

# The Pursuit of Battery-Free Energy Storage in the United States

An STS Research Paper  
presented to the faculty of the  
School of Engineering and Applied Science  
University of Virginia

By

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March 14, 2024

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## **The Pursuit of Battery-Free Energy Storage in the United States**

The impact of fossil fuels and the need for a transition to low carbon energy is heavily debated. This transition would see an increase of renewable energy and with it, the issue of energy storage. Yet the primary sources of renewable energy, solar and wind, are highly variable, necessitating capacious energy storage systems to stabilize supply. The transition to renewable energy is deepening America's reliance on batteries to store this energy. In 2021 battery-electric vehicles (BEVs) accounted for nearly 10 percent of global car sales, and this share is expected to rise to 30 percent by 2030 (IEA, 2022). In the US, residential solar installations rose by 34 percent in 2021 relative to 2020 (Leppert & Kennedy, 2022). Batteries are a viable choice for storage, but cannot meet all the energy storage needs of the US. In 2017, the US generated 4 billion MWh of electricity, but could store only 431 MWh (Zablocki, 2019). The motivations and strategies of different social groups is crucial in determining the weight of the information they spread. In the United States, environmental advocacies, consumer groups, conservative think tanks, renewables companies, and fossil fuel companies compete to influence the energy transition, including the place of battery-free storage in it. Proponents of battery-free energy storage warn that storage is necessary to offset extreme fluctuations in generated renewable power supply, and that battery storage is infeasible. Their critics, however, contend that battery-free energy storage systems are infeasible and allege that proponents of such schemes are more interested in selling their products than in solving renewable energy supply problems.

### **Review of Research**

Motivations and agendas are important to any competition. They are also important to holding companies and social groups accountable. Dunlap and McCright (2011) examine the

motivations of deniers of climate change. They attribute the denial to reasons ranging from economic to personal, but ultimately to a “shared opposition to governmental regulatory efforts to ameliorate climate change.” They expose the efforts taken to undermine climate science by attacking the science and specific scientists, questioning the reality and seriousness of climate change. Despite a majority of the world's scientists agreeing on the existence and dangerous nature of climate change, people continue to deny it. A study by Häkkinen and Akrami (2014) found that climate change denial can be altered by the media that participants of the study are shown. Dunlap and Brulle (2020) also dive into the climate change countermovement and its motivations and amplifiers. They point out the same strategy of undermining public understanding of climate change, as well as a deeper look into the sources of this movement. They explain how these undermining efforts are often perpetrated by third parties or “front groups” to “hide corporate responsibility” attached to the efforts.

The motivations and strategies of groups and companies denying climate change is not the only thing to consider. Kolk and Pinkse (2004) discuss the market strategies for companies in favor of, or profit from climate change. They address how corporate measures include activities and initiatives to reduce emissions, product and process improvement, and cooperation with other companies and government agencies to exchange technology and expertise. They then discuss the shift in the strategies used. Developing from political non-market strategies into using the market component. They distinguish categories used to classify the evolution of corporate climate change strategies from reactive to proactive. They explain reactive as being a stance that denotes responsibility, and proactive as a strategy that anticipates developments. They also identify a third option somewhere in between these two extremes. In an opportunistic/hesitant strategy companies prepare and anticipate, but do not act right away.

Continuing the discussion on corporate reactions, Dahl and Fløttum (2019) conducted a study of how climate change is constructed into different companies' business strategies. They studied three energy companies. Finding that Statoil ASA, previously an oil and gas company that has transitioned to broad energy, views climate change as a business opportunity. Suncor Energy Inc, an almost entirely oil based company, views it as a business risk. Total S.A., an oil and gas company, views it as a responsibility that the company is ready and willing to take on. This study gives insight into how the product and agenda of a company shapes how they view issues like climate change. It should be noted that this study was conducted for companies in Norway, Canada, and France which all use energy differently than the United States, so there are some expected differences when considering this in the context of American companies.

