Moon energy systems lift capacity in Falcon Heavy units and dollar equivalents

| Systems | Comment | Energy System Surface kg | Energy System LO/L1 kg | Energy System LEO kg | Energy System GEO kg | Required Storage on Surface | Surface Only FH | LO/L1 FH | LEO FH | GEO FH | Tot FH with EP | Tot FH without EP | Tot FH $ with EP | Tot FH $ without EP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Store - Flywheel - ISRU | **requires lunar production** | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | $0.00 | $0.00 |
| Store - Thermal - Al - ISRU | **requires lunar production** | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | $0.00 | $0.00 |
| Store - Thermal - Fe - ISRU | **requires lunar production** | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | $0.00 | $0.00 |
| Store - Chemical - monthly - H2+ ISRU O2 (RFC mass not included) | **requires lunar production** - Chemical energy storage system for 17 days of lunar darkness - H2 only recharged monthly from Earth - O2 produced by ISRU | | | | | 306 | 0.05 | 0.00 | 0.00 | 0.00 | 0.02 | 0.05 | $1,432,080.00 | $3,391,310.41 |
| ELEOLS | Beamed energy from Earth to a DS constellation in LEO | 625 | | 1,860 | | 240 | 0.15 | 0.00 | 0.04 | 0.00 | 0.11 | 0.19 | $6,949,800.00 | $11,818,547.40 |
| LOPMLS (SP) | LO Polar Multiple satellite LS - SP-powered | 50 | 2,409 | | | 240 | 0.05 | 0.14 | 0.00 | 0.00 | 0.08 | 0.19 | $5,115,240.00 | $12,113,406.13 |
| EGEOLS | Beamed energy from Earth to DS at GEO | 625 | | | 1,000 | 240 | 0.15 | 0.00 | 0.00 | 0.05 | 0.09 | 0.20 | $5,608,200.00 | $12,586,547.40 |
| LEOLS (SP) | Low Earth Orbit LS - SP-powered | 625 | | 2,812 | | 240 | 0.15 | 0.00 | 0.05 | 0.00 | 0.13 | 0.20 | $8,434,920.00 | $12,960,947.40 |
| L1LS (SP) | L1 based LS - SP-powered | 63 | 2,600 | | | 240 | 0.05 | 0.15 | 0.00 | 0.00 | 0.09 | 0.20 | $5,474,040.00 | $12,963,080.86 |
| LEOLS (PV) | Low Earth Orbit LS - PV-powered | 625 | | 3,202 | | 240 | 0.15 | 0.00 | 0.06 | 0.00 | 0.14 | 0.21 | $9,043,320.00 | $13,428,947.40 |
| LOPMLS (PV) | LO Polar Multiple satellite LS - PV-powered | 50 | 2,799 | | | 240 | 0.05 | 0.16 | 0.00 | 0.00 | 0.09 | 0.21 | $5,723,640.00 | $13,554,158.92 |
| LOPCLS (SP) | LO Polar Constellation satellite LS - SP-powered | 50 | 2,889 | | | 240 | 0.05 | 0.17 | 0.00 | 0.00 | 0.09 | 0.22 | $5,864,040.00 | $13,886,640.33 |
| L1LS (PV) | L1 based LS - PV-powered | 183 | 3,520 | | | | 0.03 | 0.20 | 0.00 | 0.00 | 0.10 | 0.24 | $6,347,640.00 | $15,031,854.09 |
| LOPCLS (PV) | LO Polar Constellation satellite LS - PV-powered | 50 | 3,279 | | | 240 | 0.05 | 0.19 | 0.00 | 0.00 | 0.10 | 0.24 | $6,472,440.00 | $15,327,393.12 |
| L1LS (PV) | L1 based LS - PV-powered | 63 | 3520 | | | 240 | 0.05 | 0.20 | 0.00 | 0.00 | 0.11 | 0.26 | $6,909,240.00 | $16,361,779.74 |
| LOPPVLS (PV) | LO Polar single satellite LS - PV powered | 50 | 2,799 | | | 510 | 0.10 | 0.16 | 0.00 | 0.00 | 0.11 | 0.26 | $6,987,240.00 | $16,546,491.64 |
| LOEPVLS (PV) | LO Equator single satellite LS - PV powered | 50 | 3,360 | | | 510 | 0.10 | 0.20 | 0.00 | 0.00 | 0.12 | 0.29 | $7,862,400.00 | $18,618,959.11 |
| L5LS (SP) | L4 or L5 based LS - SP-powered | 625 | | 16,221 | | 240 | 0.15 | 0.00 | 0.31 | 0.00 | 0.46 | 0.46 | $29,352,960.00 | $29,051,747.40 |
| L5LS (PV) | L4 or L5 based LS - PV-powered | 625 | | 17,391 | | 240 | 0.15 | 0.00 | 0.33 | 0.00 | 0.49 | 0.48 | $31,178,160.00 | $30,455,747.40 |
| LPSMS (PV) | Lunar Polar Surface-Mounted System - PV-powered | 2,380 | | | | 1,320 | 0.64 | 0.00 | 0.00 | 0.00 | 0.27 | 0.64 | $17,316,000.00 | $41,006,040.89 |
| LOSPLS (SP) | LO SP-powered LS | 110 | 2,520 | | | 3,870 | 0.69 | 0.15 | 0.00 | 0.00 | 0.35 | 0.84 | $22,557,600.00 | $53,418,680.30 |
| LOPVLS (PV) | LO PV-powered LS | 110 | 3,000 | | | 3,870 | 0.69 | 0.17 | 0.00 | 0.00 | 0.37 | 0.87 | $23,306,400.00 | $55,191,914.50 |
