

# LUNAR NIGHT SURVIVAL



Executive Summary  
Space Studies Program 2018



# TO THE MOON

Many countries and their space agencies have come together with the goal of sustainably expanding human and robotic presence into the Solar System. The Global Exploration Roadmap outlines *"an international effort to prepare for space exploration missions beginning with the International Space Station and continuing to the lunar vicinity, the lunar surface and then on to Mars."* Our team project is inspired by, and based on, some of the elements of the Global Exploration Roadmap.

We express our sincere gratitude to our sponsors at ESA and NASA for presenting us the opportunity to work on this compelling project.

## THE CHALLENGE

Absence of atmosphere. Galactic cosmic rays and solar particle events.

21 km diameter craters, 4.5 km deep.

Low thermal conductivity lunar surface material.

Limited solar energy.

Temperature variations between 250°C and -150°C.

## OUR GOAL

*Survival.*

**"What makes the desert beautiful," said the little Prince, "is that somewhere it hides a well."**

Antoine de Saint-Exupéry, *The Little Prince*

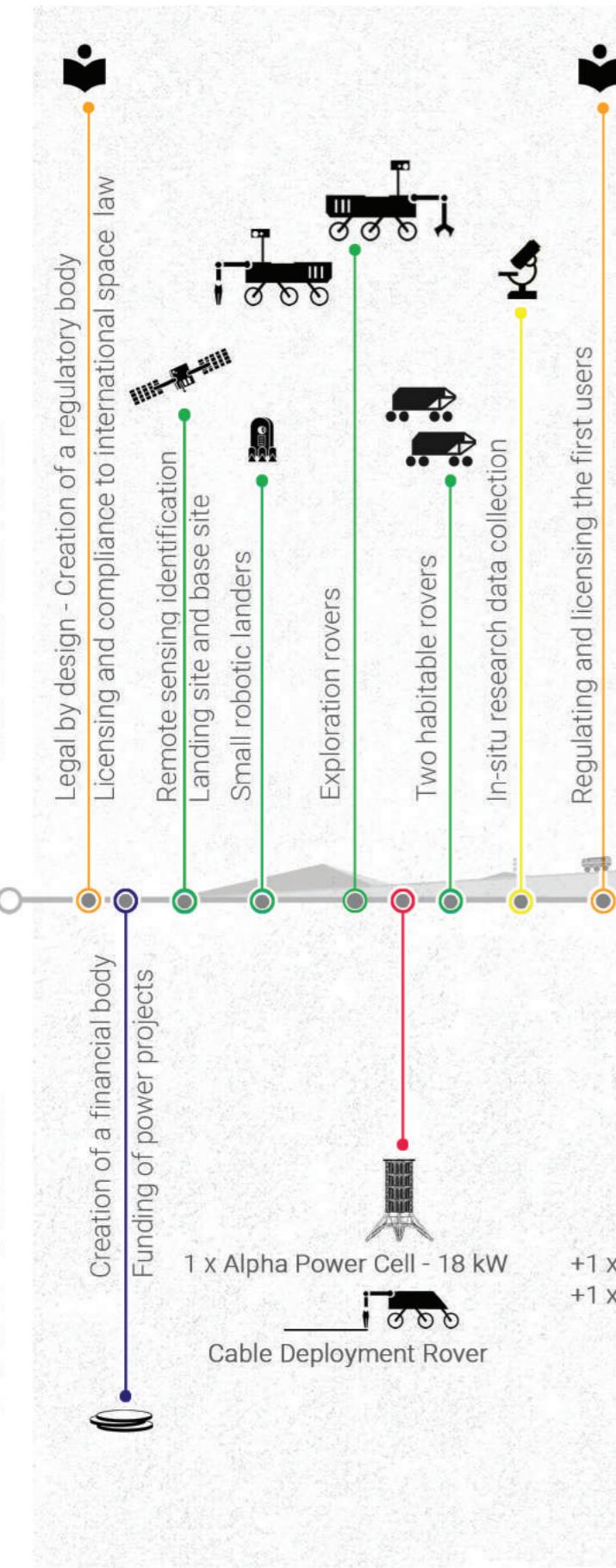
## OUR MISSION

Create a scalable power generation and distribution system for utilization during lunar days and nights to enable a sustained presence on the Moon.

