



Energy Sources on Mars

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Background

- *You want to wake up in the morning and think the future is going to be great - and that's what being a spacefaring civilization is all about. It's about believing in the future and thinking that the future will be better than the past. And I can't think of anything more exciting than going out there and being among the stars."*
- — ELON MUSK, SPACEX

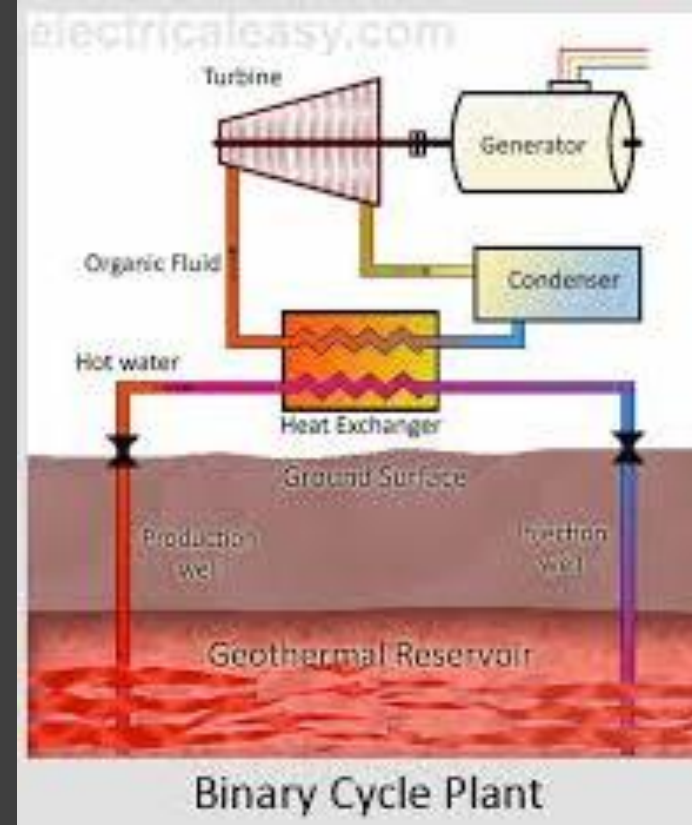


Background

- To sustain a colony on Mars, energy must be readily available.
- Typical U.S. residential customer consumes 10,900 kWh per year.
- Much more energy would be required on Mars (for example, life support, heating, transportation, etc.)

Possible Sources of Energy

- Wind
- Solar
- Nuclear
- Geothermal



Wind Energy

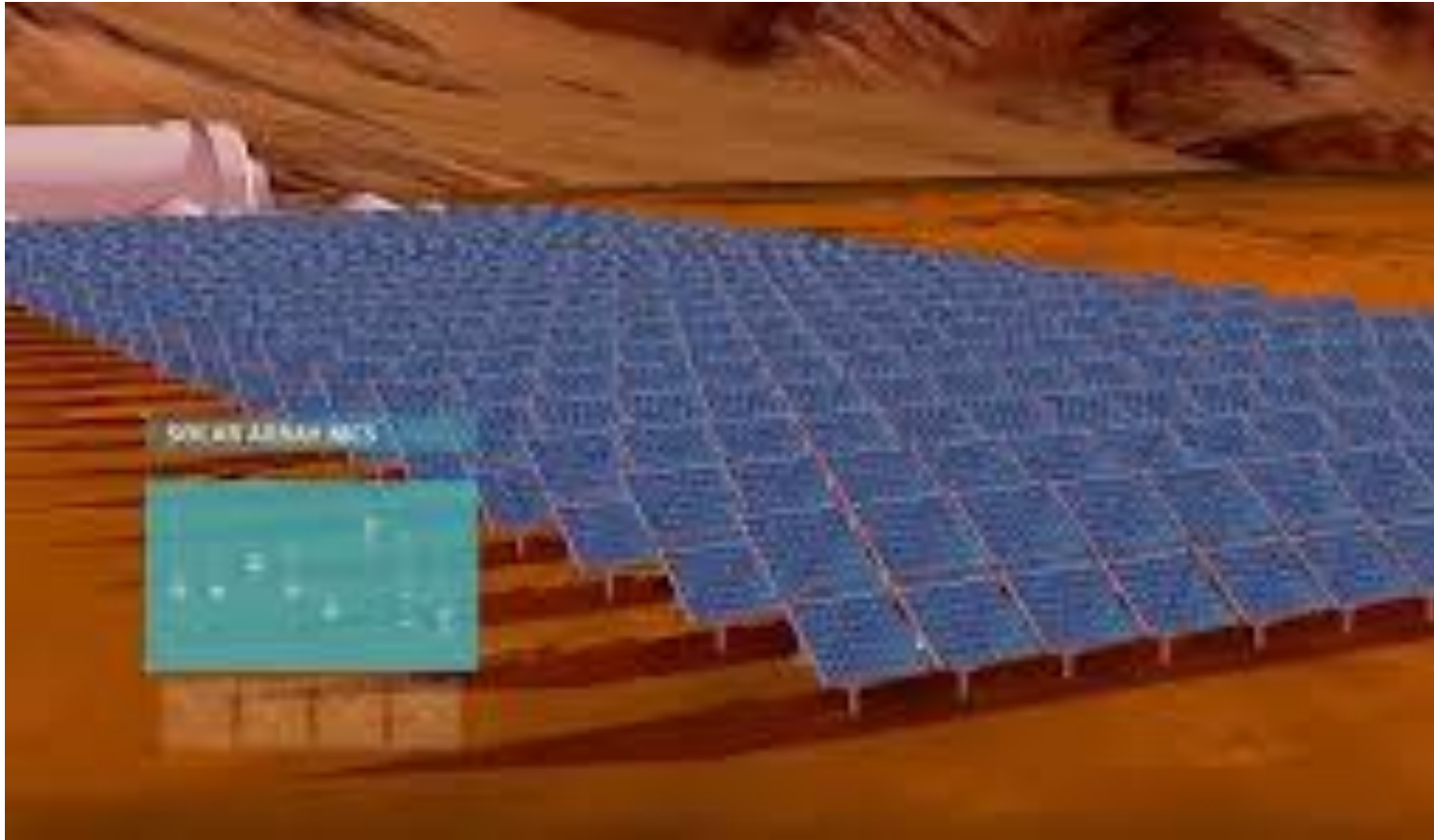
- Inefficient due to low atmospheric pressure (about 0.6% of atmospheric pressure on Earth).
- Wind speeds of 98 feet/second required to produce electricity on Mars.
- Would work best in areas prone to dust storms.



