ICAO ENVIRONMENT

ACT-SAF #18 SERIES

Understanding SAF Clearing Houses

Objectives

Provide participants with knowledge of the role of SAF Clearing Houses in facilitating SAF testing and certification, bringing SAF to market, in support of SAF development and deployment

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ACT-SAF Series #18 Speakers

ACT SAF

Zachary West, PhD
Principal Research Engineer
Group Leader, Fuel Science

Matthew Jee
Deputy Director,
UK SAF Clearing House

Prof. Stephen Dooley
Director EU SAF Clearing House, managed by EASA
Trinity College Dublin

Agenda

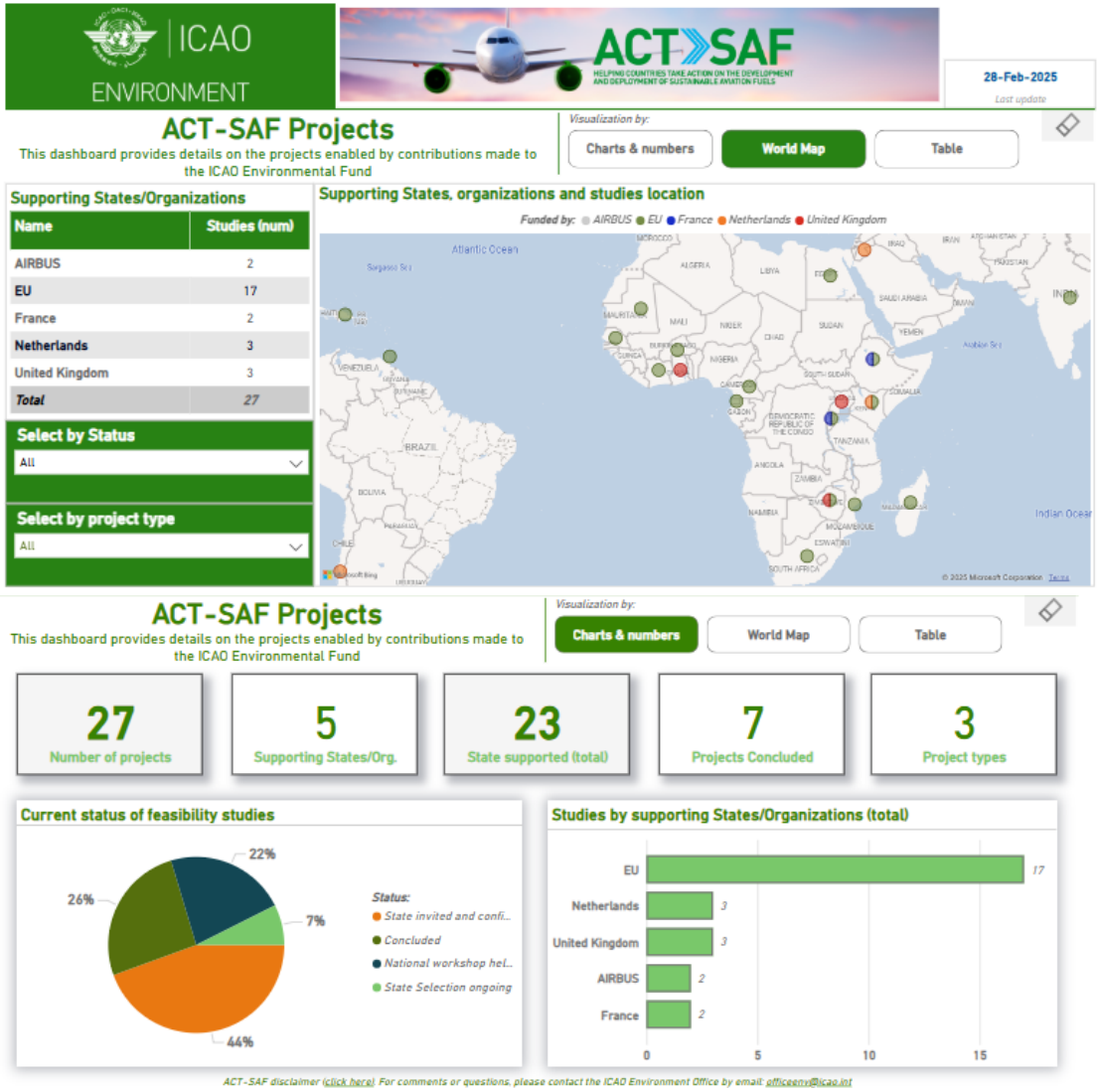
- Opening
- Updates on ACT-SAF
- Presentation on SAF Clearing Houses
- Q&A
- Closing

Updates on ACT-SAF

- **ICAO ACT-SAF Partner States/Organizations**
  - Increased opportunities for expert contributions towards training, feasibility studies, etc.
  - More than 200 ACT-SAF Partner States and Organizations
  - Supports further outreach of SAF development and deployment initiatives