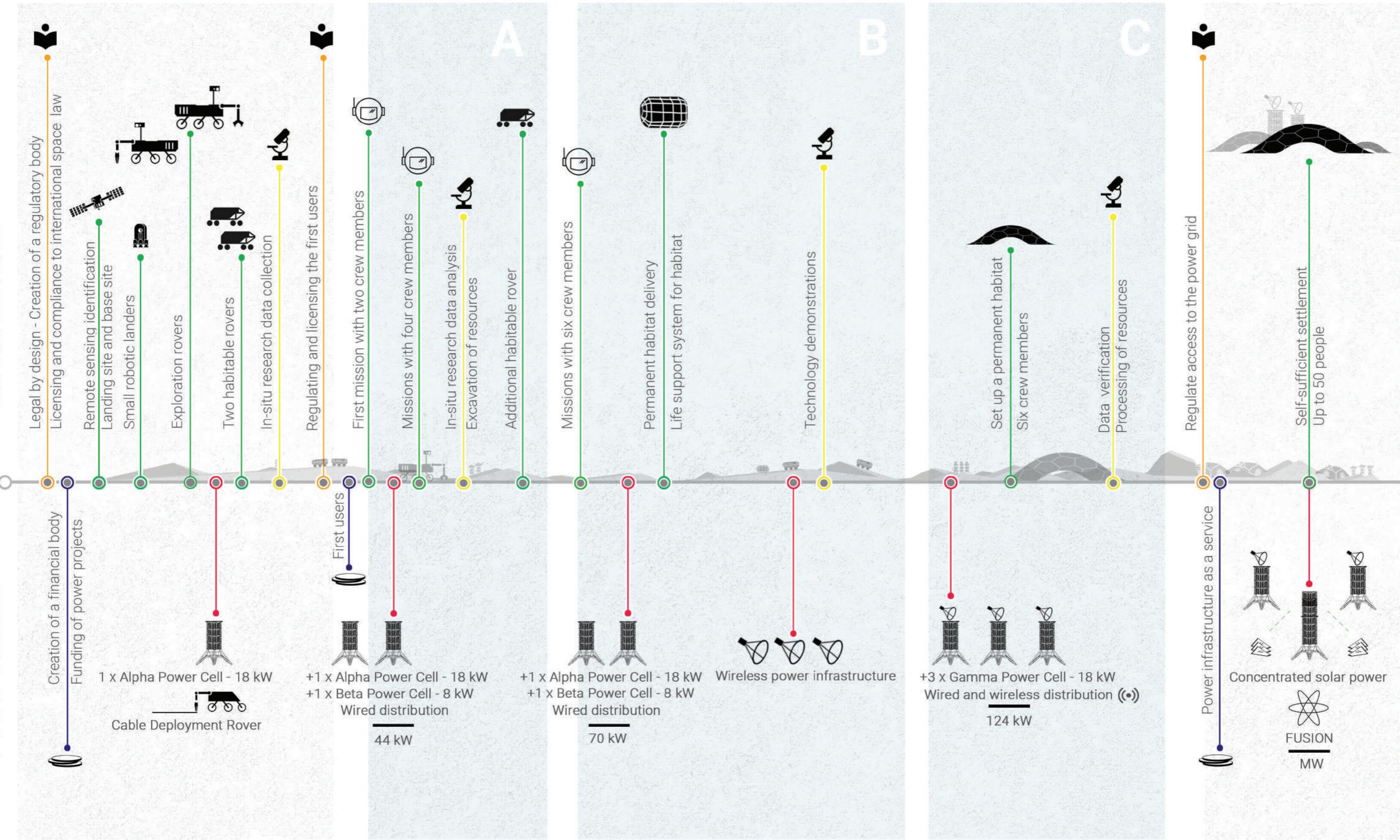
# Timeline of Power Evolution

● Moon activities ● Science and technology ● Law and policy ● Power ● Economy

