

## The Economics of Dyson Sphere

In my final project, I have decided to explore the concept of Dyson spheres. The concept of the Dyson sphere was the result of a thought experiment by physicist and mathematician Freeman Dyson, when he theorized that all technological civilizations constantly increased their demand for energy. He reasoned that if human civilization expanded energy demands long enough, there would come a time when it demanded the total energy output of the Sun. He proposed a system of orbiting structures (which he referred to initially as a shell) designed to intercept and collect all energy produced by the Sun. Dyson's proposal did not detail how such a system would be constructed, but focused only on issues of energy collection, on the basis that such a structure could be distinguished by its unusual emission spectrum in comparison to a star.

### Intentions

I decided to explore this concept because of the ever-expanding energy demands of the mankind. Our civilization continues to grow at an unprecedented rate and hence our energy demands need to match up with that pace. At one point we would run out of resources on Earth or even if we do not, we would require much more energy that we could produce from Earth. This will especially be true when we achieve the goal of space travel. So, to find solutions for that problem a Dyson Sphere can be the solution. Even though the technology right now can't be yet achieved I intend to provide a motivation to find a solution for these technological shortcomings via my visualization.

### Visual Strategies

I decided to show a Dyson Sphere in a solar system. A few of the parameters could be adjusted so that a user can play with it and get a feel as to how much it will cost to build a Dyson Sphere based on the parameters selected. The economics of deploying it in space are also shown. These are just the deployment costs and they do not take into account the manufacturing costs. To explain the science behind the visual I also provided a link. On clicking it a new HTML page opens which describes the parameters and also lists the references.

### Challenges & Techniques

While attempting to do the project I ran into several challenges. They mainly were around animations. To figure out the rotations of the planets, I had some issues. Then as every planet rotates with its own speed around the sun, I had to fix different rotations for them. I tried to incorporate Earth's moon into the visualization but was unsuccessful as I could not account for its rotation around Earth. So, I completely left it out of the picture. I wanted my stars to shine. To achieve that I decided to make a transition that changed the opacity of the circular stars. But I was unable to do that as well. Hence, I dropped that idea as well. Next, I wanted my Dyson spheres to have a rotation around the sun. This I was able to code successfully but I removed it from my final submission as I thought that it was too distracting.

To explain how a Dyson Sphere changes with the manipulation of parameters I gave users an input slider. This would also ensure that whatever happens, the input would always be in a reasonable range. Next to explain the parameters I made a static HTML page. To give a way back to the visualization I put a hyperlink back.

## **Sources**

My data was taken and collated from various websites like Wikipedia, Enerdata, Britannica encyclopedia, and Columbia university's lectures on climate. I have listed them as references in my static webpage describing the parameters.

## **Key Insights**

Even the most basic Dyson Sphere has enough power to produce more than thrice the energy that the whole of world produced in the year of 2017. While it is a very enticing prospect in this regard, the economics behind it are very prohibitive. It required tens of thousands of billions of dollars just to deploy the Dyson Spheres in sphere. Now this does not take into account the manufacturing costs which once included would inflate this figure even more. So, at the moment Dyson spheres are not a solution due to both the technological and economical limitations.

## **Files**

Main visualization- [vs3br\\_final.html](#)

Explanation- [dyson\\_sphere.html](#)