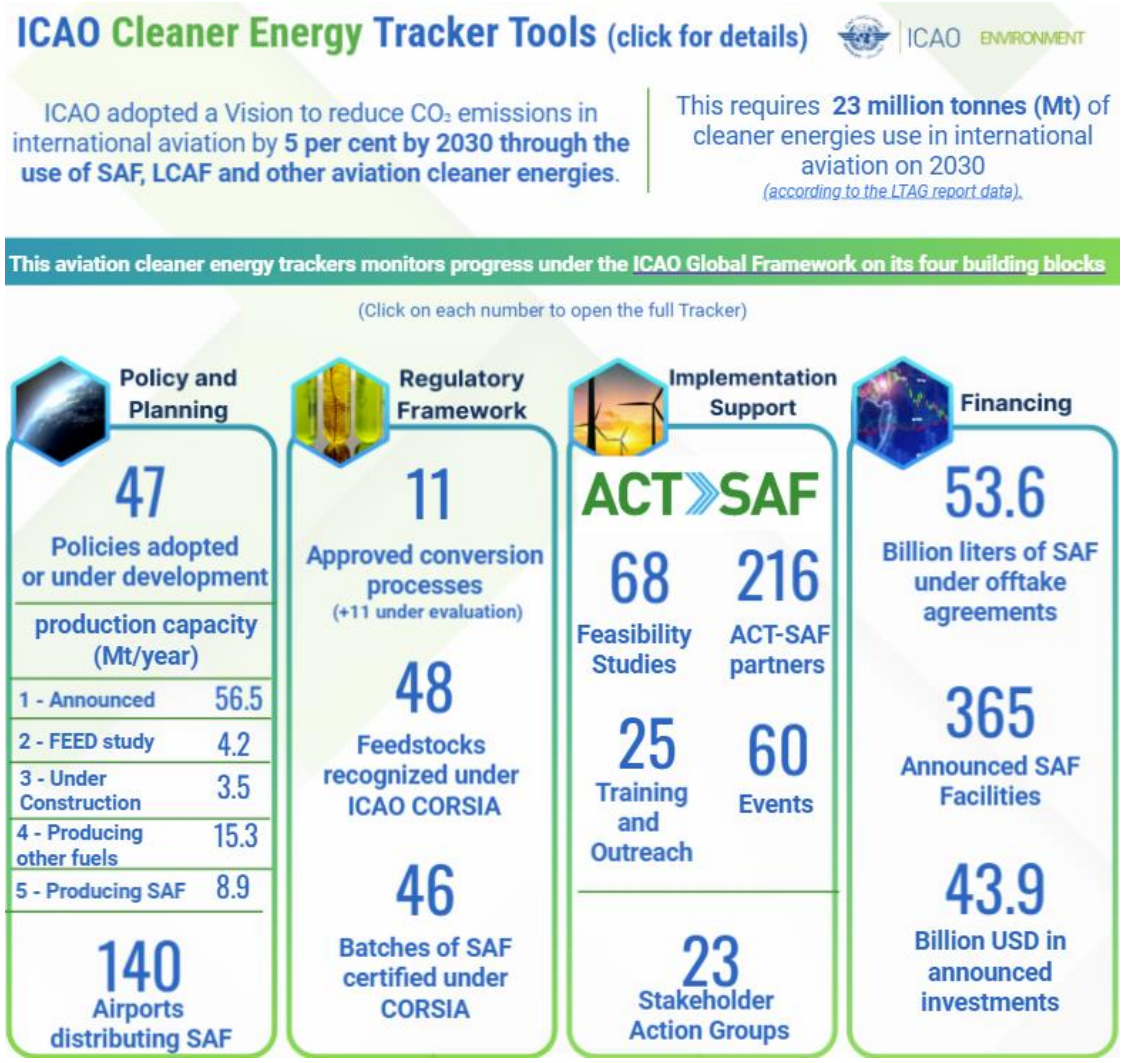
Updates on ACT-SAF

- **ICAO ACT-SAF Projects**
  - Already concluded: 7 SAF feasibility studies
  - 20 more SAF feasibility studies and business implementation reports, with the contributions provided by France, the Netherlands, United Kingdom and the European Union, and a planned contribution to be provided by Airbus
  - Work ongoing to structure projects with the resources offered by Austria and Côte d'Ivoire to ACT-SAF
  - ICAO has engaged consultants to commence feasibility studies/business implementation reports for Chile, Ethiopia, India, Jordan, South Africa and Zimbabwe
  - Projects in Argentina, Côte D'Ivoire, Kenya, Peru, Rwanda, and Uganda are expected to kick off in the coming month
  - Beyond SAF feasibility studies and business implementation reports, additional scope for support (regulatory design, translation of ICAO Documents, etc.) is being explored



ICAO Energy Tracker Tools

- **ICAO Cleaner Energy Tracker Tools**
  - Layout to reflect four building blocks of the Global Framework
  - SAF-related indicators in airports distributing SAF, policies adopted/under development, SAF volumes/offtake agreements, approved conversion processes, etc.
  - Please reach out to officeenv@icao.int to have your initiatives updated



ICAO Energy Tracker Tools

- **Reflecting latest information from ACT-SAF partner States/Organizations**

  - MIT Report on sustainable decarbonization of aviation in Latin America
    - Special report describes targets for advancing technologically feasible and economically viable strategies
    - Financial support for study provided by LATAM Airlines and Airbus
  - ICAO ACT-SAF feasibility study kick-off workshop
    - Close to 100 participants attended a SAF feasibility kick-off workshop organized by DGCA India, EASA and ICAO on 23-24 January 2025 in New Delhi, India.
    - Commencement of the ICAO ACT-SAF project, financed by the European Union, which will facilitate the development of local SAF production projects.
  - Sustainable Aviation Futures – Latin America and Europe
    - Latin America (31 March – 2 April, 2025). Featuring 250+ aviation, energy and biofuel industry professionals, the three-day event will digest the momentum of the Latin American aviation region and understand how the region can drive global supply for SAF.
    - Europe (6 - 8 May 2025). This event will be featuring the most influential leaders from throughout the entire aviation value chain, including airlines, fuel producers, policymakers, hydrogen and energy developers and OEMs

CAEP/13

- **Committee on Aviation Environmental Protection – 13th Meeting**

  - Held in Montréal, Canada, 17 to 28 February 2025
  - More than 200 participants from 31 CAEP Member States, 5 CAEP Observer States, and 13 International Organizations
  - Proposed amendments to ICAO Documents related to CORSIA Eligible Fuels – aim to share this with ACT-SAF partners in future ACT-SAF series
  - Discussed future work on aviation fuels
  - The outcomes of CAEP/13 will be considered by the ICAO Council

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ACT SAF

D4054 CLEARINGHOUSE

University of Dayton Research Institute

Presentation of US D4054 Clearinghouse, UK and EU SAF Clearing Houses

UK SAF Clearing House

University of Sheffield | Energy Innovation Centre

RICARDO

Introductions: Key Documents

- Technical documents commercial aviation relies on for fuel safety:

(Note: Other, post-refinery quality assurance documents are relied on such as EI 1533 and aircraft AMMs)

ASTM D1655
SPECIFICATION for Aviation Turbine Fuel (**Jet A/A-1**)

ASTM D7566
SPECIFICATION for Aviation Turbine Fuel Containing Synthetic Components (**SATF**)

ASTM D4054
STANDARD PRACTICE for Evaluating New Aviation Fuels and Additives

DEF STAN 91-091
SPECIFICATION for Aviation Turbine Fuel (**Jet A-1**)
[HARMONIZED with D1655 & D7566]

Used for production & Procurement contracts

Used for technical development of specifications

How they work to ensure safety

Safety Certification:
Equipment is certified to fly on industry specified fuel

Safety Check:
Fuel is specified to meet technical requirements

4 D1655 / DEF STAN 91-091 = D7566
Conventional Jet Fuel Specs → Drop-In Jet Fuel Spec

1 
Aircraft Approved Operating Limitations Based on Industry Fuel Specifications

2 ASTM D4054
SATF Evaluation Process
If New SATF Meets Conventional Jet Fuel Composition & Properties

Safety Review:
Fuel/blend components evaluated to fall within existing technical requirements

3 ASTM D7566
Drop-In Jet Fuel Spec
Then New SBC Annex Added to Drop-In Fuel Spec

Clearinghouse supported area/activities

ASTM D4054: An Evaluation Process

Tier 1
Fuel Specification Properties
Relating to Engine Safety, Performance, and Durability
(ASTM D1655/DEF STAN 91-091, MIL-DTL-83133, MIL-DTL-5624)

Tier 2
Fit-for-Purpose Properties

CHEMISTRY
- Hydrocarbon chemistry (carbon number, type and distribution)
- Trace Materials

BULK PHYSICAL AND PERFORMANCE PROPERTIES
- Boiling Point Distribution
- Vapor/Liquid Ratio
- Thermal Stability Breakpoint
- Lubricity
- Response to Lubricity Improver
- Viscosity vs. Temperature
- Specific Heat vs. Temperature
- Density vs. Temperature
- Surface Tension vs. Temperature
- Bulk Modulus vs. Temperature
- Thermal Conductivity vs. Temp.
- Water Solubility vs. Temperature
- Solubility of Air (oxygen/nitrogen)

ELECTRICAL PROPERTIES
- Dielectric Constant vs. Density
- Electrical Conductivity and Response to Static Dissipator

GROUND HANDLING/SAFETY
- Effect on Clay Filtration
- Filtration (coalescers & monitors)
- Storage Stability
  - Peroxides/Potential Gum
- Toxicity
- Flammability Limits
- Autoignition Temperature
- Hot Surface Ignition Temperature

COMPATIBILITY
- Preliminary materials compatibility
- Additive Compatibility & Perf (New Additives Only)