| Store - Chemical - monthly - H2 + O2 + RFC (RFC mass not included) | **requires lunar production** - Chemical energy storage system for 17 days/month without solar energy - H2 & O2 recharged monthly from Earth | | | | | 5,204 | 0.91 | 0.00 | 0.00 | 0.00 | 0.38 | 0.91 | $24,354,720.00 | $57,674,442.38 |
| CRFC* | Cryogenic storage Regenerating Fuel Cell system - *Applicable to all systems requiring energy storage if practical | 920 | | | | 4,285 | 0.91 | 0.00 | 0.00 | 0.00 | 0.38 | 0.91 | $24,359,400.00 | $57,685,525.09 |
| Store - Li/S Battery | Lithium sulfer battery energy storage system for 17 days lunar dark - assumed 500 Wh/kg. | | | | | 12,000 | 2.09 | 0.00 | 0.00 | 0.00 | 0.88 | 2.09 | $56,160,000.00 | $132,992,565.06 |
| FOLS | Fixed Orbit Laser System - PV-powered - 2009 NASA concept study | 4,116 | 3,000 | | | 7,875 | 2.09 | 0.17 | 0.00 | 0.00 | 0.96 | 2.26 | $60,797,880.00 | $143,975,534.39 |
| LNSMS (PV) | Lunar Non-polar Surface Mounted System - PV-powered | 1,095 | | | | 12,240 | 2.32 | 0.00 | 0.00 | 0.00 | 0.98 | 2.32 | $62,407,800.00 | $147,787,987.92 |
| Store - Flywheel | Flywheel energy storage system for 17 days/month without solar energy | | | | | 27,513 | 4.79 | 0.00 | 0.00 | 0.00 | 2.02 | 4.79 | $128,760,840.00 | $304,918,703.53 |
| Store - Li Battery | Lithium battery energy storage system for 17 days of lunar darkness - measured in Tesla Model S batteries (100 Wh/kg) | | | | | 60,000 | 10.45 | 0.00 | 0.00 | 0.00 | 4.42 | 10.46 | $280,800,000.00 | $664,962,825.28 |
| | | | | | | | | | | | | | | |
| **SYLLABUS** | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| **Systems** | The various systems analyzed for creating and storing useful energy on the lunar surface | | | | | | | | | | | | | |
| **EP** | Electronic Propulsion (EP) to power a system from Low Earth Orbit (LEO) to another destination | | | | | | | | | | | | | |
| **Surface kg** | The total mass in kg on the lunar surface for a system receiving either laser energy or solar energy for conversion purposes | | | | | | | | | | | | | |
| **LO/L1 kg** | The total mass in kg either in Lunar Orbit (LO) or at L1 receiving either laser energy or solar energy for conversion purposes | | | | | | | | | | | | | |
| **LEO kg** | The total mass in kg at LEO receiving either laser energy or solar energy for conversion purposes | | | | | | | | | | | | | |
| **Required Storage on Surface (RFC)** | The total mass in required energy storage on lunar surface as measured in Regenerated Fuel Cell mass (RFC) | | | | | | | | | | | | | |
| **Required Storage in Space (RFC)** | The total mass in required energy storage in space as measured in Regenerated Fuel Cell mass (RFC) | | | | | | | | | | | | | |
| **Surface FH** | Portion of system launched directly from the Earth's surface to the lunar surface - Lift Capacity (LC) measured in Falcon Heavy units (FH) | | | | | | | | | | | | | |
| **LO/L1 FH** | Portion of system launched directly from the Earth's surface to either LO or L1 - LC measured in FH | | | | | | | | | | | | | |
| **LEO FH** | Portion of system launched directly from the Earth's surface to LEO - LC measured in FH | | | | | | | | | | | | | |
| **GEO FH** | Portion of system launched directly from the Earth's surface to GEO - LC measured in FH | | | | | | | | | | | | | |
| **Tot Surface FH with EP** | The total mass of the system as measured in FH launched from the Earth's surface to LEO and then moved with EP to LO, and from LO to the lunar surface | | | | | | | | | | | | | |
| **Tot LO/L1 FH with EP** | The total mass of the system as measured in FH launched from the Earth's surface to LEO and then moved with EP to LO or L1 | | | | | | | | | | | | | |
| **Tot FH without EP** | The total mass of the system as measured in FH launched directly from the Earth's surface to a combination of GEO, LEO, LO, L1, or the lunar surface - LC measured in FH | | | | | | | | | | | | | |