### **The Influence of Research**

Researchers have evaluated the viability of non-battery energy storage technologies and promote it as a logical choice. In a life-cycle assessment on gravity energy storage (GES) for large-scale applications, Berrada et al. (2021) found that GES is cost-competitive with two other non-battery techniques: Pumped Hydro Energy Storage (PHES) and Compressed Air Energy Storage (CAES). This journal article was published in the influential *Journal of Energy Storage*. A study, published in *Renewable and Sustainable Energy Reviews*, of PHES has shown that its flexibility and storage capacity improve grid stability (Rehman et al., 2015). Nzotcha et al. (2019) accentuates the sustainability of PHES, how it could produce zero greenhouse gasses, while maintaining low prices of electricity. CAES is an energy storage solution for areas with limited reliable energy. Adib et al. (2023) explains that a CAES system is a cost effective and reliable storage solution for these areas. Researchers publishing data and evidence solidifies renewable energy storage as a viable and attainable tool. This information builds a solid

argument that can be backed up by credible sources. It builds the strength of an argument and allows the information to be presented in an accurate and reliable way. An argument can be made persuasive by including relevant data and statistics. The audience of this research, however, is limited to academics and other readers seeking scholarly information. This data, although reaching a large audience, is not reaching an entire population of people. It is limited in its audience to readers who would already be interested in this information. To reach a broader audience the research must be used in an article written for a larger target audience. This is why the influence factor of a journal is so important. It demonstrates that the research is not only credible, but is being used in more than one setting, reaching more than one audience. For example, Rehman et al. (2015) wrote an article that was cited over 750 times. It has been cited in frameworks for innovative technologies and in articles promoting the benefits of renewable energy storage. These citations improve the visibility of the research, however the issue still applies that the target audience is restricted to a certain group of people.

### **Corporate Competition for Influence**

Companies like HOLCIM, Energy5, and Gravitricity promote sustainable energy. HOLCIM has partnered with other companies to develop non-battery storage technology. Their head of global innovation explains how “the world needs innovative solutions to accelerate [its] shift towards renewable energy generation, distribution and storage” (Bermejo, 2022). HOLCIM, along with their partners, promote their “innovative solution” on their website to advance themselves, their product, and green energy. HOLCIM is a company whose primary agenda is to sell their product. Non-battery storage technology is one of their products, so by promoting themselves and establishing the need for an innovative solution, they successfully create a need for their product. Gravitricity manufactures technology in gravity and hydrogen storage. They

make a point that as the “world generates more electricity from intermittent renewable energy sources, there is a growing need for technologies which can capture and store energy” (Gravitricity, 2024). They implement similar methods as HOLCIM: emphasizing the need of their product. Energy5 offers services in sustainability, while maintaining a blog posting articles about green energy topics, including non-battery storage (Energy5, 2023). Unlike HOLCIM, they do not sell their own non-battery storage technology. Their approach is more educational at first glance, rather than promotional. They intend to inform readers about the green technology, which then makes their services desirable. HOLCIM, Gravitricity, and Energy5 promote their product and services by stressing the importance of a renewable solution and the urgency of an energy transition.

Fossil fuel companies compete with the energy transition by deeming it unnecessary. Fossil fuel companies dominate the industry and majorly profit at the expense of the environment. In 2022, the world's five largest fossil fuel companies reported a record breaking \$200 billion in profits (Sadai, 2023). These companies advance their agenda through deception and misinformation. They undermine the critical nature of climate change, and question its existence at all. In 2015 the Union of Concerned Scientists released The Climate Deception Dossiers, exposing how fossil fuel companies knowingly deceived the public about the environmental impacts of their companies (Union of Concerned Scientists, 2015c). A leaked strategy memo from The American Petroleum Institute, which has BP, Chevron, ExxonMobil, and Shell as member companies, includes strategies to manufacture uncertainty in climate change science. It lays out a strategy to “identify, recruit, and train” scientists to participate in media outreach against climate science (Union of Concerned Scientists, 2015a). The dossiers confirmed that fossil fuel companies have known the harmful climate effects of their product for

decades. A 1995 internal memo from the Global Climate Coalition, including many of the largest fossil fuel companies, concluded that the scientific basis for human activities leading to climate change is “well established and cannot be denied” (Union of Concerned Scientists, 2015b). Despite knowing the harmful effects, these companies challenge the existence of these impacts in order to ensure their products' continued demand.

