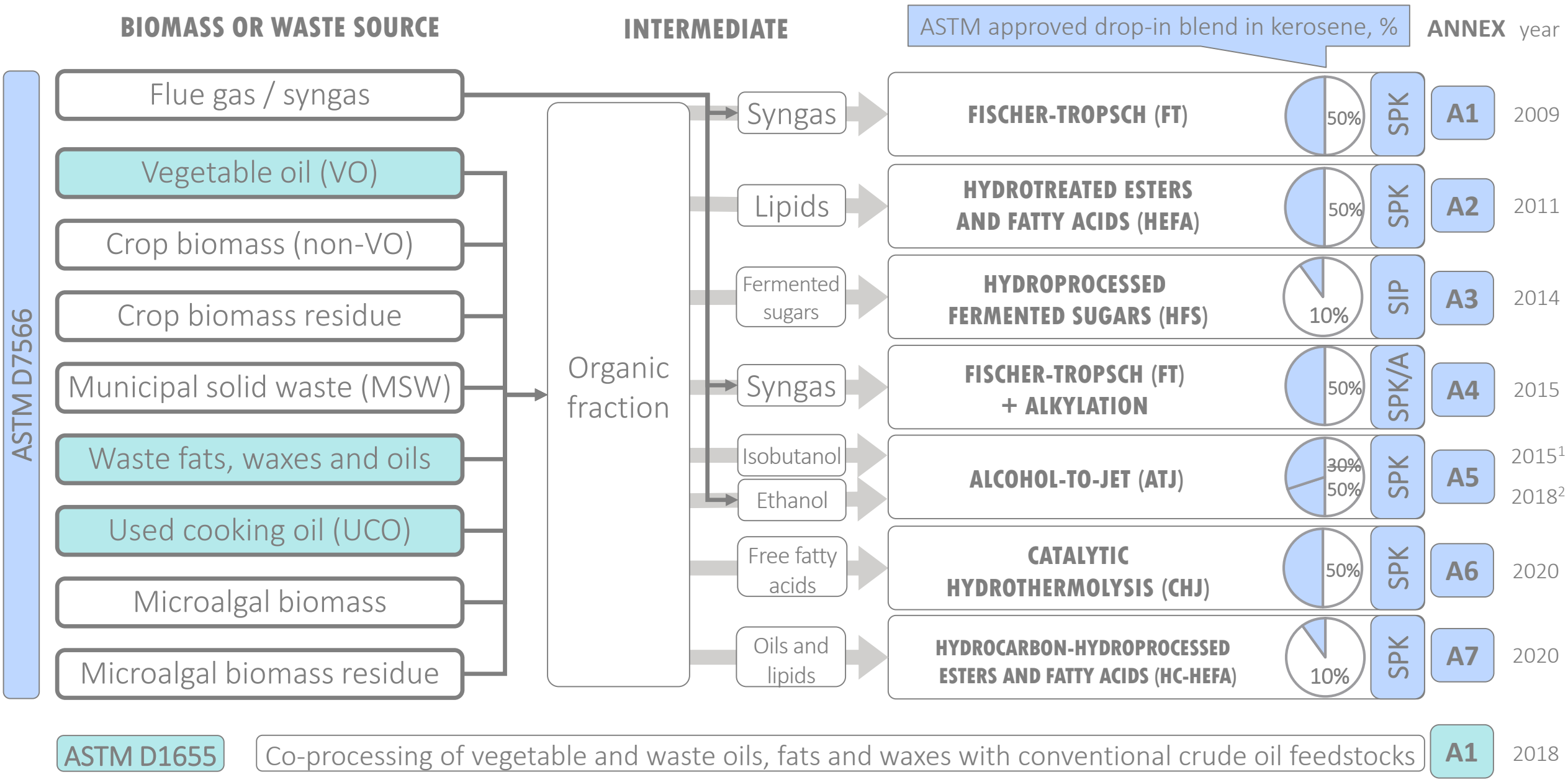


Designation: D1655

Standard Specification for Aviation Turbine Fuels[1]