MARS Turbine

- With each doubling in elevation, wind speed increases by 12%.
- With each doubling of wind speed, power output increases by a factor of 8.
- Can function at speeds greater than 63 mph, and at speeds as low as 7 mph



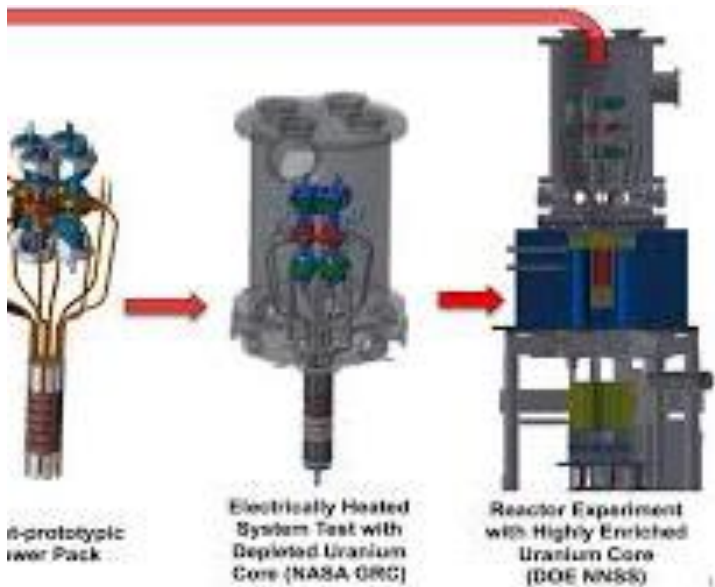


Solar Energy

- According to a NASA sponsored MIT think tank, solar energy can be utilized on Mars.
- 0-40 degrees North of Martian equator.
- A 100 by 100 meter array could produce 100 kilowatts of energy.

Kilopower reactor

- Sealed tube circulates fluid around sealed reactor.
- Heat enters Stirling engine, which pressurizes gas to move a piston attached to a motor, producing electrical energy.
- Can produce up to 10kilowatts of power.



Geothermal Energy

- Requires drilling into Martian crust to find hot water reservoir.
- Mars' Cerebus plains, its Northwestern Tharsis region and the canyons of Valles Marineris are all possibilities as geothermal hotspots.
- "With 500 kilowatts of nuclear power, they could start drilling and creating a 10 megawatt geothermal power supply. That would be enough for a town of 10,000 people on Earth." -Zubrin
- Mars Express Orbiter discovered water under southern polar ice caps (according to radar signal).

