Rhetorical Analysis

& Annotated Bibliography

# Topic – Leveraging market demand for net-zero products

It is commonly proposed that the best way to achieve net-zero carbon emissions is through legislation. Unfortunately, less invasive mitigation methods are seldom discussed in the mainstream. Here, I will focus on how leveraging demand for sustainable fuels may not only be less disruptive, but possibly more effective at achieving net-zero results faster.

Vehicle emissions make up a significant portion of global carbon emissions. Since electric vehicles are becoming more and more popular, it is important to address the implications of a future where they are the norm. Electric vehicle legislation should also be looked at. What are the alternatives to an electric vehicle dominant future, and how do these solutions stack up against one another?

# Key Questions

* What are the advantages and disadvantages of synthetic fuel production from carbon dioxide?
* How would a syngas future compare to an electric vehicle future?

# Rhetorical Analysis

## News Article

Ferris, R. (2017, November 8). *Audi expanding production of ‘sustainable’ diesel made from water and carbon dioxide.* Retrieved October 5, 2022, from cnbc.com: <https://www.cnbc.com/2017/11/08/audi-expanding-output-of-sustainable-diesel-fuel.html>

The **genre** of this article is an online informational news article. . I found the article by entering “diesel from carbon dioxide and water” into my search engine. This was the first result, and I recognized CNBC as a mainstream provider of news. Due to its mainstream nature, it is safe to say that the article is designed to be accessible to most people.

The **purpose** of this article is to provide an accessible overview of Audi’s research on sustainable hydrocarbon fuels such as gasoline and diesel. The author explains the process by which hydrogen from water and carbon from the carbon dioxide in the air can be combined through a chemical process to create nearly net-zero emissions.

The **primary target audience** is people who are interested in atypical climate change solutions. While searching, many of the other results gave similar titles and reports. However, due to CNBC’s mainstream nature this one likely had the broadest target audience. The author utilized several techniques including visual and literary devices to lower the barrier to entry.

One **clarification device** utilized by the author is “laymen’s terms.” For example, Ferris (2017) writes, “Audi says its e-diesel fuel allows cars to run in a way that is almost carbon neutral — meaning the fuel would not substantially add carbon emissions into the atmosphere, making the fuel potentially far more environmentally friendly.” Here, the author not only clarifies the phrase “carbon neutral” and then leverages the definition to make a point on why it is a good thing. Colloquial **language** is a powerful tool to broaden a target audience especially when it comes to clearing up the more technical jargon.

The article **cites** directly from Audi, the originator of the technology. The author also cites Sunfire, a partner in the development of the technology, along with Volkswagen, Audi’s parent company.

Additionally, the author incorporates a **visual** **diagram** directly from Audi. The **image** includes an overview of the conversion process with annotations to briefly describe each step.

## Scholarly Article

Ganesh, I. (2016). Electrochemical conversion of carbon dioxide into renewable fuel chemicals – The role of nanomaterials and the commercialization. *Renewable and Sustainable Enegy Reviews* , 1,7,8. <https://doi.org/10.1016/j.rser.2016.01.026>

The **genre** of this journal article is a technical summary of carbon recycling methods. I searched “carbon dioxide fuel” on Rowan University’s Library Search. It came up as the first peer-reviewed result. After reading the abstract, it was clearly quite relevant to my topic.

The **purpose** is to provide technical details on why electrochemical processing of carbon dioxide is the most viable and sustainable form of “the conversion of waste-stream greenhouse carbon dioxide (CO2) gas into value added chemicals and solar fuels” (Ganesh, 2016).

The **target audience** is people who are much more experienced in organic chemistry and those who are interested in carbon recycling. Since the article is quite technical in nature, the author assumes a strong chemistry foundation and scientific background.

The article is **organized** by increasing complexity. Through the abstract and the first section, somebody less well-versed in chemistry can come away with some basic conceptual understanding. However, the most important information is presented in a highly technical and rigorous nature.

The author cites 136 references ranging from general overviews of technical reports to precise facts and statistics. The paper is only 29 pages long, so the author cites over 4.5 **sources** per page on average. The text is quite dense already, and the abundance of supplementary information only adds to its density.

