Who Holds the Power: An Investigation Into the Power Dynamics of the Energy Industry

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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STS Research Paper

Hydropower produced more electricity than all other renewables combined until 2013. At that time, 13% of electricity generated came from renewable sources. Currently, renewable sources provide 20% of the generated electricity, that 7% increase comes from wind and solar sources (*Electricity in the U.S. - U.S. Energy Information Administration (EIA)*, 2022). Electricity generation through wind and solar is more complex than the traditional sources, as each individual source provides much less power than a coal plant – for example, so the electricity is distributed causing more connections to the grid. As energy generation becomes increasingly renewable-based, more attention must be given to the dynamics of the energy industry to ensure that electricity continues to be safely and fairly provided to all.

An energy consumer's main interest is that reliable and affordable energy is provided. It is typically on the consumer to elect the representatives that will advocate for a fair energy industry. In this paper, the energy industry is investigated using Actor-Network Theory (ANT). The investigation will culminate in an answer to the question: what actant in the energy industry has the most persuasion in dictating the overarching goals and actions? The investigations in this paper will provide the consumer with the knowledge needed to base future actions towards ensuring safe and reliable electricity.

Methods

Throughout this paper, the question of the main governing entity in the energy industry will be answered. As the energy industry is large and variable based on location across the United States, West Virginia, a notoriously coal heavy and energy driven state, is chosen as the site for analysis. Information about the industry is gathered using a case study method. The two case studies that are chosen are significant and unique events, analyzing these events that occur

on the outside of what is considered normal will show the power plays and ties that typically run beneath the surface of the system (Cresswell et al., 2010). The chosen case studies: Grant Town Power Plant and the Buffalo Creek Disaster, will be analyzed using the Actor Network Theory (ANT). ANT is a science technology and society framework that is used to analyze a system where both human and non-human entities are considered to have the ability to have equal influence (Cresswell et al., 2010). Proper use and critiques of ANT are defined later in the paper. Once the use of ANT is defined, the framework will then be applied to the case studies to complete the analysis.

The History of The Energy Industry

The traditional methods of generation and distribution of electricity were developed in the early 20th century. A handful of technological inventions created what is considered an economy of scale, where generation costs are reduced at larger scales. At this time, utilities started to spread their customer base creating larger transmission and distribution networks. The economy of scale and nature of electricity generation spurs utilities to be monopolies (Tuttle et. Al., 2016). Multiple distribution systems in one area create unnecessary redundancies therefore, as utilities developed, they typically monopolized the area they served. Local, State and Federal governments then stepped in to ensure fair treatment of customers and fair prices (Tuttle et. Al., 2016).

Federal regulation came from the Federal Power Commission (FPC) which was initially established to regulate hydropower. As the demand for energy grew, the FPC slowly grew to meet it. In 1935, the FPC was given the power to set electricity at a price determined "just and reasonable" (*DOE Spotlight*, January 25). After that, the FPC was eventually given the power to regulate transmission of power across state lines and regulate natural gas facilities (*DOE*

Spotlight, January 25). In 1977, many government agencies that served energy functions were consolidated into the Department of Energy, this also established the Federal Energy Regulatory Commission (FERC). The FERC took over the role of the FPC and is the regulator of today. The FERC itself serves the role of regulatory oversight in the interstate trade of electricity and interstate energy infrastructure development projects (*DOE Spotlight*, January 25).

In 1990, the United States started to take steps towards deregulation. At the time, all utilities served as monopolies in the area. Generation, transmission, and distribution all happened under one entity, which was heavily regulated by the FERC and state regulators to keep energy prices fair (Cleary & Palmer, 2022). This system of energy distribution is referred to as regulated utilities. The goal of deregulation was to introduce competition into the energy industry, something it was significantly lacking, especially with the focus in the US on competitive markets. Deregulation aims to split generation from transmission and distribution. The generation plants are then owned by investors instead of utilities. The sale of electricity then happens from generation plants to distribution utilities. This sale happens essentially in real-time and is based on demand. Utilities will buy electricity from the cheapest generation plant up until the purchased electricity meets the demand, the price paid to all plants will then be set at the price of the most expensive plant the utility had to buy from (Cleary & Palmer, 2022). This purchase system encourages plants to operate efficiently and enables customers to be able to choose who they want to purchase electricity from significantly increasing demand in the industry. Today, both regulated and deregulated utilities exist.