## Moon Activities



## Power Solution



Phase 1

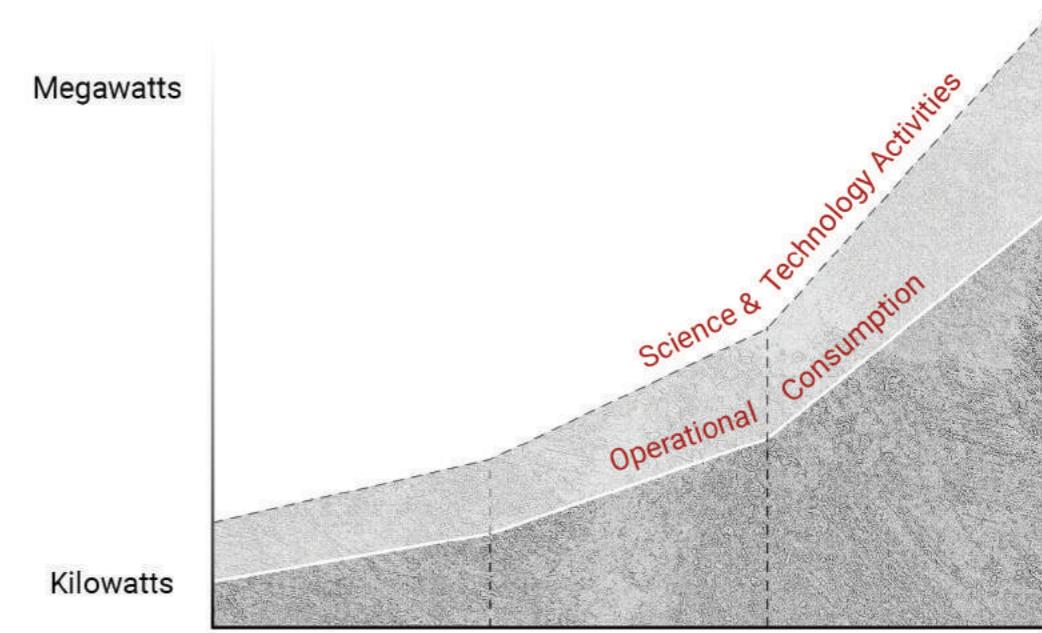
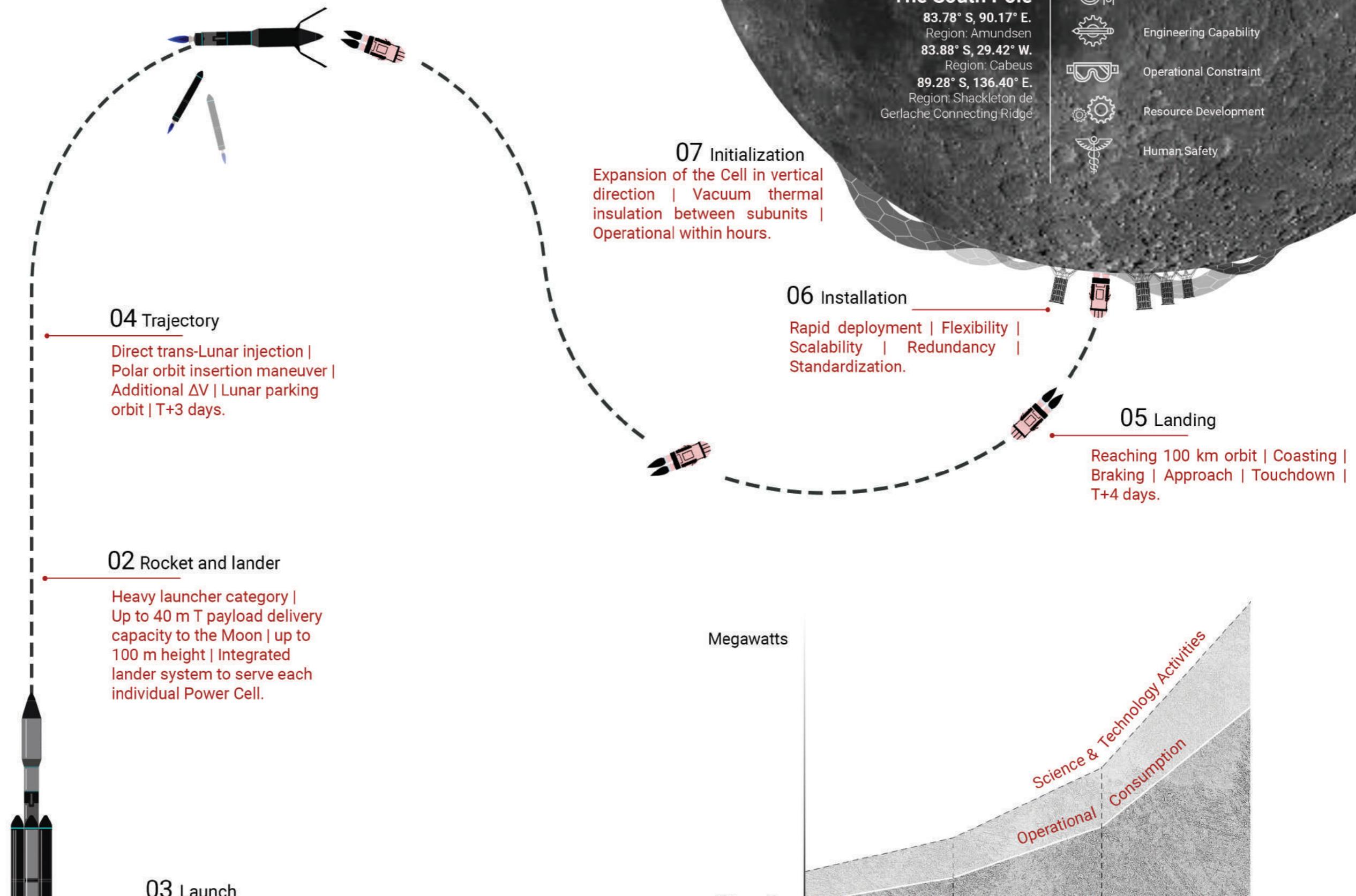
Phase 2

