

POSSIBLE ENERGY SOURCES FOR EXTRATERRESTRIAL COLONIZATION

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Nowadays Earth population is growing quickly and soon there might be a moment, when the Earth may become unacceptable for living there (it may happen due to different reasons such as nuclear war or natural disaster) or just there will be no free space left. Unless it happens, people should think about other places for living out of the Earth.

There are several options where the humanity is able to inhabit if something happens to their planet. It is Venus, Mars, moons of Jupiter or Saturn or even asteroids. It is obvious that inhabitants will encounter a plenty of different troubles. One of the most important of them is energy problem. It is clear that traditional sources of producing energy, like coal firing, are not possible to use. That is why colonists will have almost no way to produce energy except of producing by solar panels or by using the energy of nuclear fission.

The most preferable source of energy is doubtlessly solar energy. It is produced by solar panels. Solar panel refers either to a photovoltaic module, a solar thermal energy panel, or to a set of solar photovoltaic (PV) modules electrically connected and mounted on a supporting structure. The most effective type of solar panels is based on a photovoltaic system. Photovoltaics is a method of generating electrical power by converting sunlight into direct current electricity using semiconducting materials that exhibit the photovoltaic effect.

It is known, that nowadays the solar energy is the most frequently usable source of energy in space, for instance, every spacecraft has solar panels which produce energy enough for all needs of it. Solar power is not without a reason a main source of energy in space. It has some remarkable advantages in comparison with other sources.

Unlike coal and nuclear plants, space solar power does not compete for or depend upon increasingly scarce fresh water resources.

Unlike bio-ethanol or bio-diesel, space solar power does not compete for increasingly valuable farmland or depend on natural-gas-derived fertilizer. Moreover, as the station will be far from the Earth, instead of combined export of food and fuel, food will be a major export from the Earth.

Unlike nuclear power plants, space solar power will not produce hazardous waste, which needs to be stored and guarded for hundreds of years.

Although the storage will be out of the Earth, it will still be able to cause some troubles.

Solar energy may be converted to a current and in the same time to heat, which may economize charges for heating.

The solar power in space is available for 24 hours, in comparison with Earth there is no atmosphere and clouds, and consequently there are no losses in that way.

However, it has some disadvantages:

As it is known, the intensity of solar energy is inversely proportional to the square of the distance from the Sun. Hence, if the possible colony locates farther from Sun than Mars, it will be meaningless to use solar panels.

Another disadvantage resides in that to get enough energy for potential big colony, it is essential to cover with solar panels vast surfaces of place where colony will be.

Another perspective source of energy, which may be widely used in extraterrestrial colonies, is nuclear power. Nuclear power is the use of exothermic nuclear processes to generate useful heat and electricity. The term includes nuclear fission, nuclear decay and nuclear fusion. It is produced by the system, which includes nuclear reactor, cooling system, and generator and so on.

By the way, nuclear power has been already used in space exploration for 50 years, but it has been used only in small spacecrafts, and hence the capacity of such nuclear reactors was quite small. However, bigger and more powerful nuclear reactors will be needed to provide with the energy space colonies.

On the one hand, in comparison with solar energy nuclear power has some benefits:

Solar cells, although efficient, can only supply energy to spacecraft in orbits where the solar flux is sufficiently high, such as low Earth orbit and interplanetary destinations close enough to the Sun. Unlike solar cells, nuclear power systems function independently of sunlight, which is necessary for deep space exploration.

Nuclear reactors are especially beneficial in space because of their lower weight-to-capacity ratio than solar cells. Therefore, nuclear power systems take up much less space than solar power systems. Hence, it will be easier to export nuclear reactor of big enough capacity to a colony than a number of solar panels of the same capacity.

As solar panels, nuclear reactor can heat the colony and produce the electricity at the same time.

On the other hand, it has several disadvantages:

Compared with solar panels, nuclear reactors are more dangerous, especially in space. In case of accident, the consequences of it might be terrible, for example, radiation background may increase due to an accident. Moreover, it might be quite hard to repair nuclear reactors in conditions of space.

Furthermore, after an accident, the colony may forfeit its energy, and that is why the colony should have a reserve source of energy for such cases.

As nuclear reactor requires a fuel, the colony will have a dependence on the Earth, and people from it will send fuel in addition to food.

As it was mentioned, nuclear power includes a nuclear fusion. The probable fuel for new perspective type of nuclear fusion is helium-3, which is non-radioactive isotope of helium. As opposed to nuclear fission, which splits an atom's nucleus in half, nuclear fusion combines nuclei to produce energy. While nuclear fusion has already been tested with the hydrogen isotopes deuterium and tritium, those reactions give off the majority of their energy as radioactive neutrons, raising both safety and production concerns. Helium-3, on the other hand, is perfectly safe. It does not give off any pollution or radioactive waste and poses no danger to surrounding areas. Roughly, the reaction of nuclear fusion of 1 ton of helium-3 combined with 0.67 tons of deuterium produces the same amount of energy that 15 million tons of petroleum does in firing. That shows if the humanity will be able to control the nuclear fusion, it gives great energy possibilities for probable future colonies, as mostly helium-3 is contained in space objects without an atmosphere, such as Moon or Mercury, because helium-3 is an indirect result of reactions happening on the Sun, and as either the Moon or Mercury does not have an atmosphere, helium-3 is easily got there by solar winds.

Another types of energy sources, that may be used by future colonists are quite common for the humanity. The first is firing of hydrocarbons which is very usual for people, because natural gas or petroleum are derivatives of hydrocarbons. The humankind has some distant plans of colonization of the Saturn moon Titan. Titan has a plenty of hydrocarbon lakes, and the amount of possible fuel in every lake is enough to provide with energy the USA for several hundred years.

Next type of source is geothermal energy. Geothermal energy is thermal energy generated and stored in the planet. Some of planet-giants' moons have a lot of active volcanoes, that indicates the activity of their core and possibility of using it as a source of geothermal energy. Despite people likely will not be able to inhabit there, they may use it as energy resource.

The last energy source is hydrogen energy. Although this source is still not very popular, it has a great potential due to several reasons, the first is

that it is absolutely harmless, as the product of its firing is hydrogen. Secondly it the most wide spread element in the universe, that is why it is unlimited. Furthermore, it might be use during colonization of one of the most preferable places for extraterrestrial colonization. The name of it is Europe, the moon of Jupiter. It is totally covered with ice layer, which consists of hydrogen. Moreover, there are hydrogenous oceans under the ice layer. Hence, people will be able to use it for producing energy, which will be practically unlimited.

To sum up, if one day there will become a moment, when people will have to leave the Earth, they will have some possible places for creating a new human “Motherland”, and at the same time, they will have some ways to provide it with energy. In my humble opinion, the most perspective type of energy for possible colonization is the energy of nuclear decay and nuclear fusion as they have important benefits compared to solar power. They do not depend on light source, such as the Sun.

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MODERN METHODS OF THE GASIFICATION

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High temperature processes of interaction of the organic mass of solid or liquid combustible minerals or products of their thermal treatment with air, oxygen, steam, carbon dioxide or their mixtures, which results in the organic portion of the fuel drawn into combustible gases are called gasification. The raw materials for the process are usually hard coal, brown coal, oil shale and peat [1].

Gasification processes can be classified by the following features: