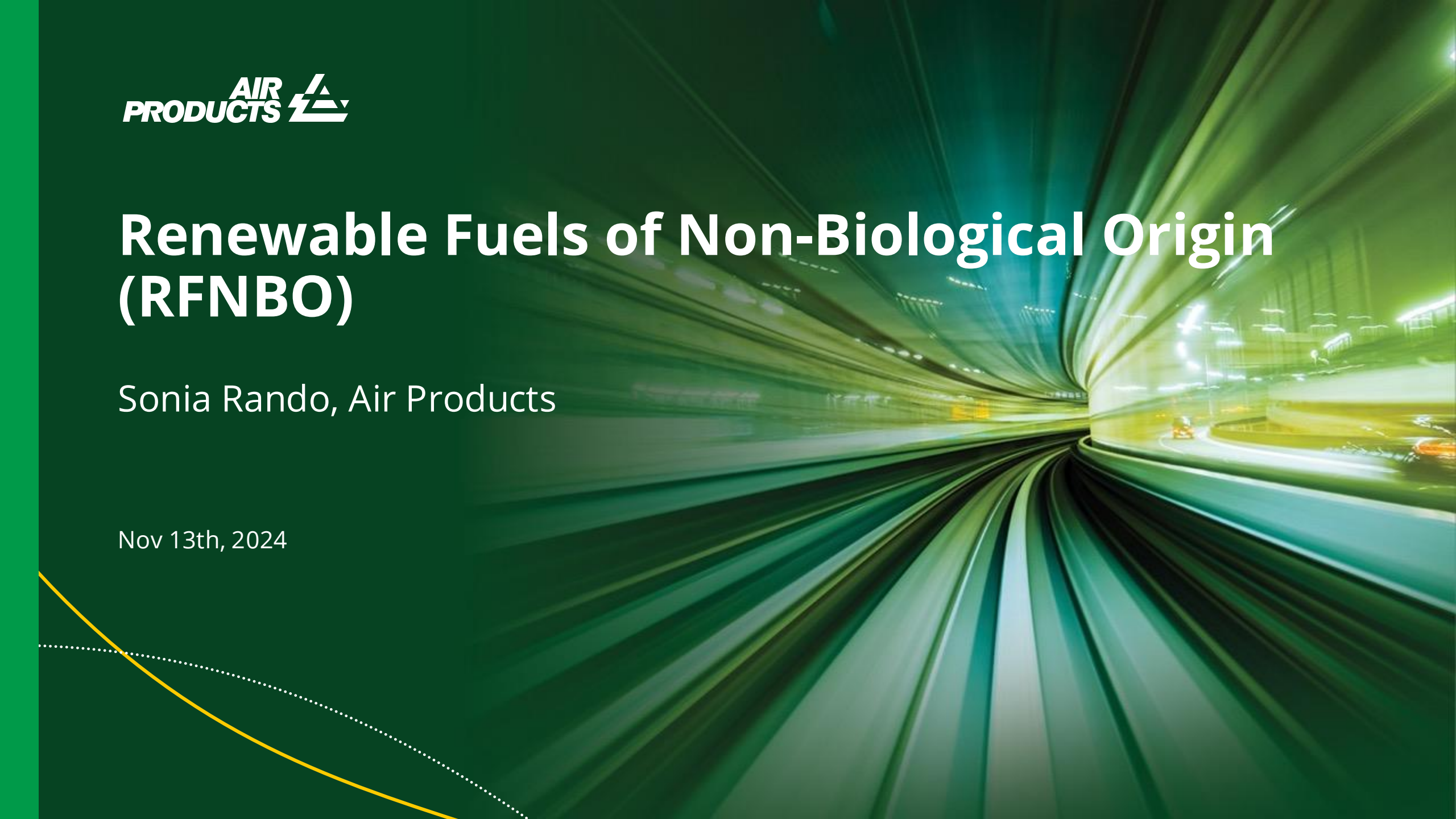


Renewable Fuels of Non-Biological Origin (RFNBO)

Sonia Rando, Air Products

Nov 13th, 2024

Air Products at-a-glance

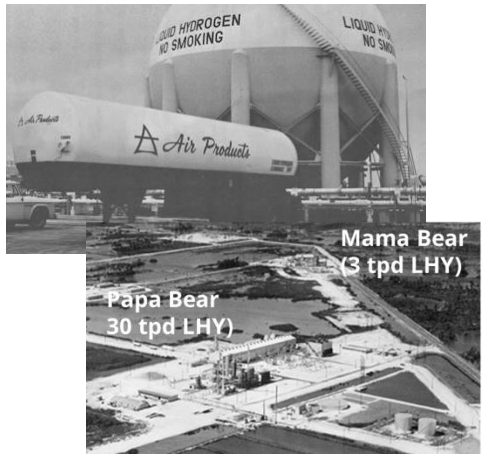
23,000	employees
83	years of industry leadership
50+	countries
750+	production facilities
110+	hydrogen production facilities in operation today
9,000+	tones of hydrogen per day production
109+	TWh of hydrogen per year production
and	
65	Years safely operating hydrogen molecules

When it comes to hydrogen, Air Products has been answering the call for more than 60 years.