The author includes many tables, diagrams, and figures to show chemical processes and lab results. In this case, **visuals** are very helpful for readers scanning the document for relevant information.

## Rhetorical Analysis - Summary

I purposely chose two article covering very similar topics to compare what academia sees as compared to the general public. The first thing I noticed was readability. The technical paper is so utterly dense with material that beyond the introduction, someone without a background in organic chemistry is likely to get lost fairly quickly. In contrast with the general news article, readability is not an issue at all. Clarifications are made for any technical jargon and very little chemistry knowledge is required to understand the gist of Audi’s “e-fuels.” From a design standpoint, these two articles have very little in common.

Additionally, the two articles differ greatly in purpose, which would explain the differences in presentation. While the purpose of the news article is to inform the public on possible up-and-coming technology with a very simplified overview of the processes behind the technology, the purpose of the scholarly journal article is to give an in-depth description on the how and why of the chemistry. As a result of this, the journal article is much more likely to be used as a scientific resource for anyone looking to make developments in this area.

On the contrary, the articles have some things beyond topic in common. They both conclude that electrochemical reactions are viable ways to make usable products from carbon dioxide. And from a formatting standpoint, they both utilize visuals to drive home points and make complicated processes easier to grasp.

Overall, the two article each fill their niche purpose and do a fairly good job at it. They are both useful for somebody doing research for a report on the topic of renewable hydrocarbon based fuels.

Annotated Bibliography

Source 1 - High Energy Density “Bezel-less” Lithium-ion Battery Using Solvate  
Ionic Liquid-based Quasi-solid-state Electrolyte

Unemoto, A., Hirooka, M., Seki, E., Kawaji, J., & Okumura, T. (2020). High Energy Density  
“Bezel-less” Lithium-ion Battery Using Solvate Ionic Liquid –based Quasi-solid-state Electrolyte. Electrochemistry. https://doi.org/10.5796/electrochemistry.19 -00076

This article describes research on leading -edge battery technology. The authors describe Lithium battery technology as critical to electric vehicles and renewable energy storage. In this case, efforts were focused on maximizing energy density, or the amount of energy that is stored in the battery per unit mass or unit volume. In this case, research was focused on a “bezel-less” battery design, which both increased battery safety and the usable volume of the battery.

While performance of lithium batteries are discussed at length, the environmental impacts of lithium mining are not discussed at all. Therefore, while there was little to no experimental bias, there exists a preconceived, almost closed -minded notion that large-scale commitment to lithium-ion batteries is a step in the right direction. According to a rigorous life-cycle assessment of electric vehicles, “variations of the specific energy requirements for battery manufacturing, the specific vehicle consumption, and the specific CO2 emission levels associated to energy exert a huge impact on the overall CO2 emissions of an EV” (Franzo & Nasca, 2020).

Source 2 - Energy Consumption, Pollutant Emissions and Cost of Electric  
Vehicles and Fuel Vehicles

Yue, H., Zhang, S., Tang, X., & Wang, W. (2021). Energy Consumption, Pollutant Emissions and Cost of Electric Vehicles and Fuel Vehicles. Material Science, Energy Technology, and Environment Engineering. EDP Sciences.

This article comes from the 6th international Material Science, Energy Technology, and Environment Engineering conference in China. The experimental methods incorporated are well explained and reasonably sound. The vehicles used to demonstrate “Well to Wheel” environmental impacts are sufficiently comparable. Limitations of the methodology are discussed, “WTW system does not involve the part of automobile recycling, so the calculation of this article does not consider the disposal cost” (Yue, Zhang, Tang, & Wang, 2021).

The results were peer reviewed, however the formatting in some of the figures is slightly underwhelming. For example, graph axis labels are slightly cluttered, showing more points than necessary.

Source 3 - A comprehensive review of the key technologies for pure electric  
vehicles

Li, Z., Khajepour, A., & Song, J. (2019). A comprehensive review of the key technologies for pure electric vehicles. Energy.

Source 4 - Life cycle environmental assessment of charging infrastructure for electric vehicles in China

Zhang, Z., Sun, X., Ding, N., & Yang, J. (2018). Life cycle environmental assessment of charging infrastructure for. Journal of Cleaner Production.