Phase 3

## Mission Architecture

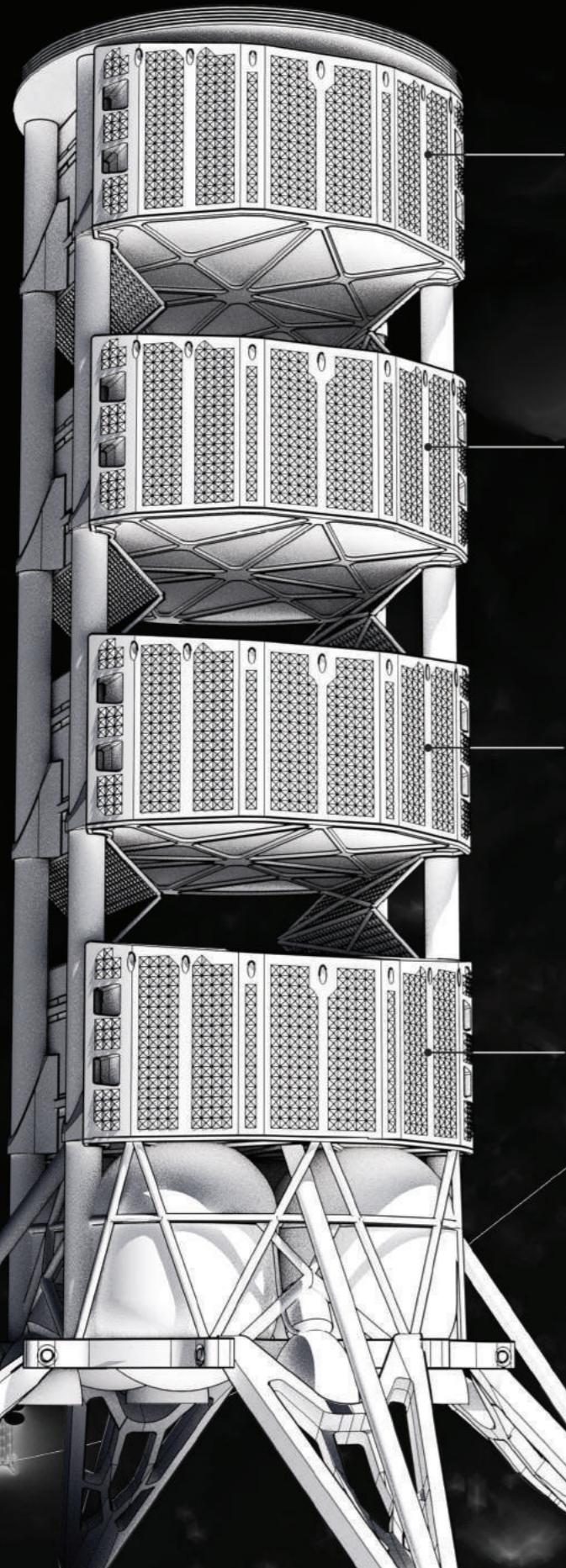
The mission architecture which is presented here outlines our strategy and plan to deliver, install, and initialize our power solution at the South Pole of the Moon during Phase 2 of our timeline.

