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## Renewable Energy Misinformation: A Literature Based Approach to Rebutting False Claims

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 <p><b><i>Matthew Ard</i></b></p> <p>Major: <b>Mechanical Engineering</b></p> <p>Mentor: <b>Dr. Syed Zaidi</b></p> <p><i>Renewable Energy Misinformation: A Literature Based Approach to Rebutting False Claims</i></p>	<p><b><i>Biography</i></b></p> <p><i>Matthew is studying mechanical engineering to work on renewable and clean energy technology. He is particularly interested in thermal engineering and energy storage systems. After graduating he plans to pursue a PhD in Energy Science and Engineering to study geological or thermal energy storage methods. Additionally, Matthew is very interested in the social aspects of energy and hopes to bridge the gap between scientific discoveries and positive societal impacts through legislation. While working on scientific discoveries he hopes to collaborate with environmental lawyers and policymakers to develop impact legislation and communicate these discoveries across disciplines.</i></p>
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***Renewable Energy Misinformation: A Literature Based Approach to Rebutting False Claims***

**ABSTRACT**

State emission policies have played a crucial role in the expansion of renewable energy generation. However, misinformation centered around climate change has led to a heightened polarization among politicians and the general public. As a result, climate legislation has become harder to pass. Previous work completed by the Renewable Energy Legal Defense Initiative (RELDI) at Columbia Law School identified numerous false claims regarding solar energy, wind turbines, and electric vehicles (EVs), which were commonly used in campaigns opposing renewable energy projects. To counter the spread of this misinformation, rebuttals were developed through a review of both governmental and academic sources. Additionally, gaps in available sources to rebut these false claims were identified. It was determined that literature concerning wind energy are widely available, but there is a relative scarcity of existing sources to disprove statements about EVs and human health impact of solar panels.