Battery companies highlight an interesting sector. Companies like Tesla are leading manufacturers of batteries, inherently competing with non-battery storage. Unlike fossil fuel companies, they also support the energy transition. Batteries are an essential part of the transition, their demand increasing as the transition progresses. Tesla promotes themselves as “accelerating the world’s transition to sustainable energy” (Tesla, 2024). While it is true that batteries advance the energy transition, they may not be as sustainable as they seem. The production of the lithium-ion batteries that power EVs result in more carbon dioxide, and require more energy, than the production of regular car batteries (IER, 2023). The disposal of batteries also releases many harmful toxins when disposed of in a landfill. Researchers estimate that only around 5% of lithium-ion batteries are recycled (Stone, 2020). The debate about if batteries, and EVs in general, are actually environmentally beneficial is relevant when considering the wording that Tesla uses to promote themselves. In Tesla’s 2022 impact report, they state that every “battery [they] install... moves the needle in the direction of a sustainable future,” however, they do not mention anything about the harmful manufacturing impacts of their product (Tesla, 2022). Tesla is emphasizing the importance of an energy transition and their role in it. Like HOLCIM, Gravitricity, and Energy5 they are doing this to promote their products. Like the fossil fuel companies, however, the information they are promoting may be skewed and edited to fit a narrative that advances their agenda.

Based on their names, battery and non-battery storage should be competitors, yet the mention of each other is nowhere to be found. Battery companies do not really acknowledge non-battery options, and the only time non-battery companies mention them, it's in reference to helping supplement the storage demand. Gravitricity includes a quote from the International Energy Agency (IEA) on their website that states how, with the upcoming transition, their product will be necessary to “manage the impact on the power grid,” implying that batteries will not be able to do it on their own (Gravitricity, 2024). The lack of competition between these groups can be attributed to a few reasons. First, non-battery storage technology is new to the commercial industry. There are not many actual technologies that are currently in use, and thus do not pose a threat to battery companies. Existing technologies will continue to improve, which will introduce a level of competition in the sector. Battery companies can not handle the demand being placed on them, and that demand will continue to increase as the energy transition progresses. The energy transition is something that both types of companies support in order to win the influence of consumers. In order to sell their product, both companies want to emphasize the need for a solution to advance the energy transition. These two sectors of the same field are not competing yet because there is still room to grow, once that room runs out, the competition begins. Currently, the larger issue is the shared fight to acknowledge that the energy transition is a dangerous reality. Once they win this fight, they can move on to competing against each other. Some companies offer battery and non-battery options. Energy Vault offers breakthrough technology that harnesses gravity energy storage. They are building facilities that utilize large bricks as an energy source. Energy Vault said that this project “emphasized the indispensable role of gravity energy storage in the crucial mission of global decarbonization” (Jowett, 2024). This quote hits the mark on both aspects. Emphasized the product, gravity energy storage, and the



crucial necessity of it. Before this project, Energy Vault has focused on battery storage. They have a wide variety of short, long, and ultra-long duration “solutions” that consist of lithium-ion battery, gravity, and hydrogen energy storage (Energy Vault, 2023). Energy Vault demonstrates the current lack of competition between battery and non-battery storage. The competition to focus on is between environmental companies, including battery manufacturers, and fossil fuel companies. The competition is in the fight for influence over consumers about the energy transition.

### **Advocacy and Opposition**

Federal agencies like the Office of Energy Efficiency and Renewable Energy (EERE) advance the research and development of technologies to help America reach net-zero greenhouse gas emissions (WPTO, 2023). Nonprofits like the National Hydropower Association (NHA) release reports and articles, and support projects surrounding non-battery energy storage (Fitzgerald, 2022). NHA lobbies for the budget of the WPTO and takes credit for the successful increase stating that “the \$179 million budgeted to the WPTO would not have been obtainable without NHA members sharing their experiences and needs with lawmakers”(Laurita, 2023). NHA advocates for policies at the federal and state level. At the federal level, NHA lobbies for legislation to streamline pumped hydro storage, seen in the Community and Hydropower Improvement act. This act removes many of the obstacles in obtaining a permit for hydropower. The state level supports the meeting of targets for pumped hydro storage (Fitzgerald, 2023). NHA has many committees and councils to help them further their agenda. Their Pumped Storage Development Council focuses on the regulatory and legislative issues surrounding PHES development (National Hydropower Association, 2023). Crossley (2013) describes how the lack of legal definition for energy storage poses a challenge for policy makers. This is seen in the

