

# **Energy Production via Microbial Metabolism**

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## Project Overview

As you know, we are performing research into constructing a low-cost, low-maintenance microbial bioreactor for energy production. The general idea is to use autolithotrophic bacteria to convert atmospheric gases into hydrogen. We strongly believe that our project follows the ideals of SmartHome in the creating a reliable and self sustainable household. Furthermore, hydrogen energy produced from the earth's most abundant polymer (lignin) has great potential as a safe and efficient energy source. In our project, we hope to complement SmartHome's current energy projects in Solar and Wind energy. As a matter of fact, we have made significant progress in the construction of our prototype and have reached a point where more support is needed given that we are limited by our personal tools, space and money.

By our design, microbes will be used to produce hydrogen, which would then be passed through a fuel cell to produce electrical energy. Microbes were selected for hydrogen production because they are self-replicating, easily accessible, renewable, and need minimal maintenance. Using such a system would allow for environmentally-minded or rural individuals to live off the grid.

Essentially, we plan to use the Sun's energy to produce molecules that will then generate electrical energy. If you wonder why we don't simply use solar cells to harvest the Sun's energy, there are three main reasons. First, solar cells are very expensive to produce making them economically unattractive. Secondly, biological systems are self-perpetuating, which means that very little of the bacterium would be needed and repairs would be almost automatic. Additionally, existing facilities could inoculate virgin samples. Lastly, microbial techniques are manageable in remote area; our project, fermentation in essence, is an ancient science.

While this proposal may initially be met with skepticism, we ask that the issue be approached with an open mind. This technology is viable. In fact, S. C. Johnson (the international pharmaceutical conglomerate), often boasts of using methane to produce half of the electricity to run their largest factory located in Racine, Wisconsin since 2003 ( S. C. Johnson & Son, Inc, 2008). This methane is produced through microbial metabolism. This switch has saved the company. We strongly believe the primary reasons that microbe based energy systems are under-utilized are a marked resistance to change, political, and economic.

## Goals

As a group, our goal is to produce a decentralized, renewable, microbe-based energy system that can be implemented in remote locations. Our immediate goal is to develop a prototype system as a proof of concept. In the long term, we intend to implement this technology in developing nations. If the world is to move in a more environmentally friendly direction, it is essential that developing nations not become addicted to fossil fuels.

## Current Progress

Luckily, we have produced more than eco-rhetoric; our group has finalized the design, purchased the majority of our materials, and has begun construction (Fig 1). We have already constructed our team and have knowledge bases in economics, biology, chemistry and computer and electrical engineering. Additionally, we have consulted with several professors concerning our project. In fact, after meeting with the Vice Provost of Research, he was generous enough to offer us financial support.

## Safety Concerns

We have come to understand that there is a certain level of concern about the safety of the residents of Smart Home living in the home while there is an experimental hydrogen generator on the compound. These concerns are understandable, however we do not intend on culturing the prototype in the Smart Home. Instead we will be conducting the totality of the biological experimentation in a biological lab. The innovations lab will be used primarily the assembly of the mechanical and electrical components.



**Figure 1: Bioreactor Prototype**

This figure illustrates the current level of construction of the prototype. On the left you will see the tubing that will be used, in front is the pressure gauge, on the left of the super structure is a hand pump, and the right is a syringe. The central glass carboy is the main reaction chamber.

# Tentative Timetable

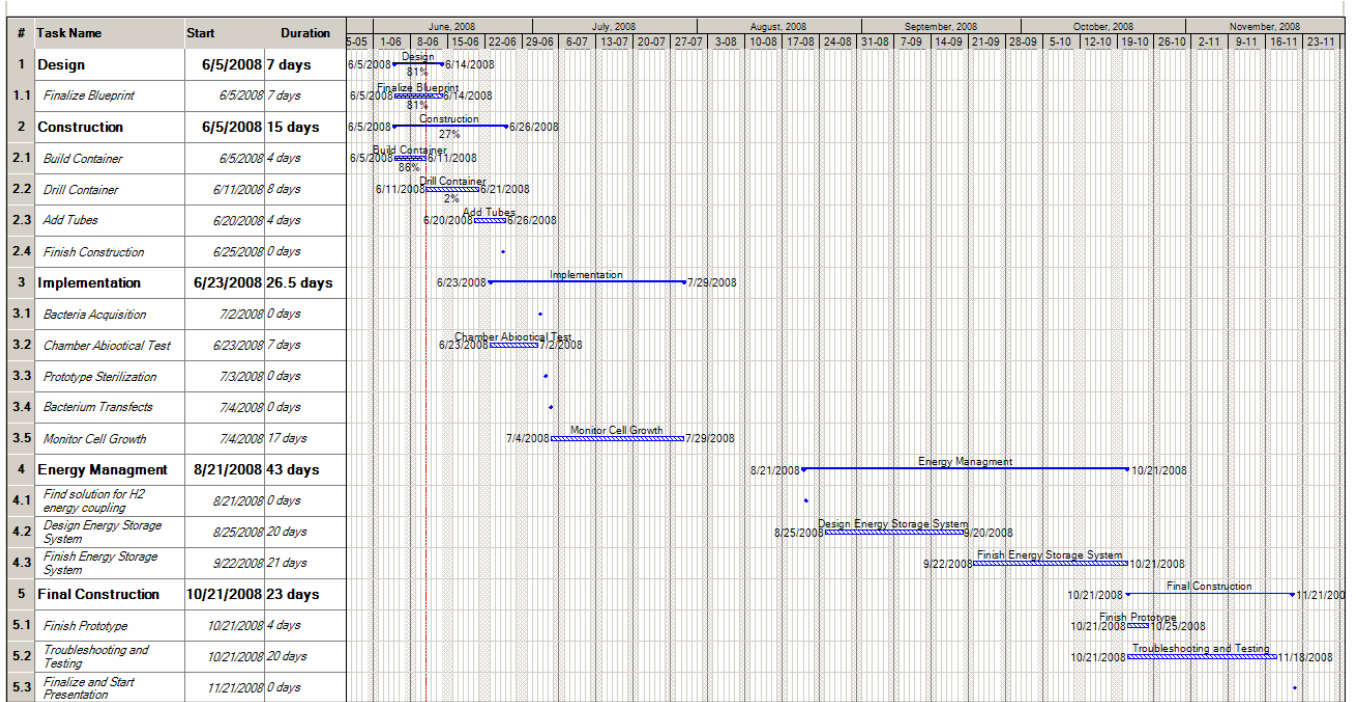


Figure 2: Gant Chart

## Source

[http://www.scjohnson.com/environment/conserving\\_1.asp](http://www.scjohnson.com/environment/conserving_1.asp). Retrieved June 10, 2008.