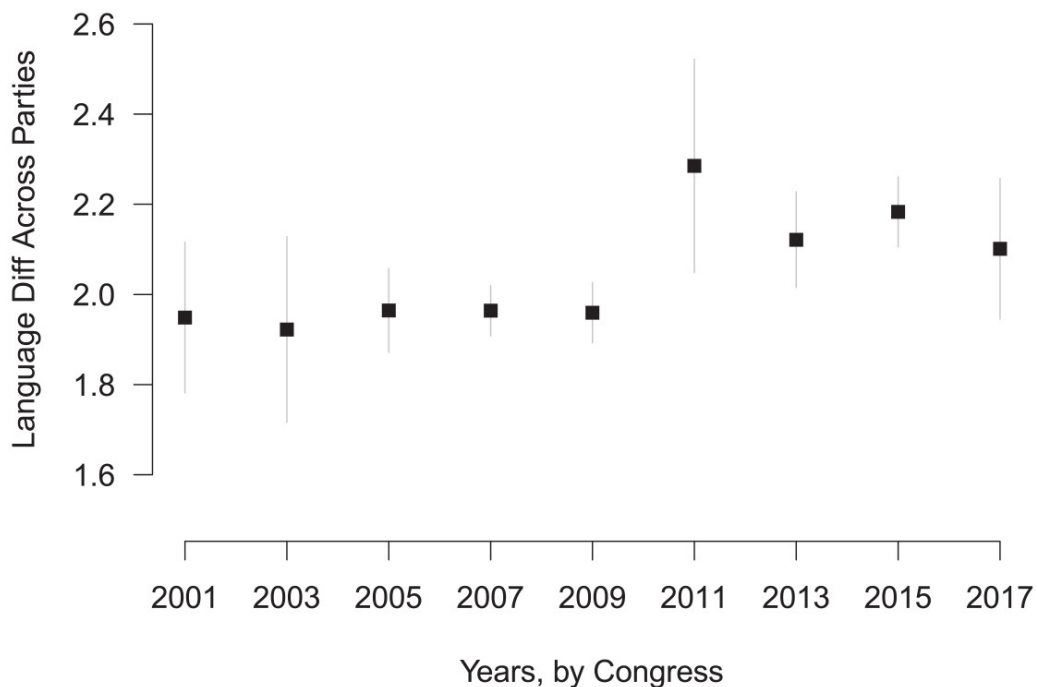
## INTRODUCTION

Energy is a crucial component to our modern society and has significantly increased the quality of life for people across the globe. However, with the advancement in technology and global population this energy demand has only increased in recent years. With this rise in energy demands, we have also seen a rise in greenhouse gas emissions, due to the burning of fossil fuels, resulting in the effects of climate change (Olabi & Abdelkareem, 2022). For instance, carbon dioxide (CO<sub>2</sub>), which accounts for 77% of greenhouse gases, has seen a significant increase going from 300 ppm to over 410 ppm (Cao et al., 2020). Other examples of major greenhouse gases are methane and nitrous oxide. These gases in our atmosphere pose significant danger to life on Earth; causing changes in Earth's climate, rise in sea level, changes to ecosystems and severe health implications (Olabi & Abdelkareem, 2022). Due to these threats caused by greenhouse gases resulting from fossil fuels a significant effort has been made by the scientific community to move humanity away from fossil fuels and towards renewable and clean forms of energy generation.

Due to the urgency of this energy transition that is required, government legislation has been implemented to help push for renewable energy innovations and increased installation. For instance, policies such as the Federal Production Tax Credit and Investment Tax Credit have made clean energy more affordable, officially becoming cheaper than fossil fuels in 2020 (Susskind et al., 2022). Furthermore, just recently one of the largest climate change spending bills was passed known as the Inflation Reduction Act which would invest \$391 billion in climate solutions (Cartwright, 2022). However, even with this increased push for clean energy, in 2022 renewable energy only accounted for 13% of the nation's energy consumption and nuclear fission only contributed 8% (EIA, 2023). While there has been an increase in energy generation the presence of opposition against renewable energy projects has become a significant obstacle.

According to a study by Lawrence Berkeley National Laboratory, since the early 2000's about half of new renewable energy generation has been attributed to state and federal climate policies (Susskind et al., 2022). However, a study has shown that local opposition to these energy projects has made it much harder to pass this legislation with more than 60% of opposition raising concerns about the environment and land value. Much of

these oppositions stem from a spread of misinformation which has seen a rise in recent years. Furthermore, polarization has seen a steady increase among politicians when discussing climate change policies, shown in Figure 1 (Chinn et al., 2020). Notably, this rise in polarization has occurred a few years after the occurrence of political figures mentioned of politicians in news articles discussing climate change has surpassed the appearance of scientists.



**Figure 1: Increased polarization among the language used when discussing climate change in Congress (Susskind et al., 2022).**

These local opposition efforts and rise in climate change polarization can be most attributed to the rise in misinformation, specifically about climate change and renewable energy. The rise in renewable energy misinformation has become a great concern for fighting the climate change battle as public support and policies are essential for expanding renewable energy efforts. Multiple studies have determined that simply telling people scientific facts is not enough to convince them what is a true statement and what is false (Farrell et al., 2019). These studies have

shown that for many, their personal ideology plays a significant role in whether they will believe this scientific information or the false claims that are shared. However, social scientists have determined that one possible way to counter this is through social “inoculation”, where individuals are shown arguments rebutting false claims before that encounter them on their own, similar to how a vaccine works for people. Furthermore, researchers believe that people should be made aware of the parties that are spreading these false claims by calling out specific groups and stating their motivations behind this misinformation. This can have a larger impact by stopping the spread at its source.

There are many nuances to renewable energy that can be quite difficult for people to understand. To demystify these growing fields of energy generation, common misinformation statements about clean energy have been identified. To increase the spread of reliable information, evidence-based rebuttals have been constructed to counter the spread of false information about solar panels, wind turbines, and electric vehicles. Additionally, through this extensive literature review, gaps in the availability of information to counter such false claims have been identified to help increase awareness of what needs to be further researched.