Tier 1

Specification Properties

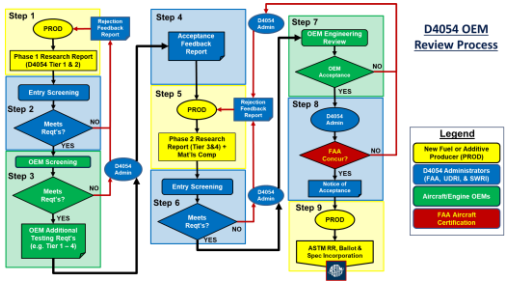
Tier 2

Fit-For-Purpose Properties

Phase 1 ASTM Research Report

SAFRAN BOEING Honeywell Rolls-Royce AIRBUS

OEM Review & Tier 3 & 4 Requirements



Tier 3

Component/Rig Testing

Tier 4

Engine/APU Testing

Phase 2 ASTM Research Report

SAFRAN BOEING Honeywell Rolls-Royce AIRBUS

OEM Review & Approval

FAA Review

ASTM Review & Ballot

Accept

Reject

Re-Eval As Required

ASTM Specification

ASTM Balloting Process

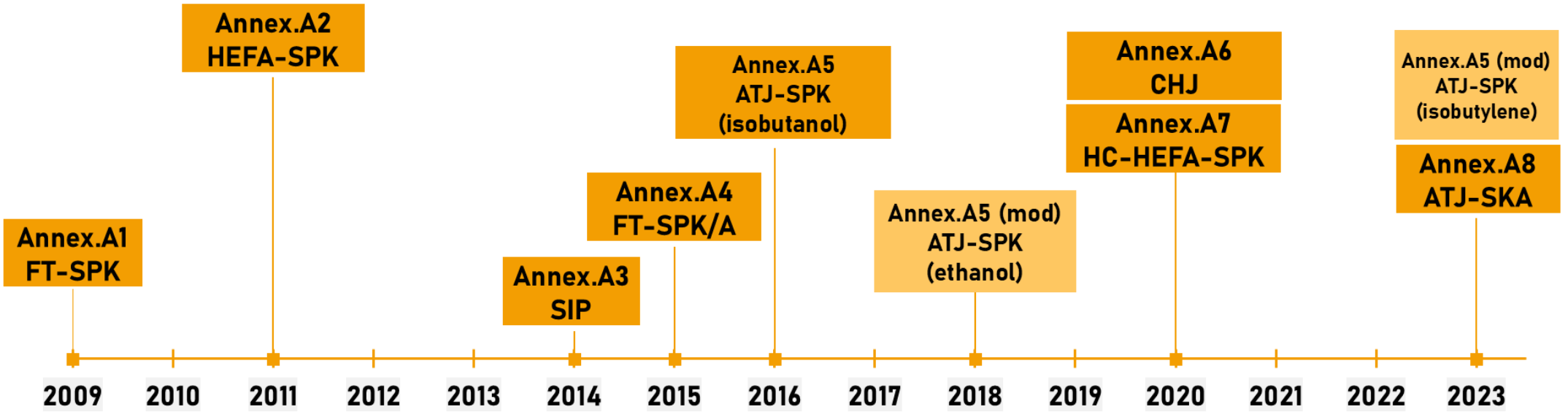
ASTM INTERNATIONAL Standards Worldwide

ASTM Specification

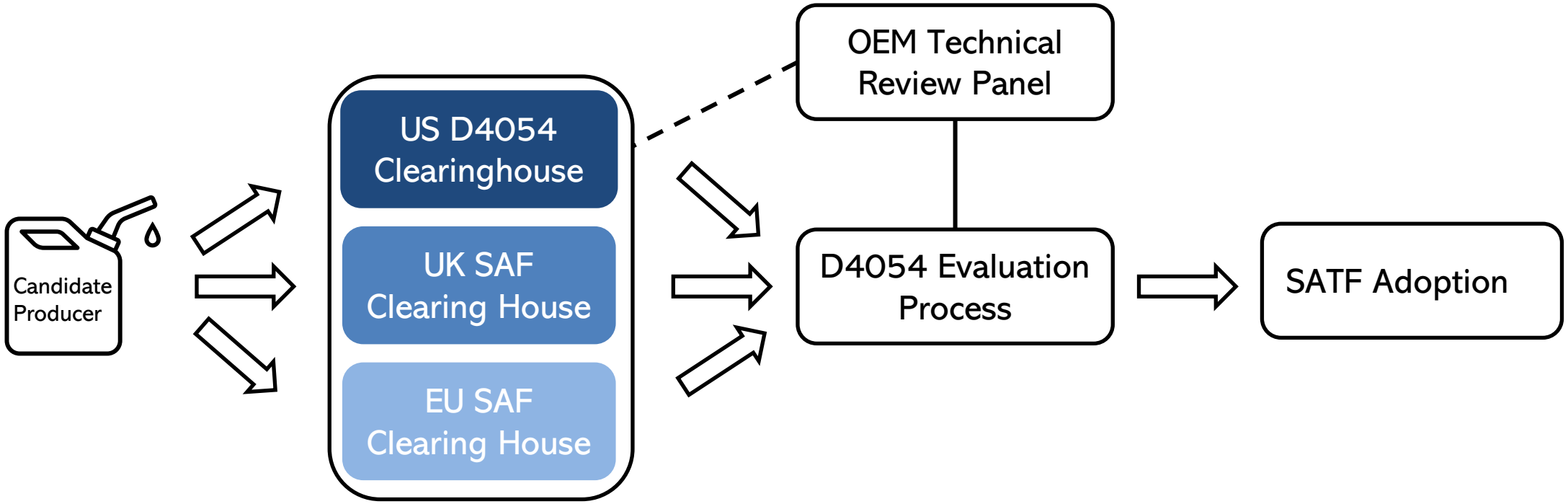
- Process & Safety driven
- Technical evaluation
- Iterative approach
  - Tier 1 & 2 required
  - Tier 3 & 4 optional (depending on 1 & 2 results)

Successful Transitions

- Approved SATF pathways: 8 (plus 2 major annex modifications)
- International collaboration—Annex proponents from: France, Germany, Japan, Netherlands, South Africa, Sweden, and United States