During Phase 3, more comprehensive and sophisticated infrastructure will be built on the lunar surface. The ultimate aim is to support humans in their endeavor to become a multiplanetary species.



## Power Cell

Our proposed solution for power generation and storage is the Power Cell, a modular structure of stackable subunits. This solution is rapidly deployable, standardized, and scalable to meet different energy demands.



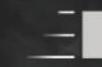
### SCALABILITY

More subunits can be added and new technologies can be incorporated with new power demands.



### REDUNDANCY

The Power Cell stores energy to support critical Life Support Systems throughout a two-week lunar night, enabling operations even if the primary generation fails.



### FAST DEPLOYMENT

The Power Cell is fully operational within a few hours of landing.



### FLEXIBILITY

The Power Cell can be easily relocated to reconfigure the grid, accommodating the evolving infrastructure.



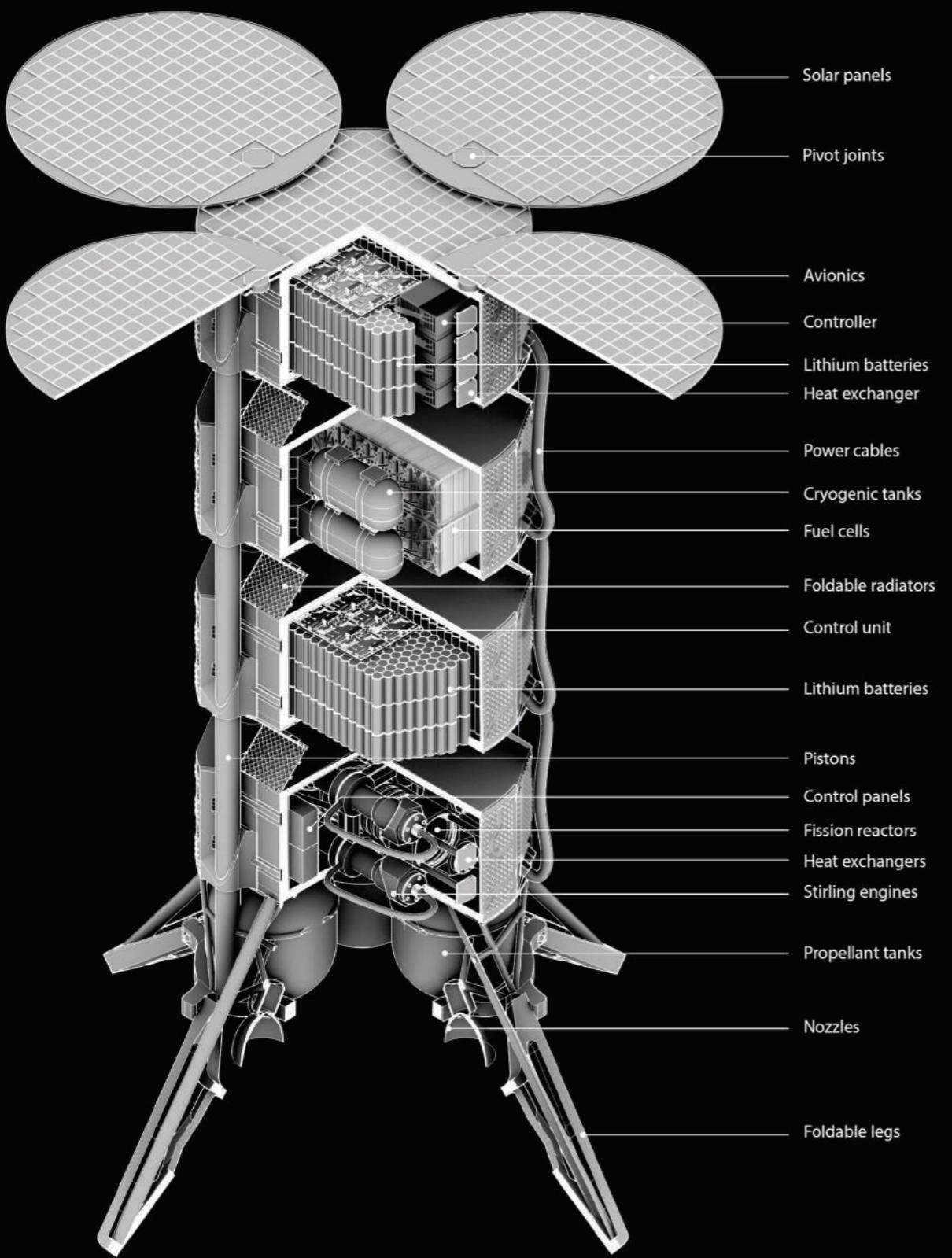
### STANDARDIZATION

Standard dimensions of sub-units and the Powr Cell. The adaptable structure of the Power Cell allows easy integration of new technologies.

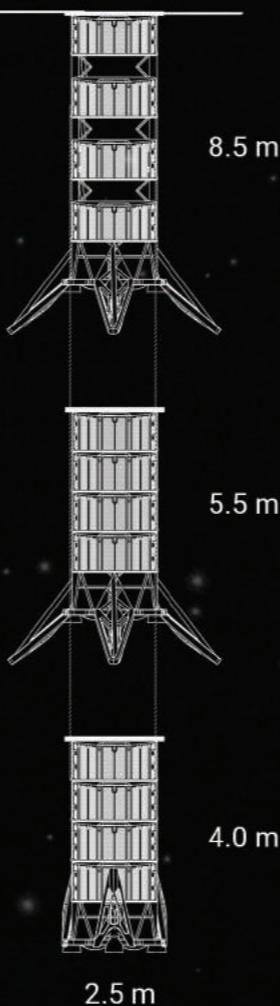
## Power Distribution

The power is distributed within a decentralized microgrid with a localized network of power generation and storage facilities. Initially, power will be transmitted through cables, but will later include wireless transmission, to support preparation for larger settlements.

- Power supply at multiple voltage levels in AC and DC.
- Supports both current and future power generation sources.
- Redundant network within each power cell.
- Expandable grid structure.

