UNOOSA Scientific and Technical Subcommittee: 2026

The MVA Lunar Industry Working Group - Status/Outlook

Lunar Industry Development

- Giant Leaps, Small Steps -

Study Phase 1

January 2026

IWG Members

- Co-chairs
  - Satoru Kurosu, MVA Board of Directors and Moon Market Development Coordinator
  - Mr. Atsushi Saiki, Executive Fellow, ispace, Inc.


- Members
  - Ms. Misuzu Onuki, Executive Vice President, SPARX Asset Management Co. Ltd.
  - Mr. Kiho Fukaura, Unit Leader, Lunar Plant Unit, DX Technology Exploration Group, Digital Project Delivery Department, JGC Corporation
  - Mr. Jeffrey Max, CEO, Magna Petra Corp
  - Mr. Yosuke Enomono, Senior Manager, PwC Consulting LLC
  - Mr. Issei Mamiya, Senior Corporate Strategy Specialist, Corporate Strategy group, ispace, Inc.
  - Mr. Hassan Abou Seada, Director of Frequency Coordination Department, Egyptian Space Agency (EgSA)
  - Mr. Lari Cujko, Startup Program Lead, esric (Co-Chair, MVA Lunar Trade & Investment WG (Lunar Commerce and Economics WG))
  - Mr. Christophe Bosquillon, CEO, Autonomous Space Futures Ltd (Co-Chair, MVA Lunar Trade & Investment WG (Lunar Commerce and Economics WG))
  - Ms. Shima Suresh, Business Development Manager, 3IPK (MVA, Moon Market Development Coordinator Support)
  - Dr. Yosuke Yamashiki, Professor, Chairperson of Division, Chairperson, SIC Human Spaceology Center

IWG Introduction

- Background
  - The rise of lunar development by both space agencies and private companies is accelerating the emergence of a new lunar industry. While long-term investments and significant funding are required, bold, opportunity-driven thinking is essential to transform potential into viable business.
- Goal
  - Position the lunar industry as a high-growth sector by providing concrete projections and a clear roadmap.
  - Furthermore, leverage lunar- derived technologies to address Earth-based challenges, fostering new business opportunities both on the Moon and on Earth.

Executive Summary of the Phase 1 Study

1. We mapped the overall landscape of promising market segments, both on the Moon and in related terrestrial industries.
2. As the “First Small Step” toward lunar industry, we focused on propellant production plants within the resource sector, where concrete studies are already underway. Our analysis suggests that propellant plants and power supply facilities could potentially achieve investment recovery within approximately 3–5 years.
3. We outlined how the industry could expand beyond this initial step, including emerging areas such as lunar data centers and helium-3 exploration, as well as intangible resources like lunar tourism and advertising/entertainment.
4. We examined how lunar-derived technologies—particularly environmental control and life support systems (ECLSS), which are essential for human presence—could contribute to terrestrial SDGs through circular-economy applications.
5. We developed an industrialization roadmap from 2026 through 2050, indicating a potential cumulative market of US$150B–230B.

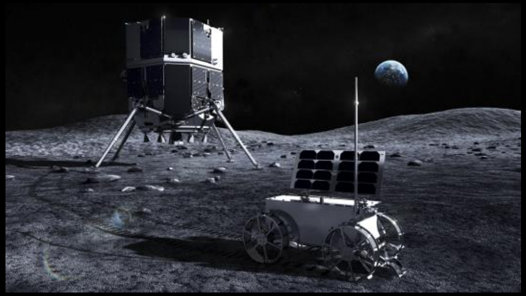
Commercial Moon Rash!

Intuitive Machines IM-1
Landed in Feb. 2024
©NASA

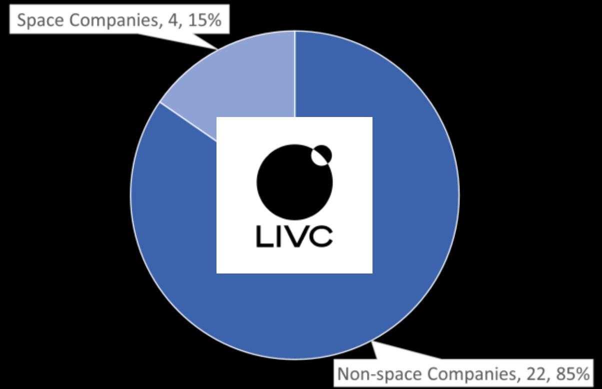
Intuitive Machines IM-2
Landed in Feb. 2025
©NASA