| **Tot FH with EP** | The total mass of the system as measured in FH launched from the Earth's surface to LEO and then moved with EP to GEO, LO, or L1 - LC measured in FH | | | | | | | | | | | | | |
| ISRU | In Situ Resource Utilization | | | | | | | | | | | | | |
| DS | Deflecting System satellite; used to alter the path of an LS | | | | | | | | | | | | | |
| GEO | Geostationary Earth Orbit | | | | | | | | | | | | | |
| L1 | Solar insolation captured by a solar-powered laser system at Earth-Moon Lagrande Point 1 (L1) | | | | | | | | | | | | | |
| LS | Laser System | | | | | | | | | | | | | |
| LO | Lunar Orbiting | | | | | | | | | | | | | |
| PV | PhotoVoltaic system | | | | | | | | | | | | | |
| SP | Solar Pumped | | | | | | | | | | | | | |
| RFC | Regenerated Fuel Cell | | | | | | | | | | | | | |
| CRFC | Cryogenic storage Regenerating Fuel Cell. From 2009 NASA concept study | | | | | | | | | | | | | |
| FOLS | Fixed Orbit Laser System. From 2009 NASA concept study | | | | | | | | | | | | | |
| EGEOLS | Beamed energy from Earth to Geostationary Earth Orbit | | | | | | | | | | | | | |
| ELEOLS | Beamed energy from Earth to a DS constellation in LEO | | | | | | | | | | | | | |
| L1LS (PV) | L1-based LS - PV-powered | | | | | | | | | | | | | |
| L1LS (SP) | L1-based LS - SP-powered | | | | | | | | | | | | | |
| LEOLS (PV) | Low Earth Orbit LS - PV-powered | | | | | | | | | | | | | |
| LEOLS (SP) | Low Earth Orbit LS - SP-powered | | | | | | | | | | | | | |
| LOELS (PV) | LO Equator single satellite LS - PV powered | | | | | | | | | | | | | |
| LOPLS (PV) | LO Polar single satellite LS - PV powered | | | | | | | | | | | | | |
| LOPVLS (PV) | LO PV-powered LS | | | | | | | | | | | | | |
| LOSPLS (SP) | LO SP-powered LS | | | | | | | | | | | | | |
| LOPCLS (PV) | LO Polar Constellation satellite LS - PV-powered | | | | | | | | | | | | | |
| LOPCLS (SP) | LO Polar Constellation satellite LS - SP-powered | | | | | | | | | | | | | |
| LOPMLS (PV) | LO Polar Multiple satellite LS - PV-powered | | | | | | | | | | | | | |
| LOPMLS (SP) | LO Polar Multiple satellite LS - SP-powered | | | | | | | | | | | | | |
| LPSMS (PV) | Lunar Pole Surface-Mounted System - PV-powered | | | | | | | | | | | | | |
| LSMS (PV) | Non-polar Lunar Surface Mounted System - PV-powered | | | | | | | | | | | | | |
| Store - Li Battery | Lithium battery energy storage system for 17 days of lunar darkness - measured in Tesla Model S batteries (100 Wh/kg) | | | | | | | | | | | | | |
| Store - Li/S Battery | Lithium sulfer battery energy storage system for 17 days lunar dark - assumed 500 Wh/kg. | | | | | | | | | | | | | |
| Store - Chemical - monthly - H2+O2 | Chemical energy storage system for 17 days/month without solar energy - H2 & O2 recharged monthly from Earth | | | | | | | | | | | | | |
| Store - Chemical - monthly - H2 | Chemical energy storage system for 17 days of lunar darkness - H2 only recharged monthly from Earth - O2 produced by ISRU | | | | | | | | | | | | | |
| Store - Chemical - recycled H2O | Chemical energy storage system for 17 days/month without solar energy - H2 & O2 produced by ISRU | | | | | | | | | | | | | |
| Store - Flywheel | Flywheel energy storage system for 17 days/month without solar energy | | | | | | | | | | | | | |
| Store - Flywheel - ISRU | Flywheel energy storage system for 17 days/month without solar energy - ISRU | | | | | | | | | | | | | |
| Store - Thermal - Fe - ISRU | Battery energy storage system for 17 days/month without solar energy - stored in molten iron (Fe) - ISRU | | | | | | | | | | | | | |
| Store - Thermal - Al - ISRU | Battery energy storage system for 17 days/month without solar energy - stored in molten aluminum (Al) - ISRU | | | | | | | | | | | | | |