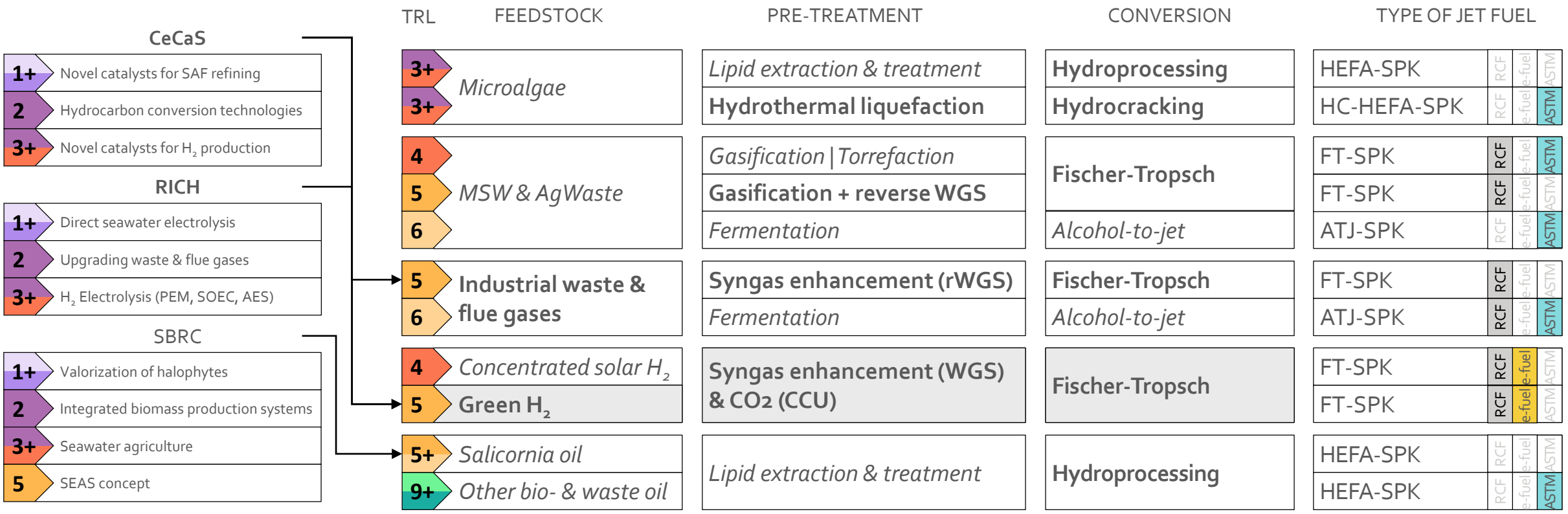
Designation: D7566

Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons[1]


BIOMASS OR WASTE SOURCE
INTERMEDIATE
ASTM approved drop-in blend in kerosene, %
ANNEX
year
ASTM D7566
Flue gas / syngas
Vegetable oil (VO)
Crop biomass (non-VO)
Crop biomass residue
Municipal solid waste (MSW)
Waste fats, waxes and oils
Used cooking oil (UCO)
Microalgal biomass
Microalgal biomass residue
Organic fraction
Syngas
Lipids
Fermented sugars
Syngas
Isobutanol
Ethanol
Free fatty acids
Oils and lipids
FISCHER-TROPSCH (FT)
50%
SPK
A1
2009
HYDROTREATED ESTERS AND FATTY ACIDS (HEFA)
50%
SPK
A2
2011
HYDROPROCESSED FERMENTED SUGARS (HFS)
10%
SIP
A3
2014
FISCHER-TROPSCH (FT) + ALKYLATION
50%
SPK/A
A4
2015
ALCOHOL-TO-JET (ATJ)
30%
50%
SPK
A5
2015[1]
2018[2]
CATALYTIC HYDROTHERMOLYSIS (CHJ)
50%
SPK
A6
2020
HYDROCARBON-HYDROPROCESSED ESTERS AND FATTY ACIDS (HC-HEFA)
10%
SPK
A7
2020
ASTM D1655
Co-processing of vegetable and waste oils, fats and waxes with conventional crude oil feedstocks
A1
2018

UAE-relevant candidate fuels

There are a number of pathways to produce SAF. The highest potential is in the exploration of **e-fuels** and other **hydrogen-derived advanced fuels for aviation**.



