# • Air Liquide

## **Refuelling at Air Liquide,**

## A perspective from Earth industry to Facilitate the Emergence of In-Orbit Refuelling

Global Markets & Technologies

Space for Inspiration 2024 Bertrand BARATTE - Space Market Director

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#### Would we accept a world where cars couldn't be refuelled?



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### Space & Sustainability: a paradox?



# SUSTAINABILITY VS. SPACE

Making space operations sustainable = our next leap!

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#### Sustainability in Space, the next leap ! Call for Action - Air Liquide vision

#1 Decarbonation

- #2 Standardize & Develop Interoperability
- #3 Develop Reusability
- #4 Develop In-Orbit Servicing & Refuelling
- #5 Develop In-Situ Resource Utilisation from celestial bodies
- #6 Foster international collaboration

**#7 Regulate** 

#8 Reduce our digital obesity



2028: NYX, Moon Mission, The Exploration



2020-2021: MEV-1 & 2 Mission Extension Vehicle, Northrop Grumman



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Dec. 2025 : NASA ARTEMIS III - Moon Landing from 2023 : rovers from USA, Japan, China, UAE, EU

2026 : in orbit fuel depots





### Air Liquide: A World Leader in Gas and Cryogenics from 1902



#### Emergence of a Low Carbon Hydrogen Economy An Air Liquide Strategic Priority





**AIR LIQUIDE** 

**KEY FIGURES** 

today

Nearly **200** H<sub>2</sub> Refuelling Stations



**3GW** Electrolysis by 2030





### H2 refuelling @Air Liquide : from space, through ground mobility, to aerospace. A long journey!



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#### Lessons Learned The chicken & egg dilemma

Cross Industry coalitions to scale-up, reduce TCO and deliver the ambition worldwide

DEMAND Refuellable vehicles Containing Ce TCO mbition

Refuelling infrastructure

Institutions as anchor customer to foster the emergence of industrial champions and to create the infrastructure

R&I Funding Guichet to develop End To End Value Chains

International Collaboration to develop standards and interoperability



#### Our experts' feedback Points of attention





#### Conclusion

#### In orbit Refuelling is key to space sustainability

#### Institution and public support is needed

International and cross sectoral collaboration for interoperability

Focus on TCO, safety, reliability & concept of operations