SORA-Q (LEV-2), the world's smallest and lightest transformable lunar exploration robot, developed by JAXA, TAKARATOMY, SONY and Doshisha Univ. ©JAXA

Firefly Aerospace Blue Ghost M1
Landed in Mar. 2025
©NASA



ispace M2
Attempted to land in Jun. 2025
©ispace



Non-space companies are joining the space industry
(Corporate members of Lunar Industry Vision Council)

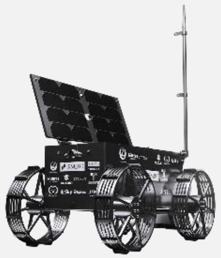
Completed in 2025

Mission 2 Overview

Hardware

RESILIENCE

- Size: Approx. 2.3m tall by 2.6m wide (legs deployed)
- Mass: Approx. 1,000kg (Wet: fully fueled), Approx. 340kg (Dry: unfueled)
- Design Payload Capacity: Up to 30kg



TENACIOUS™

- Design: Lightweight to withstand vibrations during transit to the lunar surface
- Mass: approx. 5kg
- Design Payload Capacity: up to 1kg

Highlights

- An R&D mission aimed at verifying technologies related to lunar landing and lunar exploration
- Although the final lunar landing was not achieved, the mission successfully demonstrated reliable transportation capability to lunar orbit
- The cause of the landing failure was a hardware issue in the laser range finder (LRF)
- Corrective actions will be made to incorporate further improvements into subsequent missions, including a review of the landing sensors and expanded technical support from JAXA
- As for payload contracts, the net sales to be recognized decreased by $1.5Mn to a total of $14.5Mn; however, no refunds or compensation for damages were incurred, and the financial impact of the failed landing is limited
- Recorded our first data service net sales of ¥23Mn in Q1

Payload Customer

Sales Completed

Total net sales:
$14.5Mn(1)

P : Private-sector A : Academia G : Government

(from the left)

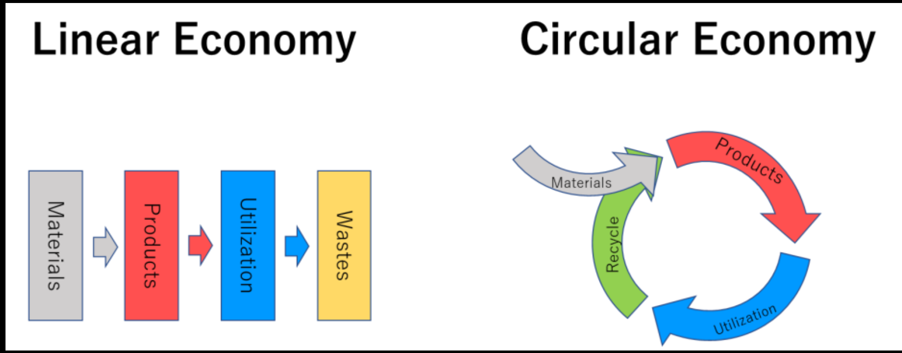
- P Takasago Thermal Engineering: water-splitting experiment
- P euglena: lunar algae-cultivation equipment
- A National Central University, Taiwan: deep space radiation probe
- P BANDAI NAMCO: “GOI Space Century Charter” plate
- P Artist, Mikael Genberg: Moonhouse (artwork)

(1) As of August 8, 2025. Numbers are rounded down to the nearest whole number. Of the total contract amount of $16Mn, $1.5Mn was not received due to the incomplete lunar landing, resulting in a decrease in recognition of total net sales.

