Mars Power Module: Overview

A closed-loop hydrogen–argon engine that stores power and gives the water back

Bryan Adams, independent concept, Tacoma WA · Nov 19, 2026 · Preliminary concept, not for fabrication. Not affiliated with any agency or company.

In one line: An early concept for storing power on Mars as hydrogen and oxygen, burned in a sealed argon engine that returns the water, with every number labeled as sourced, calculated or assumed.

How it works

- **Store:** When there is spare power (solar or fission), an electrolyzer splits water into hydrogen and oxygen, which are stored in separate tanks.
- **Run:** When power is needed, the engine burns hydrogen and oxygen in argon instead of air. Argon is a monatomic gas, which lets a piston engine run more efficiently than it would on air (published lab work: the Argon Power Cycle).
- **Recover:** The exhaust is just steam and argon. The steam is condensed back to water and the argon is dried and reused, so the loop stays closed.
- **Top up:** Small argon leaks can be replaced from the Mars air, which is about 1.9% argon (NASA).

What it is, and what it isn't

- **It is energy storage, not an energy source.** The calculated round trip is about 30%: water is split and then remade, not created.
- It's a stationary generator in an underground equipment room. It is not a rocket engine.
- The obvious question is why use an engine instead of a fuel cell or batteries. Possible reasons (unverified): no platinum catalyst, repairable with ordinary machine-shop skills, and usable waste heat. Reasons against: moving parts and lower efficiency. **No head-to-head comparison has been done yet.**

Key numbers (one notional module)

Item	Value	Status
Electrical output	10 kWe	Assumed
Engine efficiency (fuel to electricity)	50%	Assumed
Fuel use at full load	0.60 kg/h H_2 + 4.76 kg/h O_2 makes 5.36 kg/h water	Calculated
Round trip, electricity in to electricity out	about 30%	Calculated (assumes 55 kWh/kg electrolyzer)
Heat to reject	about 13.6 kW; radiator about 15.6 m^2	Calculated from assumed temperatures
Argon in Mars air	about 1.9%	Sourced (NASA Mars Fact Sheet)

Open questions

- Adapt an existing engine, or design one from scratch? No 10 kW argon-cycle engine is known to exist.
- The condenser has to run cold while the radiator runs warm. This needs a heat pump or a larger radiator, and it's unresolved.
- Electrolyzer type and energy use, parasitic loads, and the comparison against fuel cells and batteries.

What's in the drawing set (MPM-001 to 004)

- Sheet 1: process flow · Sheet 2: energy and mass balance · Sheet 3: equipment room sections · Sheet 4: system boundary, what it is and isn't.

Sources: NASA NSSDC Mars Fact Sheet; Argon Power Cycle research (Noble Thermodynamic Systems; UC Berkeley; MDPI Processes 2023; Tongji Univ. preprint). Lab efficiencies are indicated values from Earth engines, not Mars-rated. Reviewed by a simulated AI committee. No outside expert has reviewed or endorsed this work. Corrections welcome.