## **METHODS**

This work builds from previous research completed by the Renewable Energy Legal Defense Initiative (RELDI) at the Sabin Center for Climate Change Law at Columbia University. The prior work identified numerous false claims that were common among social media posts, such as Facebook, and campaign websites for local grassroots organizations opposing local renewable energy projects. Some of these smaller groups have even grown to a larger scale. For instance, a group known as “Citizens for Responsible Solar” started as a small grassroots campaign to stop solar projects in Culpeper, Virginia, which has now grown to a national organization to help other anti-solar groups (Citizens for Responsible Solar, n.d.). These groups, spread statements about renewable energy technologies that are either overexaggerated or false. RELDI has identified a number of these to develop rebuttals against which have been expanded after further research. These statements are focused on various aspects of solar panels, wind turbines, and electric vehicles. To streamline the analysis portion of

the information found they have been categorized based on the topics they go over. These categories are further discussed in the Results section.

To develop these evidence-based rebuttals an extensive literature review was conducted to find relevant sources. For most statements, sources were limited to academic papers and government reports to maintain the highest standard for information. However, in some cases—where information was limited— industry and news articles were utilized as sources. To find the resources Google Scholar was primarily used in the search, while general search engine’s such as Google Search and DuckDuckGo were used to find reports and news articles. To ensure relevant information was collected, searches were limited to 2013 or newer. Additionally, the keywords used in the searches were derived from the false statements itself, with synonyms used as well. For example, in the false statement talking about the decline of property due to wind turbine placement, keywords such as “wind turbine”, “property value”, and “home price” were used. Similar methods of searching were used for other false statements rebutted. Microsoft Excel was then used to complete the data analysis of the sources found.

### **EXAMPLE REBUTTAL**

One of the most common, and arguably damaging, claims that were shared among these groups were about the land use of solar panels. Many organizations argue solar panels will require an extreme amount of land to generate enough energy, harming wildlife, property values, and the economy (Citizens for Responsible Solar, n.d.; NO TO SOLAR, n.d.). To give a better understanding of how rebuttals were structured this section will discuss one of the false claims that was focused on and the counter statement to rebut it. The specific false claim that this section focuses on is, “Solar projects will significantly reduce agriculture production, hurting farmers and rural communities”. While not the exact phrasing that is used in anti-solar campaigns, they share a very similar sentiment. For instance, NO TO SOLAR, a grassroots group in Monroe County, Michigan states on their website “Utility scale solar is a poor fit for high quality agricultural ground (NO TO SOLAR, n.d.). If agricultural land is developed into solar farms, who is going to feed our community, country, and world?”. This is

spreading the false assumption that with solar farms there will be no food because it will take over too much land.

To debunk such false claims and ideas, three key points are touched on in the rebuttal to show that these claims have no factual standing. The first crucial fact to emphasize is that the idea that solar panels will require a significant amount of land is completely false. The United States has a total of 895 million acres of farmland, but a fully decarbonized future only requires 10 million acres of land, with only a fraction of it being farmland (Larson, 2021). That's equal to less than 2 percent of the available farmland to decarbonize our energy grid. This is to show very explicitly that this information is just factually incorrect and there is no risk to food production with the growth of solar energy generation.

