

Mechanical Plants

written by Jim Keener on January 24, 2001

I see two ideas for a Martian power plant that might be worth a look at because of their low maintenance and the need for supplies is at the very bare minimum, save sunlight. One is a machine to artificially photosynthesize and carry out cellular respiration, and the other is a fuel cell.

The 'plant' machine would photosynthesize with black 'chlorophyll', created by genetic engineering, instead of the normal green variety, using the byproducts of respiration (water and carbon dioxide).

Instead of just producing glucose, it could produce pure PGAL. The PGAL is useful in that it lets the machine use 39% of the energy per molecule. The glucose, although less efficient (37% of the energy per molecule), would be used at night where less energy would be needed, and the rest stored in batteries for later use. The percentages above may seem small, but are actually almost as efficient as possible without creating new enzymes from scratch and other arduous tasks.

Energy would then be used to move an artificial 'muscle' to turn a generator. Since this will use some energy, it brings net energy production down to about 32%-30% per molecule. Since some energy was stored during the night, that number might be a little higher. The size of the generator that it would be turning could probably produce just as much energy as the fuel cell.

The fuel cell would use hydrogen and oxygen from the splitting of water to create electricity with the byproducts being water and energy. The only problem is that an efficient way to split water is needed.

One solution to this problem is to use the *Chlamydomonas reinhardtii* algae. This algae photosynthesizes usually in a sulfur environment but when deprived of sulfur will produce hydrogen instead of oxygen. There could be two tanks of these algae to produce hydrogen and oxygen. Since the one that produces oxygen needs some oxygen, there would be more of them, the extra to produce oxygen for the rest of them. They will be able to get carbon dioxide from the Martian atmosphere.

One problem with the algae (or the 'plant' machine) is that at night it cannot photosynthesize (I already gave a solution to the 'plant' machine). Therefore, I propose that some oxygen and hydrogen could be stored for night. Then, during the day the water produced at night could be recycled. Since fuel cells can produce energy at almost 100% efficiency, a high-energy output can be achieved.

My final thoughts are that the 'plant' machine is a more interesting, intriguing idea, however the fuel cell is probably the more feasible and practical one right now. This is due to the fact that NASA already has experience with fuel cells. This means that they would only have to deal with the water splitting aspect of the fuel cell idea, leaving less room for error, and a faster production period.

Works Cited:

1) Popular Science --