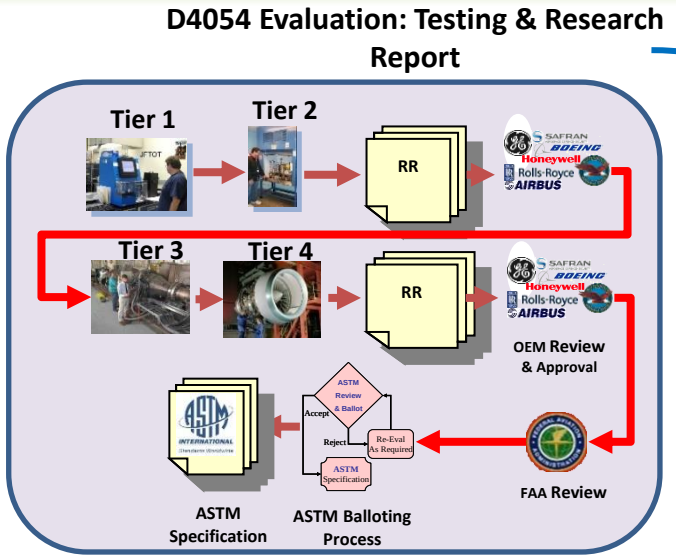
International Clearing Houses

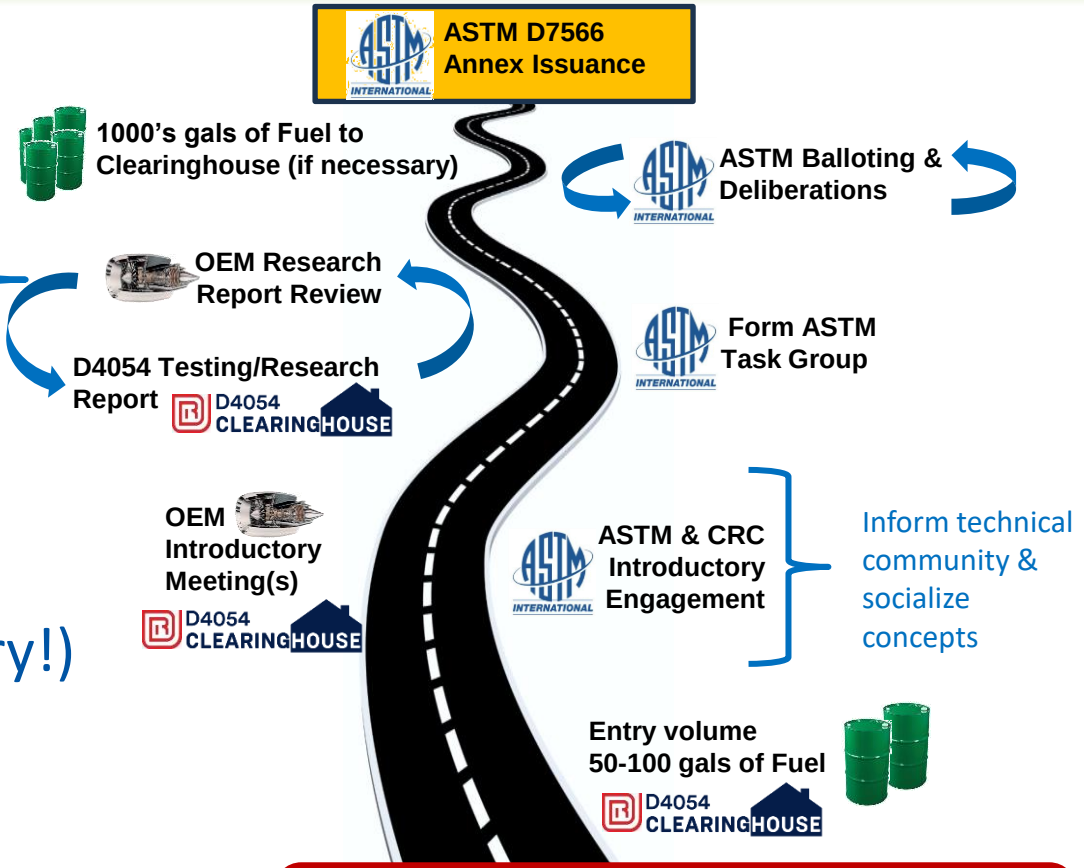


D4054 Clearinghouse

D4054 CLEARINGHOUSE

University of Dayton Research Institute





- Established in 2015 (Celebrating 10 Year Anniversary!)
- "One stop shop" for producers:
  - Fuel property & composition testing: Tier 1 + 2
  - Liaise between OEMs and new Producers
- Facilitate OEM technical review panel/process
- Collaborate with UK & EU Clearing Houses

UDRI Clearinghouse enables OEMS to review technical reports/requirements and helps producers navigate the D4054 process

UK SAF Clearing House

- Established in November 2023, delivered by the Energy Innovation Centre, University of Sheffield
- Advice and Support, free at the point of use, for SAF producers of all FRL/TRL:
  - Support with prescreening and analysis
  - Support with fuel property & composition testing: Tier 1 + 2
  - Networking and access to technical support to drive commercialization of SAF
- Access to test, hydro-processing and fractionation facilities
- Access to OEM technical review panel/process
- Two stage application process, Applicant eligibility based on:
  - Technical suitability
  - Commercial viability and business case to scale
  - Environmental sustainability (alignment with UK SAF Mandate)
- Collaborate with US & EU Clearing Houses