1950s

Played a supporting role in the United States' space race

- Supplies hydrogen to the U.S. Air Force and later NASA
- Helped start space race by supplying liquid hydrogen



1980s

Taking part in the movement to prevent acid rain

- Becomes the leading global supplier of refinery hydrogen to desulfurize pollutants that cause acid rain

2000s

Pioneering hydrogen energy for mobility

- Started developing hydrogen refuelling solutions for vehicles reaching 1,000,000 in 2012

2020s

Leveraging hydrogen innovation and technology to meet the world's demand for a sustainable future

- Developed global hydrogen strategy to answer Energy Transition challenge

Air Products is globally shaping a renewable and low-carbon fuel supply chain

>$15 billion
committed in
energy transition projects

2,000 t/d
of renewable and low carbon **hydrogen** in execution(*)

11,000 t/d
of renewable and low carbon **ammonia** in execution(*)

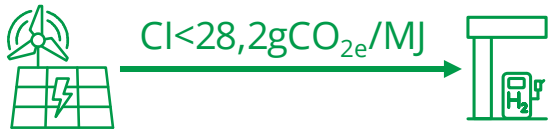
(*) co-location of projects allow synthesis/dissociation between the 2 fuels

RED EU RFNBO Criteria

"Renewability criteria" 3 main principles

Additionality	Temporal Correlation	Spatial Correlation
• Non-subsidized renewable electricity as feedstock • In operation MAX 36 months before electrolyser commissioning	Hourly	• No PPA needed if direct connection • Via grid – PPA compulsory (in same bidding zone)
Grandfathering: installations commissioned before 1/1/2028, until 1/1/2038 exempted	*Monthly before 2030*	
Not required if grid <18g CO2/MJ	Requires (PPA)	
Not required if grid >90% renewable		

CI Calculation and Book-keeping requirements



Well to wheel CI calculation: covers fuel lifecycle up to fuel delivery including emissions from compressing and distribution of hydrogen for its direct use in vehicles

CI<28,2gCO$_{2e}$/MJ : Minimum GHG emissions saving threshold of 70% vs the fossil reference 94gCO2eq/MJ should be achieved

For **production**
CI book-keeping : monthly until 2030 and then hourly
but individual countries can require hourly correlation from 2027

For **processing**
Electricity or other input (NG) do not have to be renewable
CI book-keeping : monthly

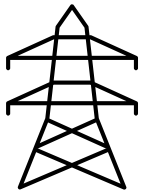
5

Global Low Carbon Hydrogen Programs (USA v. EU)

Element	US Treasury's Proposed Rule for IRA	European Union's RFNBO
CI Requirement	• Life cycle GHG **< 4 kg** CO_2e/kg of Hydrogen • Renewable power meets time matching, additionality, and deliverability	• Life cycle GHG **< 3.38 kg** CO_2e/kg of Hydrogen • Renewable power meets time matching, additionality, and deliverability
System Boundary & Technology	• Well-to-**gate** • Technologically agnostic	• Well-to-**grave** (full life cycle) • Only Renewable Fuels of Non-biological Origin (RFNBO) • Wind, Solar, Hydropower
Time Matching	• Annual matching through 2027 • Hourly matching beginning Jan. 1, **2028,** with no grandfathering	• Monthly matching through 2029 • Hourly matching beginning **2030** with no grandfathering
Additionality	• Additionality required from day one • The power source's commercial operations date (COD) should be no more than 36 months before the hydrogen production facility is placed in service	• Additionality starts Jan 2028 with grandfathering • Generating renewable electricity has come into operation up to 36 months from the installation of producing hydrogen • Hydrogen production located in a bidding zone with an average renewable electricity share exceeding 90% in the previous calendar year or the emission intensity of electricity is lower than 18 g CO_2e/MJ
Deliverability	• Renewable power generator and hydrogen producer within the same region defined by DOE Transmission Needs Study (15 regions)	• Renewable power generator and hydrogen producer within the same bidding zone

EU rules – challenges to its application to third countries

Electricity Market Desing



Bidding zone equivalent - integrated network or consists of multiple separate networks?

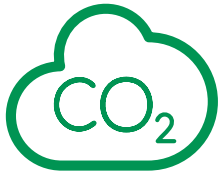
GoO vs RECs – EU recognition needed?

State Aid

No **operating aid or investment aid** for **renewable installation** – except if direct connection

Power production with IRA support non compliant – except direct connection or early onstream

Elegible Co2 Rules



Industrial Co2 allowed until 2036/2041 but only if an **effective carbon pricing system** is in place

DAC and biogenic Co2 allowed

Carbon Border Adjustment Mechanism (CBAM)

CBAM is a new Co2 tax for some import goods.

Hydrogen and ammonia are **covered by CBAM**. Methanol and other fuels aren't.

Air Products is **answering the call of the energy transition**
with renewable and low-carbon **fuels** and **infrastructure** at a global scale

We will have renewable hydrogen and **renewable and low-carbon ammonia** to
serve the needs from hard-to abate applications in the **industry** and **mobility sector**

by the end of 2026