2025/5/27 Earth Rise（©ispace）

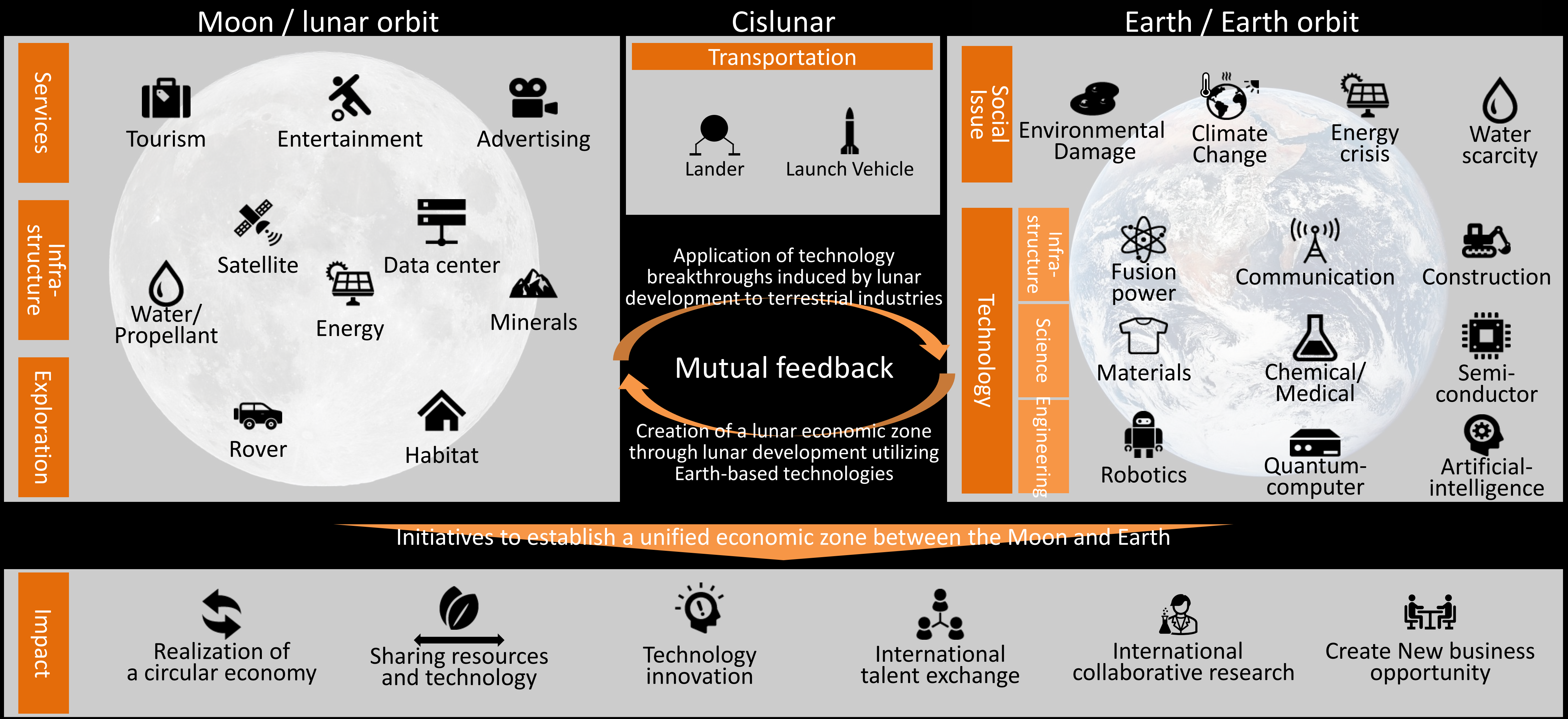
Why Moon?

- A unique testbed for developing sustainable technologies for Earth, independent of natural ecosystems
  - No fossil energy resources and limited supply from Earth
  - A cradle for Circular Economy driven by the ultimate 3R (Reduce, Reuse, and Recycle) requirements



- A proving ground for space-based resource utilization
- Driving innovation as a frontier of technology development, inspiring STEM education and creating new jobs on Earth

Potential Business Segments



IWG Study on Water-related resources

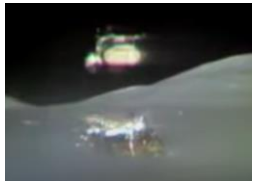
- Water-related resources (H_2, O_2, H_2O) extracted from regolith can be broadly categorized into water for **domestic use** and water for **industrial use.**
- Since domestic water is basically recycled, **the main market is assumed to be industrial water, with propellant being the largest segment.**
- As for the main demand for propellant, two types are assumed: ①**Ascender** and ②**Hopper.**

Products generated from water-related resources

- Water-related resources extracted from regolith
  - Domestic Use
    - Drinking water (H_2O)
    - Sanitary use (H_2O)
    - Breathing air (O_2)
  - Industrial Use
    - **Propellant (Liquid O_2 and H_2)**
    - Plant production (H_2O)
    - Fuel cells (H_2, O_2)
    - Others (e.g., Metal processing)

Major propellant users

Ascender (Return Vehicle)



Screenshot from a Smithsonian National Air and Space Museum video
https://www.youtube.com/watch?v=9HQfauGJaTs

For crewed missions, a return Ascender is essential. Additionally, an uncrewed Ascender is required for sample return missions.