University of Sheffield | Energy Innovation Centre

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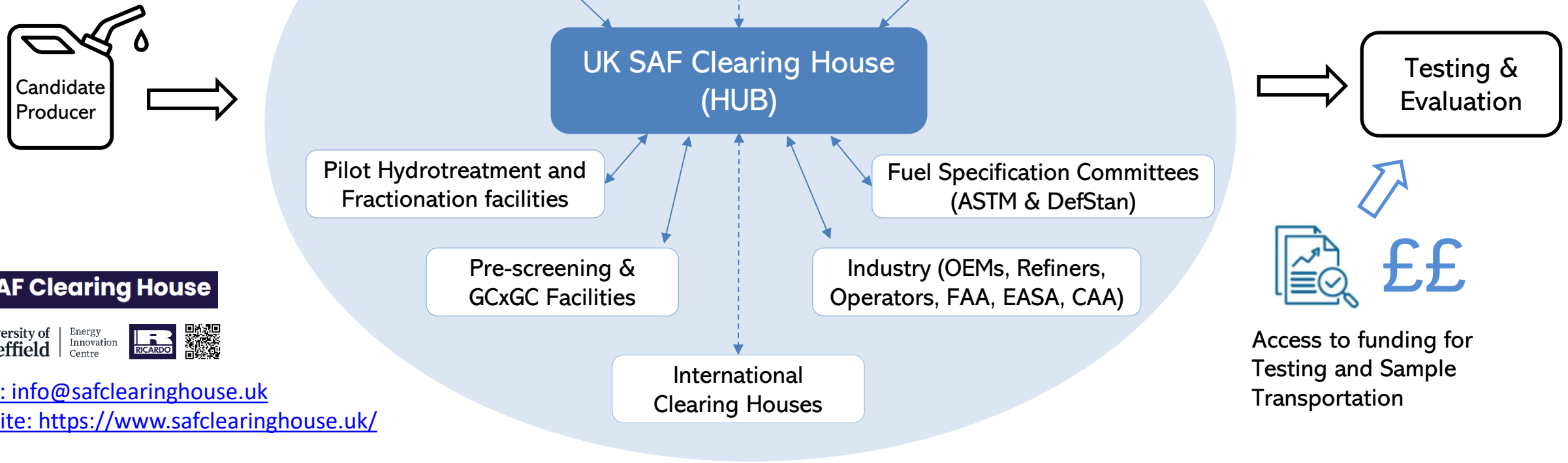
UK SAF Clearing House

UK Hub & Spoke Model
funded by UK Department for Transport (DfT)



UK SAF Clearing House
University of Sheffield | Energy Innovation Centre
RICARDO

Email: info@safclearinghouse.uk
Website: https://www.safclearinghouse.uk/

EU SAF Clearing House

Launch: Q3 2024
Director: Prof. Stephen Dooley, Trinity College Dublin
Project Manager: Andreas Busa, EASA

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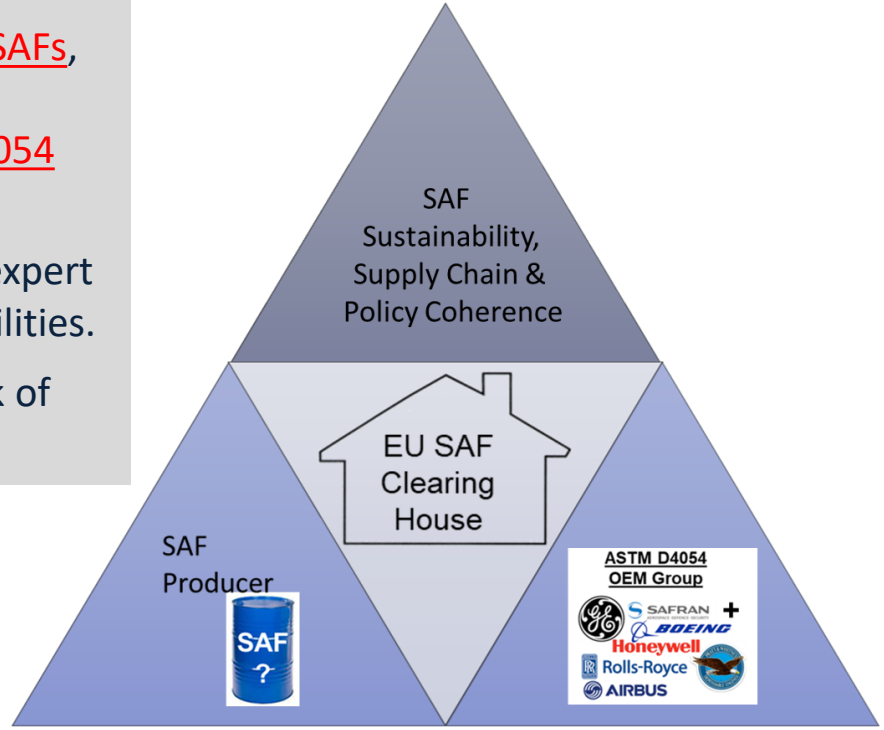
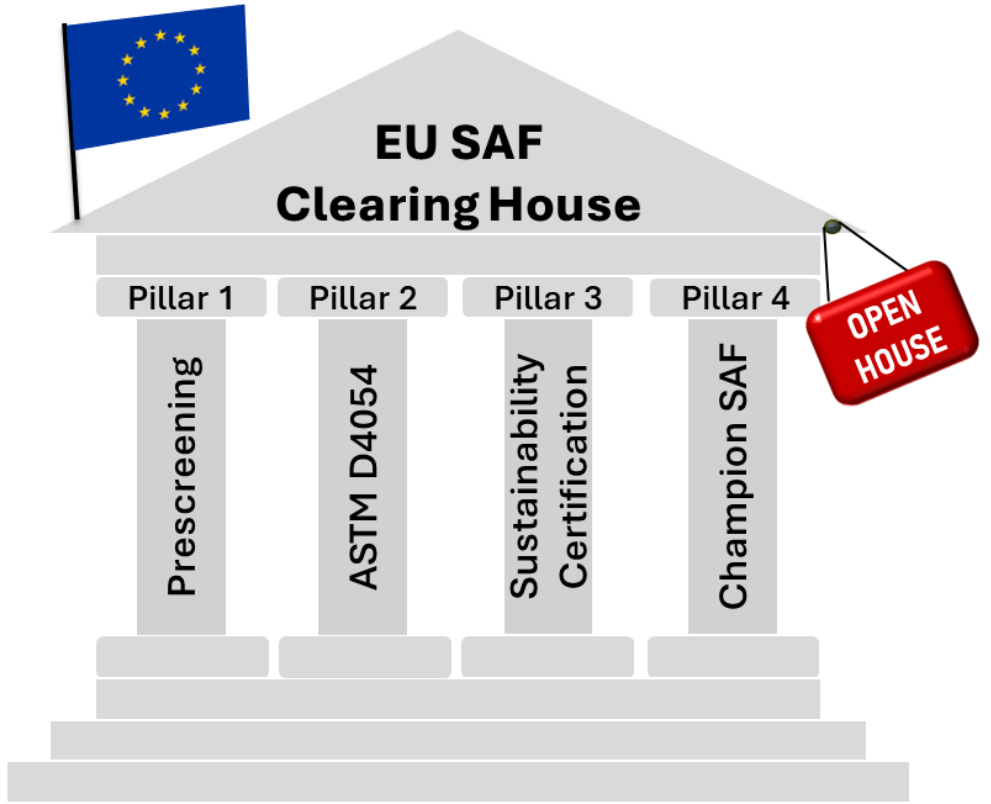
andreas.busa@easa.europa.eu
www.eusafclearinghouse.eu