Actor-Network Theory

Actor-Network Theory is a Science, Technology and Society theory used for the analysis of how technology interacts with society. This theory was developed in the 1980s mainly by

Bruno Latour and John Law. ANT enables the analysis of both human and non-human actors at the same time, a network is not limited to including just one or the other. In addition, ANT gives equal weight to technological factors and societal factors and does not have an initial bias to one or the other. This comes from the principle of generalized symmetry where non-human and human entities are examined using the same methods (Nickerson, 2023). The basis of influence therefore lies in the nature of the network (Cresswell et al., 2010).

A network of actors is developed through translation. Translation is the method in which communication is established between actors and actors are enrolled in the network. Power dynamics are developed during translation (Nickerson, 2023). Creation of a network typically occurs through one main actor who enrolls actors to meet the main actants goal (Thór Jóhannesson & Bærenholdt, 2020). A successful network relies on all actors being committed to the same goal. The fully developed network is then referred to as an assemblage. Each actor in the network is referred to as an actant, a word used to acknowledge that each actant is typically an assemblage of its own network (Nickerson, 2023). An assemblage can be considered stable but can never be considered fully developed as it is always subject to change (Thór Jóhannesson & Bærenholdt, 2020).

ANT has the advantage of being able to analyze complex networks that include human and non-human actors in an unbiased way. However, despite this it still faces many critiques. One critique suggests that ANT fails by equally weighing human and non-human entities as non-human entities cannot have intentions (Nickerson, 2023). This critique goes against the biggest strength of ANT that despite these differences both human and non-human actors can be analyzed together. Another critique is that ANT simplifies networks too much as each actor is its own network (Cresswell et al., 2010). However, this is dissipated using the term actants which

acknowledges the complexity within each actor itself. ANT will be used throughout this paper to analyze the complexities in the energy industry.

Results and Discussion

This application of ANT to case studies will find that the entity with the most power in the energy network is the entity that is willing to utilize weaknesses of the network for their own advantage and change from focusing on the group goal to the individual goal of the entity. The actor-network is established with five base actants: the utility, the power plant, the elected representative, the community, and the regulator. These five actors themselves exist in harmony where they all act towards the group goal. It is in the face of extremes where the network loses balance, and the power extremes are revealed. In the case of the Buffalo Creek disaster the plant took advantage of the lack of regulatory enforcement and used that for short term monetary gain. In turn, significant death and destruction was caused in the community. Grant Town, on the other hand, was subject to actors choosing to play more than one actor at once, this unbalanced the network and created an all-powerful body which harmed the community by the wayside. The network established in the next section is the most functional form of the network, where all entities have power. Any changes to this create an imbalance in power and a lack of necessary protection.

Defining the Actor-Network

The system of distributing energy is complex, involving many entities. These entities can be split up into five categories, the regulator, the utility, the community, the elected representatives, and the power plant. The first actant, the utility, is the entity in charge of the transmission and distribution of electricity to its' customers. On occasion, the utility will also own generating plants and head the generation of electricity that it distributed. In West Virginia,