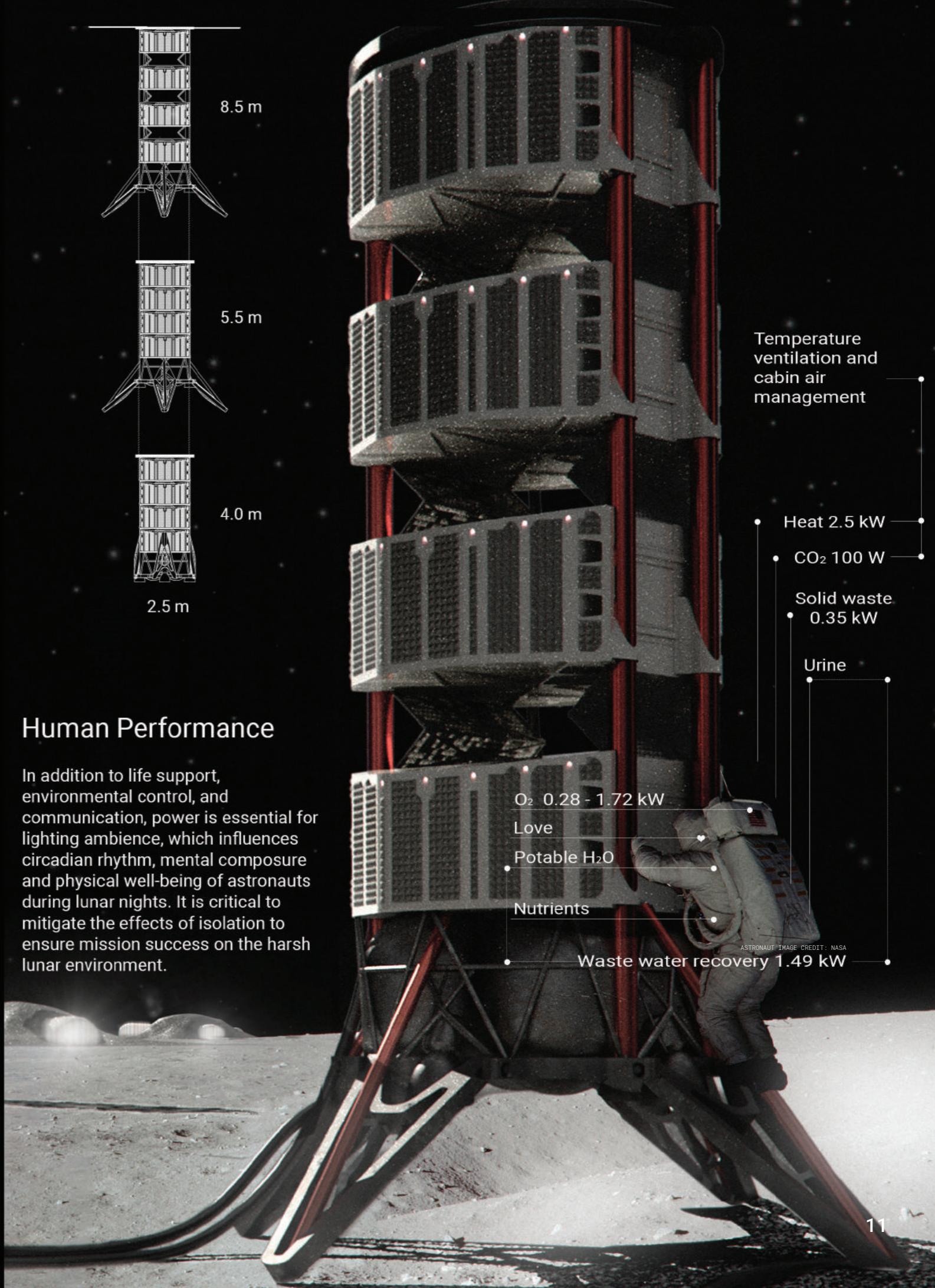


The cell is designed from a human centric perspective so it can be serviced and operated by astronauts. All critical parts are easily accessible. Lights are placed around the subunits' surface to provide an easy and intuitive indication of the Power Cell's health by changing color.