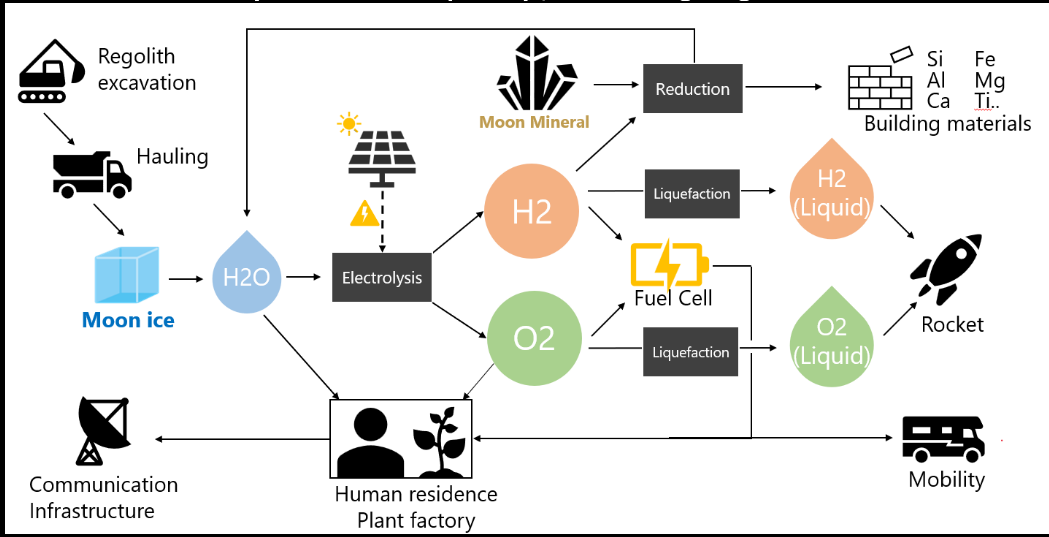
Hopper

Intuitive Machines, Micro Nova
https://www.intuitivemachines.com/micro-nova

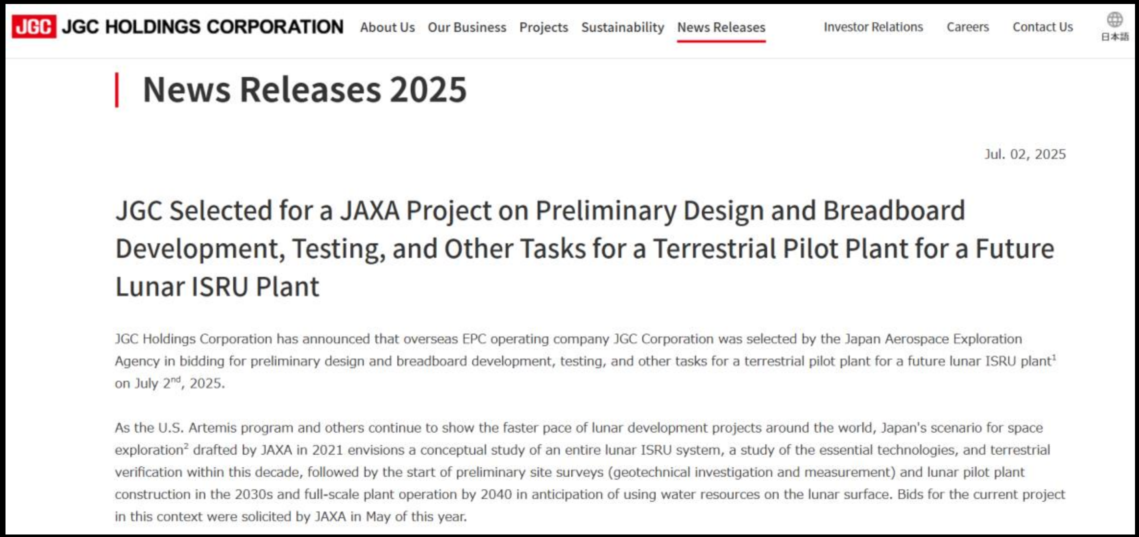
To support wide-area exploration and the future expansion of operational areas, hoppers (equipped with base stations, etc.) are expected to appear early on. In the future, the emergence of crewed hoppers is also anticipated.