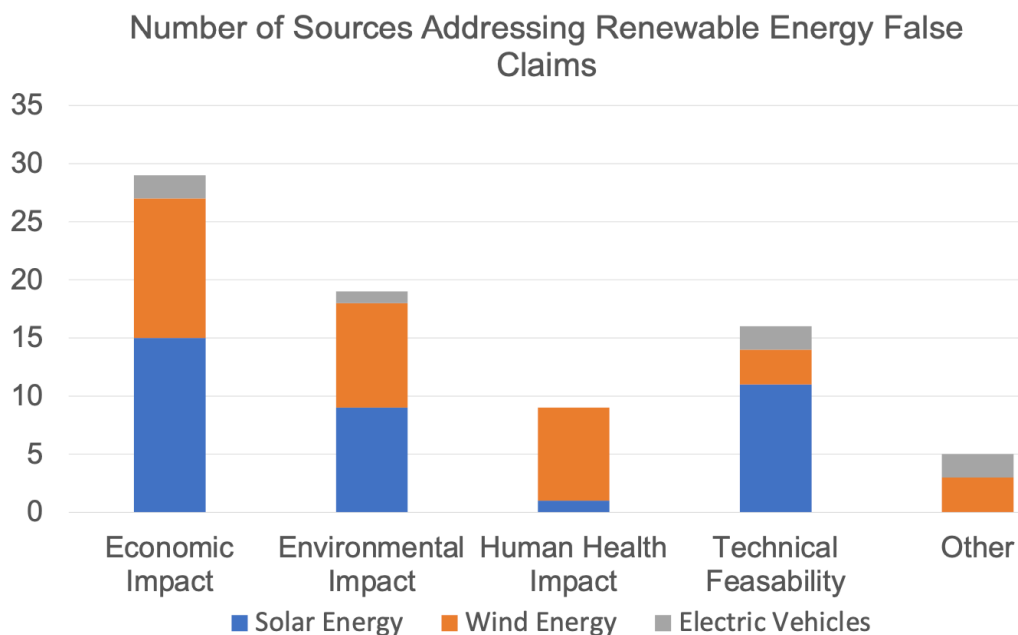
Furthermore, solar panels can be efficiently used to reduce the amount of crop land utilized and even have a positive impact on crop production. Agrivoltaics, which is the practice of growing crops underneath solar panels, on the same land, has been found to provide many benefits for both the crops and the farmers (Dinesh & Pearce, 2015). Utilizing agrivoltaics allows farmers to grow shade-resistant crops and even graze livestock, such as sheep, beneath or in between rows of solar panels, thus using the same land for agriculture and energy. These systems can increase the economic value of their farm by over 30% and allow them to earn 8% more—about \$17,000—compared to traditional farmers. Agrivoltaics aren't just economically beneficial, but they can also provide health benefits for the workers and agricultural benefits, especially in hot or dry climates. Due to the microclimates created underneath the panel they reduce water usage by 14-29%, due to the decrease in evaporation, as well as reduce the amount of crops that need to be thrown out. For instance, tomatoes can often get dried out due to hot temperatures, but with the cooler climate underneath the panel this occurs significantly less, increase crop production by 35% (Aroca-Delgado et al., 2018). This shows that not only do solar panels not harm crop production, but they can in fact provide significant benefits for both farmers and their agricultural yield. Furthermore, agrivoltaics are already widely used in Japan, with over 1,992 farms growing over 120 different types of crops and generating 500-600 MW of energy (Tajima & Lida, 2021).



Lastly, in the rebuttal against this false claim the opposite of what the statement claims is stressed. While they believe implementing solar panels will have damaging impacts on our climate, the opposite is true. If we do not implement clean energy, such as solar panels, the consequences of climate change will be far more severe with a significant impact on food production. The changes in Earth's climate along with the increased probability of severe weather will have significant impacts on the food production and significant impacts on the local and global communities that rely on them. While these may not convince someone that already believes solar panels will harm crop productions and local communities, the goal of this rebuttal and the others is to emphasis that these statements are factually incorrect. It provides reliable information with scientific rigor to prove these are false making it easier for others to understand and to increase access of such information.

## RESULTS

An analysis of the literature found was analyzed to determine the gaps in available resources to combat these false claims about wind turbines, solar panels, and electric vehicles. A total of 42 false statements were rebutted. Additionally, a total of 47 academic papers and 29 government reports were used in these rebuttals. To simplify the analysis of these resources they were categorized into five different groups based on the topics they discussed. These five categories were: economic impact, environmental impact, human health impact, technical feasibility, and other. The other category is to list any sources that did not fit into the other main groups. Looking at the chart shown below it is shown that sources discussed the economic impact of solar energy and wind turbines is well-documented, as well as the human health impacts of wind energy. However, governmental and academic sources discussing the human health impacts of solar panels and the technical feasibility of wind energy were limited. Additionally, there were few sources available that discussed electric vehicles.



**Figure 2: Number of sources discussing different topics of renewable energy, categorized.**

## DISCUSSION

With the increased interest of clean alternatives to our current sources of energy, there has also been a larger amount of research about these sources conducted. In particular, sources which discuss the economic impact of solar panels and wind turbines has been heavily researched and well documented. This makes sense, as these are some of the most common concerns among individuals and groups. Many of these groups state that solar panel and wind turbines will have significant impacts to their local economy, both on land valuation and in the community at large. Additionally, there are many concerns that there will be national impacts to the job market. They believe that these sources of energy will be replaced with outsourced manufacturing jobs, which is heavily exaggerated. Considering the concern of so many people, it makes sense for this to be such a heavily researched topic.

