

Research Proposal

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HSA 10-5 The Economics of Oil and Energy

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I. The subject of my paper

The Economic and Environmental Advantages of Artificial Photosynthesis

II. Thesis

I plan to show how the recent developments in artificial photosynthesis make it an economically and environmentally advantageous option for the production of solar fuel in the United States.

III. Outline

Introduction: Discuss how the sun is a huge source of renewable energy, but we do not take advantage of it. Introduce artificial photosynthesis as a way to both harness the sun's power and reduce our CO₂ footprint by using CO₂ and water to make hydrogen, oxygen, or other useful molecules such as acetone, formic acid, or alcohols such as methanol and ethanol.

Background/Motivations: Discuss why we need renewable energy and the current status of solar energy in the United States. In this part of the paper, I will compare the chemical processes behind natural photosynthesis and compare them to artificial photosynthesis, making sure to mention that the production of biofuel exists, but it is less efficient in converting the sun's energy to fuel.

History: The history of the development of artificial photosynthesis. This technology is not new, but recently, scientists have found a way to use less expensive metals as catalysts to replace platinum.

Technology: I will show how the artificial "leaf" inventions work by using a catalyst in splitting water into hydrogen and oxygen and discuss the different molecules that have been made from this process such as acetone, formic acid, or alcohols. These products have many uses, for example, ethanol is a part of today's car fuel.

Environmental Advantages: I will mention how this technology could provide a renewable alternative to fossil fuels, because it only requires water and its only by-product is oxygen.

Economic Evaluation: The most technical part of the paper where I calculate the \$/kWh for this technology. With the right system, it could produce hydrogen cheaper than the price of gasoline. I also need to mention the difficulty of the capture of CO₂ and how we can make the connection between artificial photosynthesis plants and factories that will already produce CO₂ for its fuel.

IV. Sources

<http://www.nanowerk.com/news/newsid=13409.php>

<http://pubs.acs.org/doi/pdf/10.1021/acs.nanolett.5b01254>

<http://nocera.harvard.edu/Publications2016>

<http://www.japantimes.co.jp/news/2015/04/12/national/science-health/lab-photosynthesis-begins-to-bloom/>

<http://news.panasonic.com/global/press/data/2012/07/en120730-5/en120730-5.html>

<http://pubs.rsc.org/en/content/articlelanding/2012/fd/c1fd00113b#!divAbstract>

http://www.economist.com/blogs/babbage/2011/02/artificial_photosynthesis

<http://news.psu.edu/story/140593/2000/09/01/research/energy-speed-light>