What is the first *"Small Step"*? -ISRU Plant Overview-

- ISRU plays a key role in building a sustainable lunar economy and enabling broader national space exploration missions.
- Domestic Development Status
  - Since FY2021, JGC and JAXA have jointly developed concepts and prototypes for a Lunar ISRU Plant, focusing on the propellant plant, progressing from basic studies to pilot plant design and testing; By FY2025, development has progressed to the basic design phase of a terrestrial pilot plant.
- Business Development
  - From a private sector perspective, the business model may start with government-led infrastructure development and gradually shift toward private-sector-driven operations, such as an SPC (Special Purpose Company) managing lunar infrastructure.



Outline for ISRU Plant
(JGC Corporation, The concept of Architecture for the realization of sustainable Lunar Society based on water ISRU plant, IAC-25-4, 11, x99390, September 2025)



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News Releases 2025

Jul. 02, 2025

JGC Selected for a JAXA Project on Preliminary Design and Breadboard Development, Testing, and Other Tasks for a Terrestrial Pilot Plant for a Future Lunar ISRU Plant

JGC Holdings Corporation has announced that overseas EPC operating company JGC Corporation was selected by the Japan Aerospace Exploration Agency in bidding for preliminary design and breadboard development, testing, and other tasks for a terrestrial pilot plant for a future lunar ISRU plant[1] on July 2nd, 2025.

As the U.S. Artemis program and others continue to show the faster pace of lunar development projects around the world, Japan's scenario for space exploration[2] drafted by JAXA in 2021 envisions a conceptual study of an entire lunar ISRU system, a study of the essential technologies, and terrestrial verification within this decade, followed by the start of preliminary site surveys (geotechnical investigation and measurement) and lunar pilot plant construction in the 2030s and full-scale plant operation by 2040 in anticipation of using water resources on the lunar surface. Bids for the current project in this context were solicited by JAXA in May of this year.

News Release, Jul. 02, 2025, JGC Corporation
(https://www.jgc.com/en/news/2025/20250702_11.html)

Year, Mass and Sales Price to Recoup Initial Investment on the Propellant Plant

MOON VILLAGE ASSOCIATION

If transportation costs are reduced to one-tenth of the CLPS price and the plant facilities can be constructed within a total weight from 30 to 50 tons, then assuming the sales price is set at half of the transportation cost, investment recovery would be achievable in approximately three to five years.

Contents			Nominal Case
Needs	Ascender (Human Flight)	Frequency	1 / year
		Fuel Consumption per use (Liquified H_2+Liquified O_2=5.3t+31.5t)**	36.8t
		Fuel Consumption per use (H_2O)**	**48.0t**
	Ascender (Cargo Flight: Sample return)	Frequency	1 / year
		Fuel Consumption per use (Liquified H_2+Liquified O_2=5.3t+31.5t)**	36.8t
		Fuel Consumption per use (H_2O)**	**48.0t**
	Exposed Hopper	Frequency	1 / year
		Fuel Consumption per use (Liquified H_2+Liquified O_2=3.0t+17.8t)**	20.8t
		Fuel Consumption per use (H_2O)**	**27.1t**
	Annual Total Consumption		**123.1t**
Cost	Transportation Cost (Earth→Moon)		$0.1M/kg
	Propellant Plant Mass		30-50t
	Development Cost		$1B
	Initial Cost		**$4-6B**
Sales	Seles Price (50% of Transportation cost)		$0.05M/kg
	Annual Revenue		$6.16B
	Annual Profit (20% Margin)		$1.23B
	Payback Period		**Approx. 3-5 years**

Demand is assumed to be limited to the minimum level of government requirements. However, if additional commercial demand—such as fuel supply for XGEO satellites or tourism—accumulates, investment recovery could be achieved in a shorter timeframe or allow for a lower sales price.