Mission

- The EU SAF Clearing House aims to remove as many barriers as possible to support the EU & International deployment of SAFs, and the approval of new SAF pathways using the ASTM D4054 evaluation process.
- Support SAF producers with expert knowledge and testing capabilities.
- Facilitate SAF evaluation work of the OEMs.





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EU SAF Clearing House

ACT SAF

EU SAF Clearing House Services

Pillar 1: "Prescreening" Fuel Technical Quality

PRIORITY

- Provides fuel testing projected data (Tier α) and measurement data (Tier β) for most critical SAF fuel properties most critical to successful evaluation & approval.
- Utilises small volumes of fuel only (5cm^3 for Tier α) (<1Litre Tier β).

Pillar 2: ASTM D4054 Service

PRIORITY

- Everything a fuel producer requires for efficient D4054 evaluation will be offered, including fuel testing, research report writing & partial funding.
- D4054 service ensures availability & integrity of data.
- Improve & streamline D4054 process, with OEMs, US & UK CHs, EASA, FAA +.
- Provides expert interpretation on conformity to testing data to ASTM D4054 limits, and OEM experience base, manages relations with OEM group.

Pillar 3: Sustainability Assessment & Certification

- Sustainability certification with $CO_{2(eq)}$ & resource intensity analysis, and coaching on alignment to EU & international regulatory environment & latest knowledge.

Pillar 4: Champion SAF

- Disseminate & explain challenges in SAF deployment.
- Advise on research & innovation questions, investment, policy coherence.

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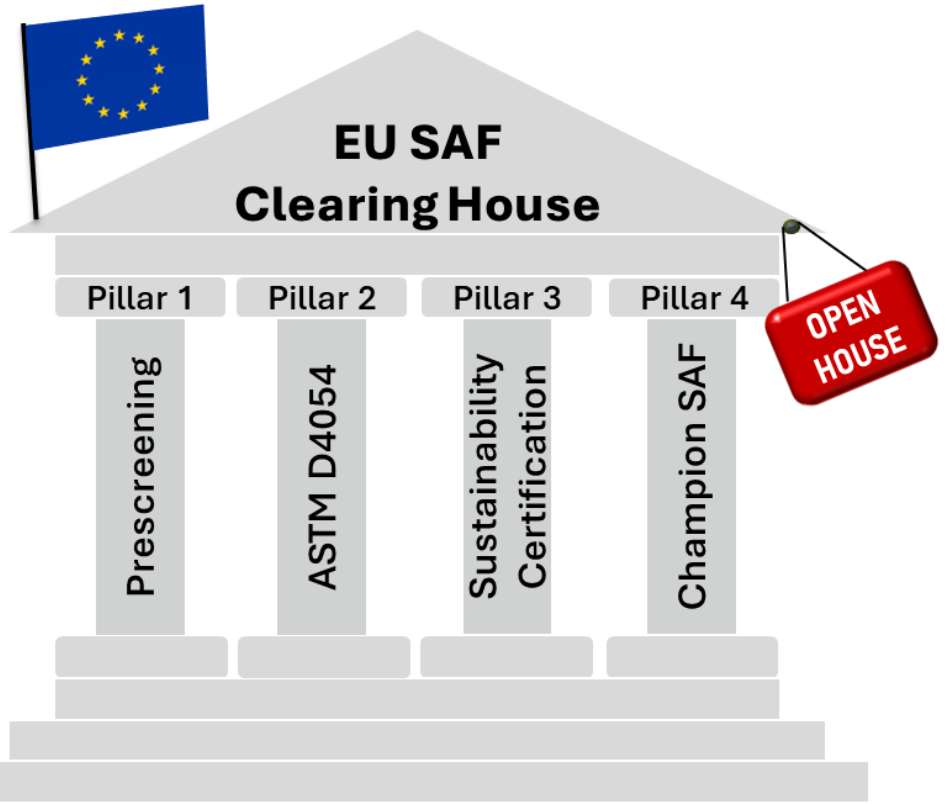