Source 5 - The environmental impact of electric vehicles: A novel life cycle-  
based evaluation framework and its applications to multi-country scenarios

Franzo, S., & Nasca, A. (2020). The environmental impact of electric vehicles: A novel life  
cycle-based evaluation framework and its applications to multi-country scenarios. Journal of Cleaner Production.

This article covers an in-depth life-cycle assessment of electric vehicles. While it primarily focuses on plug -in electric vehicles, fuel-cell and hybrid variants are also touched upon. The authors concluded that when comparing an electric vehicle to a reasonable similar internal combustion engine vehicle, “CO2 emissions associated to an EV over its life cycle are always lower than the ones associated to a comparable ICEV” (Franzo & Nasca, 2020).

Rigorous experimental methods were used, and a literature review was conducted to, “obtain a deep understanding of the extant knowledge base on the topic and to identify the research gaps to be addressed” (Franzo & Nasca, 2020). All tables, equations, and figures are formatted in a well-designed fashion. The authors demonstrate little to no experimental bias, and the limitations of the methods used are discussed at length. Finally, the authors demonstrate a lack of financial persuasion by declaring that they have, “no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.”

Source 6 - Electric vehicles standards, charging infrastructure, and impact on  
grid integration: A technological review

Das, H. S., Rahman, M. M., Li, S., & Tan, C. W. (2019). Electric vehicles standards, charging infrastructure, and impact on grid. Renewable and Sustainable Energy Reviews.

## Source 7 - Renewable Synthetic Fuels and Chemicals from Carbon Dioxide: Fundamentals, Catalysis, Design Considerations and Technological Challenges

Simakov, D. S. (2017). *Renewable Synthetic Fuels and Chamicals from Carbon Dioxide: Fundamentals, Catalysis, Design Constraints and Technological Challenges.* Waterloo, ON: Springer.

This book is great for several reasons. First, it makes the science behind synthetic fuels from carbon dioxide quite accessible. Second, it covers a wide portion of the technology behind synthetic fuels. And third, the author focuses many of his efforts on the feasibility of synthetic fuels from an engineering standpoint.

Not only is the engineering feasibility assessed, but economic feasibility is also not looked over. It is important to consider both when exploring a new technology since both are absolutely essential to any large-scale success.

## Source 8 – Energy and climate effects of second-life use of electric vehicle batteries in California through 2050.

Sathre, R., Scown, C. D., avvada, O., & Hendrickson, T. P. (2015). Energy and climate effects of second-life use of electric vehicle batteries in California through 2050. *Journal of Power Sources.*

This article focuses on one of the most glaring issues with electric vehicles – the wear of lithium batteries over time. Since lithium mining has large environmental consequences, it is important to ensure the longevity of lithium batteries. Unfortunately, however, lithium batteries are considered one of the “wear components” of electric vehicles. As such, they must be replaced once degraded.

The wear of them has two consequences to focus on: what to do with used batteries, and how to source and replace them. Currently, the former option is being addressed by simply repurposing the batteries. This article performs a life cycle analysis on the reusing of electric vehicle batteries. Unfortunately, sourcing new batteries can be difficult as they are often proprietary for the device.

This article was peer reviewed and well-organized. While the total implementation of the reusing of lithium batteries is likely quite optimistic, the experimental methods showed no bias.

## Source 9 - End-of-life treatment of crystalline silicon photovoltaic panels. An emergy-based case study

Corcelli, F., Ripa, M., & Ulgiati, S. (2017). End-of-life treatment of crystalline silicon photovoltaic panels. An emergy-based case study. *Journal of Cleaner Production.*

It is highly likely that solar power will be one of the primary methods of generating synthetic fuels. Therefore, it is important to address the climate impacts of solar power. This article focuses on the efficiency and environmental impacts of solar energy.

Methods showed no bias, and the article was peer reviewed. Other articles from the same journal also appeared to be reliable.

## Source 10 - Lithium recovery from brines: A vital raw material for green energies with a potential environmental impact in its mining and processing

Flexer, V., Baspineiro, C. F., & Galli, C. I. (2018). Lithium recovery from brines: A vital raw material for green energies with a potential environmental impact in its mining and processing. *Science of the Total Environment* .