Propellant Plant Mass (kg)
- Extraction: 210
- Electrolysis: 1,000
- Liquefaction(O2): 1,000
- Liquefaction(H2): 850
- Storage: 700
- Sub Total: 3,760
  (Power consumption: 138kW)

Power Plant Mass (t): 23-33

Total Mass: 26.76-36.76t

Source: Tanaka Y., Fukaura K., et al.: *Evaluating the value and feasibility of Lunar ISRU plants including power supply facilities*, 76th International Astronautical Congress, (2025)

Industries to Emerge Following Initial Infrastructure

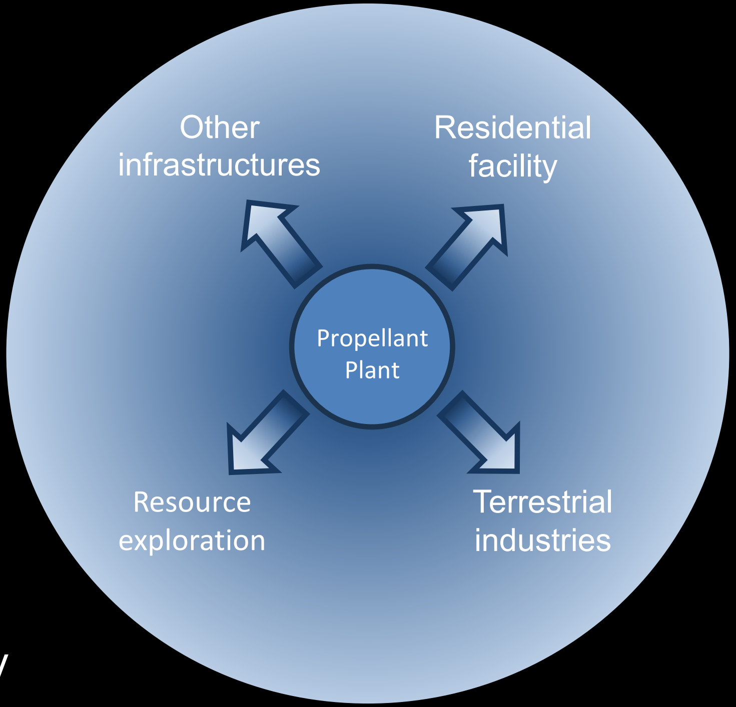
(1)Infrastructure construction
- ①Buildings
- ②Construction material plants (aluminum, titanium, etc.; material production and oxygen generation)
- ③Power generation (solar, nuclear), energy storage
- ④Communication, positioning

(2)Residential facility services
- ①Air, drinking water, food supply
- ②Transportation
- ③Governance
- ④Security
- ⑤Troubleshooting

(3)Resource exploration
- ①ISRU (In-Situ Resource Utilization)
- ②Resources with potential for export to Earth (e.g., Helium-3)

(4)Terrestrial industries utilizing lunar environment
- ①Data center
- ②Manufacturing utilizing ultra-high vacuum, low temperature, low gravity
- ③Solar power generation

(5)Potential industries that may emerge independently of lunar infrastructure
- ①Tourism
- ②Advertising and Entertainment