Additionally, resources concerning the human health impacts of wind turbines are widely available. This is most likely due to the claim that wind turbines cause “Wind Turbine Syndrome” which is not recognized as

a real phenomenon, but many people have been told that it happens and believe it (Marshall et al., 2023). This is a prime example of why it is important to make this informational readily available so that people can find information before they find the misleading or false information. Although it will be hard to convince people that already believe in Wind Turbine Syndrome that it is not a real thing, we will be able to catch others before they hear about it.

However, while there has been an increase in research regarding renewable energy, there are still many topics that require much more research. For instance, resources discussing human health impacts of solar panels as well as the technical feasibility of wind turbines have not been as well researched. While false statements regarding these topics are not as widespread many campaigns still state that solar energy will either produce electromagnetic waves that are harmful to humans or release toxic materials while in use (Citizens for Responsible Solar, n.d.; NO TO SOLAR, n.d.). Additionally, some claim that wind turbines are still too expensive, make them not a feasible source of energy. While both of these statements are false, or overly exaggerated it was more difficult to find government or academic sources to rebut these claims. Furthermore, sources discussing electric vehicles in all four major categories were very scarce. While there is no shortage of false statements about electric cars, there is a shortage of reliable sources. This is mostly likely since although electric vehicles aren't a new technology, they have only become mainstream in recent years. Beforehand, most researchers focused on studying traditional internal combustion engine vehicles, but with the increased popularity with electric vehicles we are slowly starting to see a rise in studies centered on these vehicles. However, most of these new studies generally focus on the battery of the vehicle and how to improve performance of it rather than talking about economic impacts, human health impacts or environmental impacts.

Lastly, while it hasn't been touched on much, the environmental impacts of both solar panels and wind turbines have been well documented, but with it being one of the most widely shared false information about these technologies, there is still room for more evidence to further show that they don't possess any major environmental impacts. Although government and academic sources were the large majority when crafting rebuttals against these false claims, for instances where there were limited amounts available,

news articles and industry reports were used in place. While they do not have as robust of scientific rigor as the alternative, the source and data obtained from them was ensured to be accurate and credible.

### **CONCLUSION**

The growing amount of renewable energy misinformation being spread by individuals and grassroots has made it more difficult to pass legislation to transition to clean energy and fight climate change. However, these legislations are crucial in the fight against climate change, contributing about 50% of new renewable energy generation since the 2000's. Thus, combating the spread of this misinformation has become very important to ensure that we reach net-zero energy generation. While there are many ways to stop these misinformation campaigns, one method is to increase the accessibility of reliable information for anyone to access. While this will most likely convince people who have already been exposed to these false claims, exposing it to individuals who have not been exposed these false statements can help them not fall for fake information. Additionally, informing people of those who are spreading this misinformation and why they are doing so can further help people understand the scientific facts versus misinformation.

To combat the wide spread of misinformation, evidence-based rebuttals were developed to rebuttal false claims against wind turbines, solar panels, and electric vehicles. Through an extensive literature review government and academic sources were identified to rebut these claims. A total of 42 rebuttals were developed using 47 academic papers and 29 government reports. Additionally, analysis of these sources was conducted to identify research gaps of the sources available. Resources were divided into four main groups based on the topics they discuss, and a fifth group was used to include any papers that didn't fit into the main five. Through this analysis gaps among the available sources to rebut these false claims can be identified. Most notably, there is a scarce amount of academic and government resources which discuss electric vehicles, across all fields, as well as the human health impact of solar. These are two important areas of research that need to be further investigated as electric vehicles become more widespread and as solar panels begin to age and need to be replaced.

While these rebuttals won't convince people who already believe in the misinformation, they will play an important role in ensuring the accessibility of reliable and evidence-based information. These rebuttals will be published on the Sabin Center website for anyone to refer to and access. While this was an extensive literature review, it was not an exhaustive one. Further work can be completed to look at a larger amount of literature available. Additionally, more misinformation topics can be included and rebutted such as nuclear energy, battery storage, and/or hydropower. This can further help increase the availability of reliable information, aiding in the battle against climate change.

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