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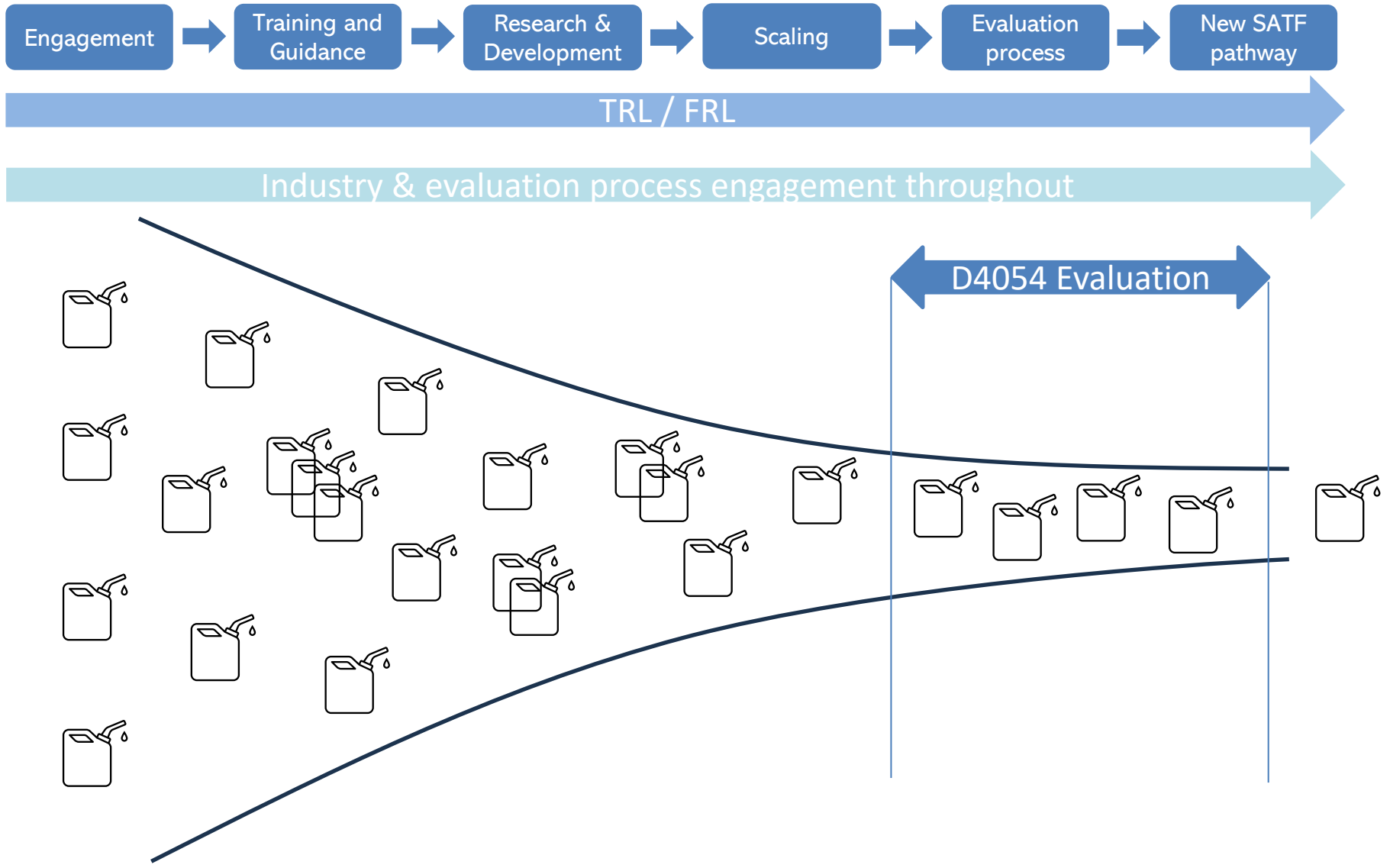
EASA RICARDO

SATF Evaluation Funnel



Current D4054 Candidates

- D4054 Clearinghouse working with producers from across the globe to advance SAF/SATF pathways
  - **Virent** (USA) – synthesized aromatic kerosene (SAK)
    - Feedstock: commercial sugars | Process: hydrodeoxygenation
  - **CSIR-IIP** (India) – synthesized kerosene with aromatics (SKA)
    - Feedstock: FOG | Process: adapted HEFA
  - **OMV ReOil** (Austria) – synthesized kerosene with aromatics (SKA)
    - Feedstock: waste plastic | Process: pyrolysis oil + refinery ops
  - **Revo** (Japan) – HEFA with higher cycloparaffins
    - Feedstock: FOGs | Process: HEFA
  - **ExxonMobil/Honeywell UOP/Halder-Topsoe** (USA/ Denmark) – Methanol-to-Jet (MTJ)
    - Feedstock: Methanol | Process: dehydrogenation + oligomerization
  - **CleanJoule** (USA) – synthesized cycloparaffins (SCP)
    - Feedstock: Isoprene | Process: oligomerization + hydroprocessing
  - **UPM** (Finland) – synthesized kerosene with aromatics (SKA)
    - Feedstock: Crude Tall Oil (CTO) | Process: hydroprocessing + fractionation
  - **IH²** (USA) – cycloparaffinic kerosene
    - Feedstock: wood/cellulous | Process: hydropyrolysis + hydroconversio

International Clearing Houses

For further information and support, please contact:

US D4054 Clearing House

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Understanding SAF Clearing Houses

Q&A

Understanding SAF Clearing Houses

Closing

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THANK YOU