Hot Topic 2 –Lunar Helium-3

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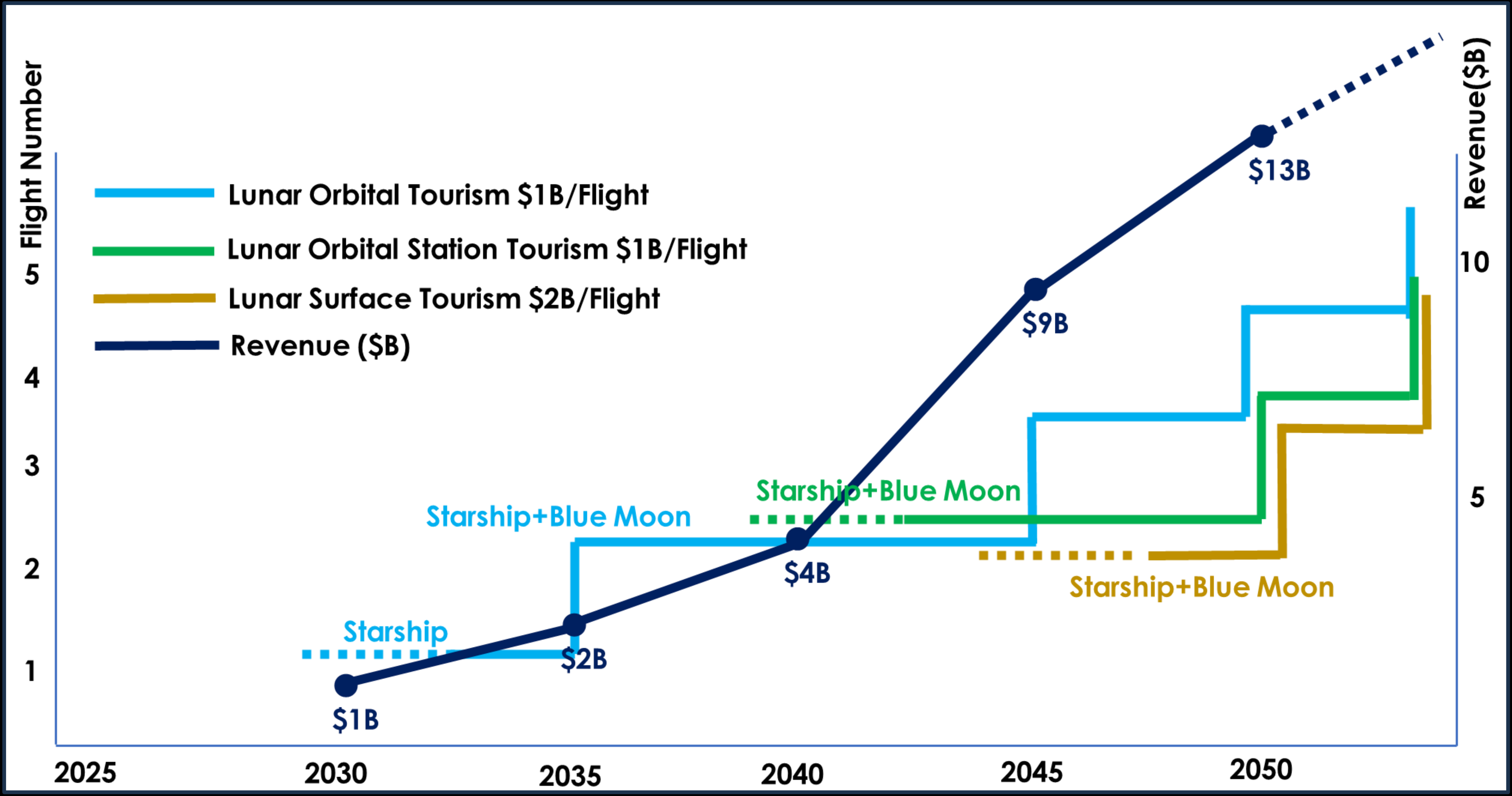
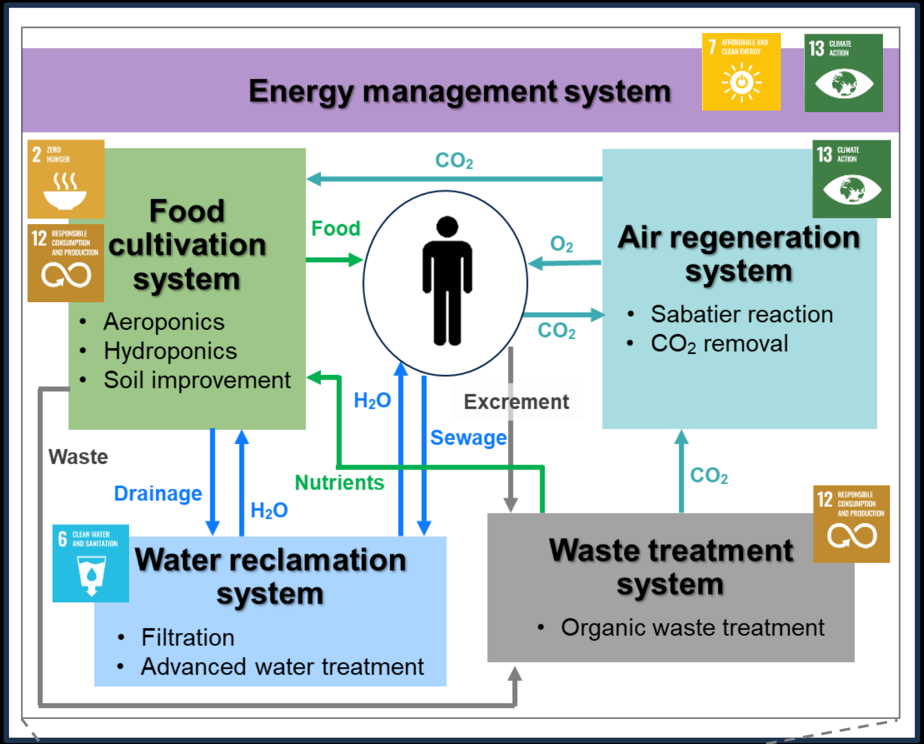
- Helium-3 is the critical supply-chain isotope for humanity's AI future
- Virtually unavailable on earth, he-3 exists in "century-long" reserves on the lunar surface
- When used as a fuel for nuclear fusion, he-3 produces zero radioactive waste
- Fusion power promises to solve the global AI datacenter power deficit
- He-3 fusion ideal power source for on-orbit & lunar datacenters
- Fusion power promises "unlimited clean power" at low cost and low impact
- Reconnaissance missions already scheduled (Magna Petra x ispace M3 – H2-2027)
- First sample return aiming for 2030