SBRC research focus

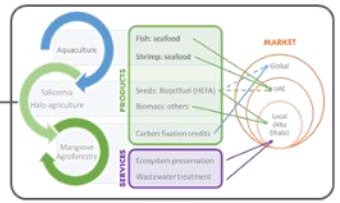
The **Sustainable Bioenergy Research Consortium (SBRC)** primarily focuses on **halophytic biomass-derived SAF**

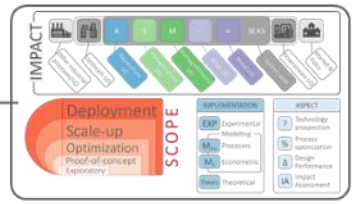
OBJECTIVE

The SBRC aims to advance the aviation industry's commitment to sustainable business practices by developing technology with the promise of producing a clean, alternative fuel supply.

KEY OUTCOMES

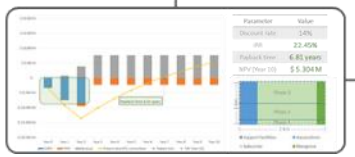
Building of a knowledge base:
Market analysis
Process modeling
R&D funding
Operation of pilot facility

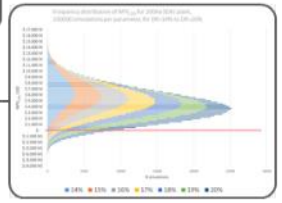




Establishment of Salicornia germplasm

Techno-economic assessment (TEA) of SEAS platform





PARTNERS

Khalifa University
BOEING
ETIHAD AIRWAYS
ADNOC REFINING
SAFRAN
BAUER

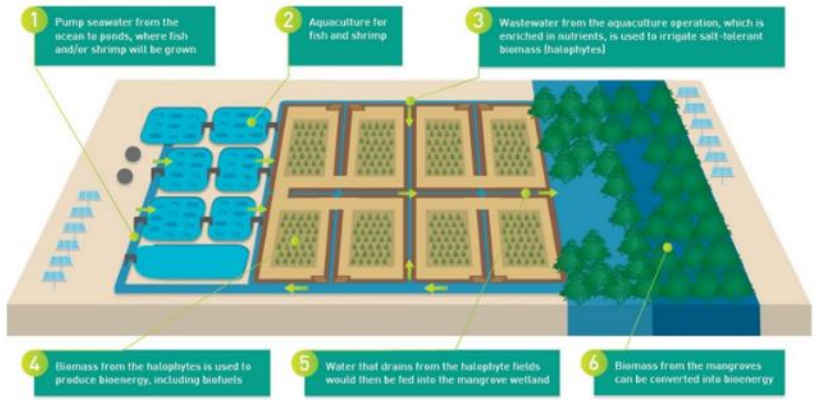
KEY FACILITIES

SEAS Pilot Research Facility

Research lab at KU

Flagship Project

Seawater Energy and Agriculture System (SEAS)