## Human Performance

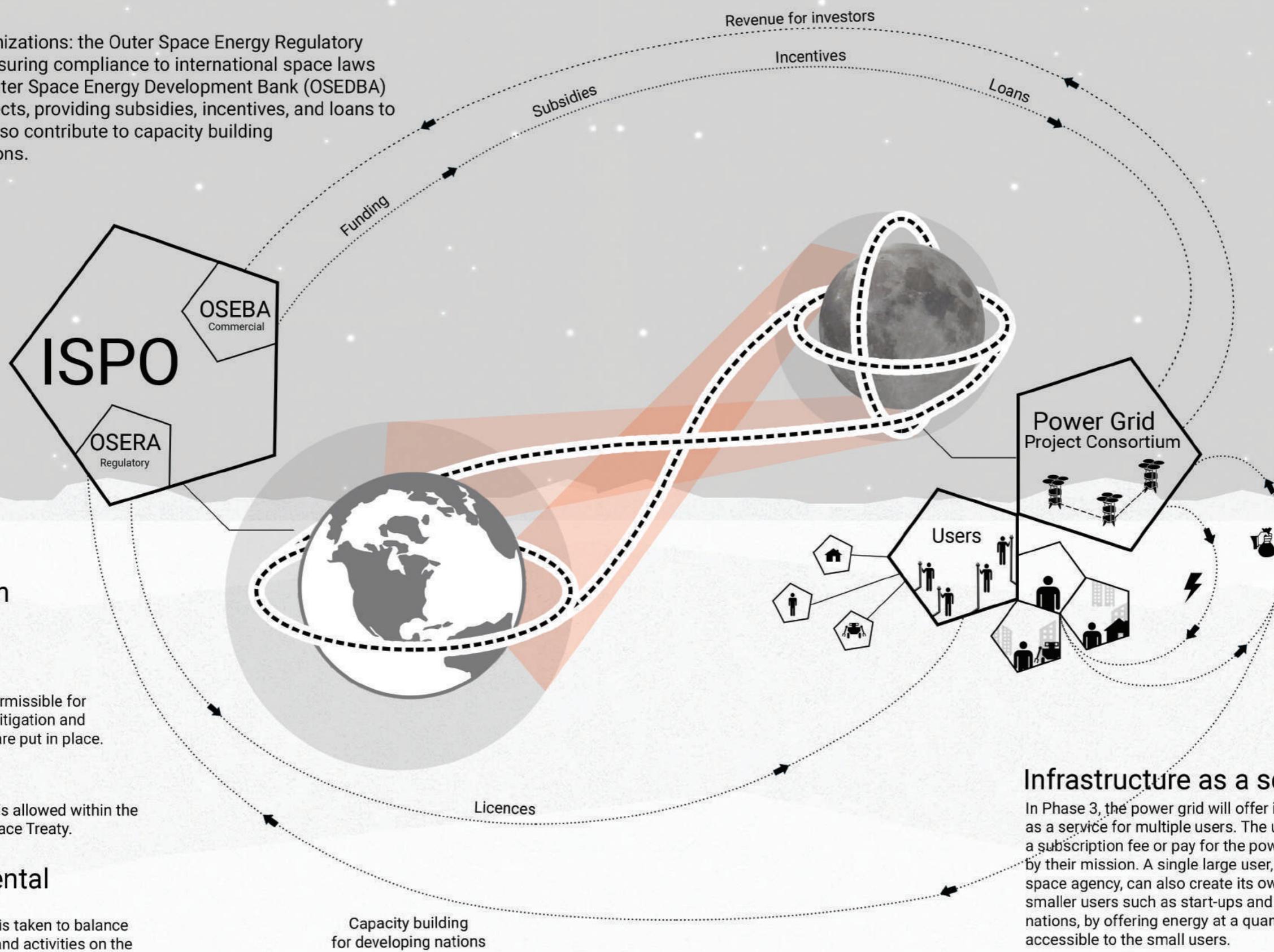
In addition to life support, environmental control, and communication, power is essential for lighting ambience, which influences circadian rhythm, mental composure and physical well-being of astronauts during lunar nights. It is critical to mitigate the effects of isolation to ensure mission success on the harsh lunar environment.



# LEGAL & ECONOMIC ECOSYSTEM

The International Space Power Organization (ISPO) will be a contractually set up international body consisting of space agencies, nations, and private commercial enterprises. ISPO will regulate the power grid on the Moon, from its infrastructure set up to when it can offer this infrastructure as a service to users.

It will have two sub-organizations: the Outer Space Energy Regulatory Authority (OSERA) for ensuring compliance to international space laws and licensing, and the Outer Space Energy Development Bank (OSEDBA) for financing power projects, providing subsidies, incentives, and loans to its members. ISPO will also contribute to capacity building in developing space nations.



# Our Team



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## Publisher Information

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ASTRONAUT IMAGE CREDIT: NASA

Lunar night survival project team is a network of international professionals collaborating on a unique approach to power generation and distribution system to support near future activities on the moon.

You can participate and engage by following our outreach campaign.

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