Prediction of Lunar Tourism Market



Utilization of space-developed technologies to address major social issues

ECLSS



Space is an extreme environment, and human habitation requires that all air, food, and water be locally produced and consumed

Complete circular ecosystem in space

Source: Kurosu S., Mizuno K., et al.: *Space-enabled Innovations to Solve Earth's Issues*, 76th International Astronautical Congress, (2025)

Technologies developed in the extreme environment like space contribute to…

Challenges on Earth

Space-developed technologies for solving challenges

Technologies for removing and capturing CO_2, a cause of global warming

Technologies enabling efficient, stable, and sustainable energy supply

Water recycling technologies using microorganisms and filters, as well as sewage treatment technologies necessary for establishing water recycling systems

Effective hydroponic and aeroponic cultivation technologies
Sustainable soil improvement technologies
Technologies for preserving food with its nutrients intact for long periods

Waste treatment technologies that enable 100% recycling

Overview of Lunar report vol.2

	Earth~Cislunar	Lunar Orbit		Lunar Surface			
	Launch & Transportation	Orbiting	Landing	Exploration	Resource Development	Infrastructure Development	Living & Applications

PwC

Lunar Report Vol.1 Coverage

Lunar Report Vol.2 Coverage

To be･･･

Report Vol.1 (Published in 2021)	• Covers the 20-year period from 2020 to 2040 • Investigated market opportunities in three themes: lunar transportation, lunar data, and in-situ resource utilization
Report Vol.2 (Scheduled for publication in December 2025)	• Covers the 25-year period from 2026 to 2050 (divided into 5 phases, each 5 years) • This report analyzes market opportunities with a focus on lunar infrastructure development. • This report investigates market opportunities for five key types of lunar infrastructure: ①Mobility ②Communication ③Energy ④Habitation ⑤Water

✓ **The figures in Lunar Report Vol. 2 appear smaller than those in Vol. 1 due to differences in scope—this edition focuses specifically on infrastructure—and the revision of transportation cost assumptions.**

✓ **Because this report focuses solely on infrastructure, the overall market estimates are expected to increase in the future as additional businesses and use cases emerge based on the built infrastructure, including those referenced in the revenue section.**

Industry Roadmap

- Giant Leaps, Small Steps -

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Market opportunities totaling $150B to $230B are assumed for the period 2026–2050.

Note: Tourism, Advertisement, Entertainment and Impact on Earth are not included.

Industry FS

Propellant Plant Setup

Industrial Infrastructure Expansion

Establishment of a Lunar Economic Zone

Impact on Earth

(To be calculated during Phase 2)

Tourism, Advertising and Entertainment

2026-2030 2031-2035 2036-2040 2041-2050

Resources : Earth → Moon ISRU Earth ←→ Moon

Financial Statement: Stand Alone Consolidated

Conclusion and the next step

- In Phase 1, we examined the overall landscape of lunar industry segments and the potential benefits for Earth.
- We focused on the propellant plant and found that it can be the "First Small Step" toward Lunar Industrialization.
- In Phase 2, we will conduct a deeper analysis of the overall economic viability and the impact on Earth. In Phase 3, we aim to engage relevant stakeholders to promote realization of these initiatives.

We would appreciate feedback.

Thank you for your attention!

We sincerely hope to collaborate with UNOOSA in promoting lunar industrialization, a key step toward realizing the Sustainable Development Goals (SDGs).

www.moonvillageassociation.org

www.internationalmoonday.org