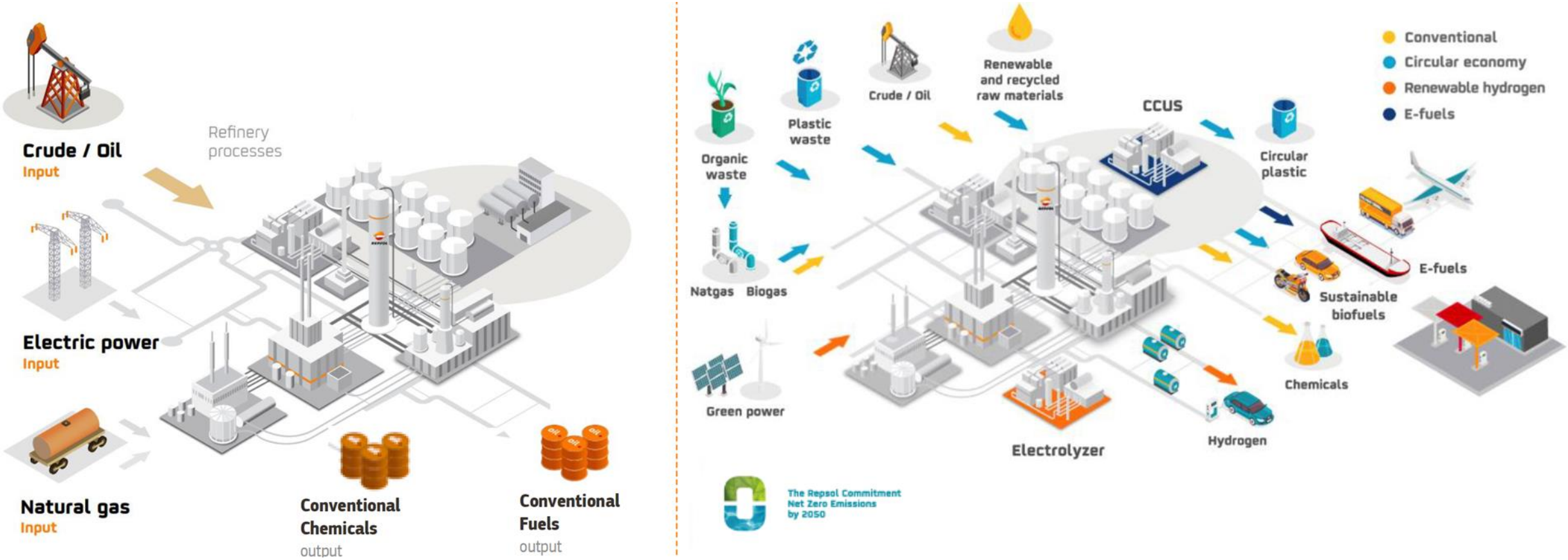
Pilot plant at Masdar City

Pilot plant (2ha) ✓→ Demonstration plant (200ha) → COMMERCIAL SCALE

1st Commercial Flight

The role of the O&G industry is key

The evolution of the **oil refining industry** towards a low-carbon future will drive the **development of SAF and e-fuels at scale**



Source: Repsol, 2021. https://ec.europa.eu/info/sites/default/files/energy_climate_change_environment/events/presentations/5_repsol_refining_transformation_berta_cabello_acrobat.pdf

Collaboration is essential

Major stakeholders across the **whole aviation fuel technology value chain** need to participate

1) SBRC members:

2) Government support:
(Members of the Low Carbon and Sustainable Fuel for the Aviation Sector Committee led by the Ministry of Energy)

3) Other potential key stakeholders:

... and others

جامعة خليفة
Khalifa University

Thank You

ku.ac.ae

CORSIA Eligible Emissions Units

- There are 8 CORSIA Eligible Emissions Units programmes approved by the ICAO Council

Emissions Unit Programme	Web Address
American Carbon Registry (ACR)	https://americancarbonregistry.org/how-it-works/membership
Architecture for REDD+ Transactions (ART)	https://www.artredd.org/art-registry/
China GHG Voluntary Emission Reduction Program	http://registry.ccersc.org.cn/login.do
Clean Development Mechanism (CDM)	https://cdm.unfccc.int/Registry/index.html
Climate Action Reserve (CAR)	https://thereserve2.apx.com/mymodule/mypage.asp
Global Carbon Council (GCC)	https://mer.markit.com/br-reg/public/public-view/#/account
The Gold Standard (GS)	https://registry.goldstandard.org/projects?q=&page=1
Verified Carbon Standard (VCS)	https://verra.org/project/vcs-program/registry-system/

The average global emissions price is currently ~$3 per tonne.