Community and Hydropower Improvement Act, which relates to pumped hydro, not any other systems. The Clean Energy States Alliance (CESA) is a trade association for clean energy technologies. They fund research on non-battery storage technologies. The Energy Storage Technology Advancement Partnership (ESTAP) is a federal-state initiative, funded by the U.S. Department of Energy and administered by CESA. It fosters partnerships between states and the government to deploy energy storage technologies. Their main methods include: project deployment, policy development, analysis, and information dissemination (Clean Energy States Alliance, 2023). Participants in this topic find success when working together. This is made difficult through the lack of legal definition of energy storage, which isolates each different system.

Fossil Fuel companies have a disproportionate financial and lobbying influence. In 2023, the lobbying total for oil and gas was over \$132 million dollars, compared to the environmental total of \$31 million (OpenSecrets, 2023b; OpenSecrets, 2023a). The fossil fuel companies spend enormous amounts of money in order to influence legislation in a way that favors themselves. In 2018, several climate change initiatives were rejected due to oil and gas lobbying. A carbon tax initiative in Washington, facing a \$31 million dollar “no” campaign from oil companies outside the state, did not pass. In Arizona, a renewable energy mandate was shot down after the utility, Arizona Public Service Co., spent almost \$22 million in advertising against the idea. It would be easy to argue that these initiatives didn’t pass due to the public not being ready to transition, until looking at the passed initiatives. In Nevada, a renewable energy mandate on state utilities faced little opposition, and had no issue passing (Roberts, 2018). The fossil fuel industry has nonprofit organizations like the Empowerment Alliance and the American Petroleum Institute. The Empowerment Alliance is an anonymously funded nonprofit organization whose mission is to

fight climate action and promote the gas industry (SeriousOtters, 2024). A common theme on their website is natural gas. They spotlight how natural gas is green, encourage states to prohibit banning natural gas, and to build more natural gas and energy pipelines. In January, 2023, Ohio's governor signed a bill to legally label natural gas as a source of "green energy," which it is not. Natural gas is a fossil fuel and emits greenhouse gasses, labeling it as a source of green energy is harmful and misleading. The Empowerment Alliance helped spread this narrative that natural gas is clean energy. Another anonymously funded group, the American Legislative Exchange Council (ALEC), helped with this campaign. ALEC and the Empowerment Alliance worked closely with Ohio lawmakers on this new law. This is not the first time these groups have communicated closely. The leader of the Empowerment Alliance, Tom Rastin, and his wife are executives of a natural gas compressors manufacturing company. The Alliance has spent \$1 million to back Ohio Republicans in the 2022 election (Joselow, 2023). ALEC is known as an organization that drafts "model bills" that tend to benefit the corporations, rather than the public. ALEC is funded by corporations like Koch Industries, Pfizer, and Duke Energy. They were previously funded by BP, General Motors, and ExxonMobil, before these companies left starting in 2011 (Common Cause, 2023). ALEC defines themselves as "America's largest nonpartisan organization dedicated to the principles of limited government, free markets and federalism." Their website includes many issues and their stance on these issues. Concerning the environment, they use manipulating language to portray climate activists as irrational. They propose their ideas as being the "voice of reason" and emphasize the importance of "rational environmental protection" implying that the current state of environmental debate is unreasonable and irrational (Trotter, 2024; ALEC, 2023).

## **Conclusion**

Competition is an aspect between most companies and social groups. Opposing agendas create two sides in the same industry. Investigating the competition for influencing the energy transition, and non-battery technology within it, exposed the different ways certain companies incorporate the issue of climate change into their business strategies. Non-battery energy storage companies use climate change as a business opportunity. They shape the crisis as a problem that they have the solution to. Battery companies reacted in a similar way. Non-battery and battery companies did not compete in the expected way, as they both offer solutions to the same problem. Instead, they are cooperating in the shared fight to acknowledge climate change as a viable issue. On the other side of this fight, fossil fuel companies, conservative think tanks, and other opponents undermine this effort calling it unnecessary and framing its supporters as hysterical.

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