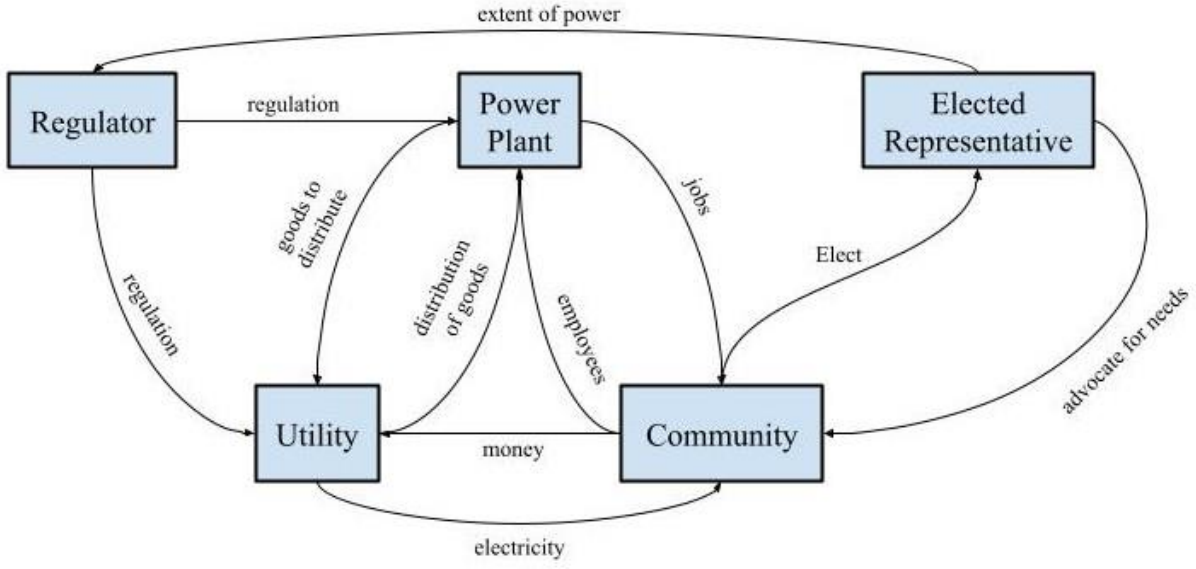
the utility is FirstEnergy, which is a combination of 10 regulated distribution companies (About Us, 2022). FirstEnergy is a combination of regulated and deregulated. It has stock in three plants but purchases the large majority of the electricity it distributes from privately owned power plants (About Us, 2022). This separates the utility and the power plant into two entities, creating the second actor – the power plant. The power plants can range from anything between a coal plant, hydroelectric dam, and solar farm. In this paper, the focus will be on coal plants as upwards of 90% of West Virginias electricity generation is from coal and it is the second largest producer of coal in the US (*West Virginia State Profile and Energy Estimates,* 2022).

Electricity is sold from the plant to the utility so that the utility has a product to deliver to its customers and so the power plant generates a profit. This exchange between the plant and the utility requires a regulator to ensure accessibility of electricity to all Americans. The regulator is the Federal Electricity Reliability Committee (FERC) and the third actor (Cleary & Palmer, 2020). The FERC sets tariffs on the electricity as it is being sold between states. The tariffs must be set so that they enable Americans to have access to affordable energy, allow for enough profit for the utility and plants to invest in new infrastructure, encourage sustainable growth, and ensure reliability (Zinaman et al., 2014). Additionally, there are other regulators that dictate waste management and environmental impact. The regulators are all federal bodies that were developed by elected representatives. The fourth actor is the elected representatives, who exist on a local, state, and federal level. The job of these elected representatives is to protect the interests of their constituents. The fifth and final actor is the community. This community is the one that provides jobs to the power plant to keep it running, they purchase the electricity from the utility, and they elect their representatives in government. Without all five actors, the network would not function properly. The relationship between the actors is what provides each

actor with power, money, and livelihood. When all is functioning properly, the communal goal of delivering safe and reliable electricity to the community is met.

Additionally, there are naturally built in checks-and-balances into this system. These checks-and-balances are developed in the translation of the network as each actor enrolled. These checks-and-balances dictate the role in which the actor plays to reach the common goal of delivering safe and reliable electricity and enrolled in the network. As seen in Figure 1, the utility provides the powerplant with distribution of goods, but needs the goods from the plant to distribute. It gets money from the community but needs to provide reliable electricity in exchange. To make sure that both exchanges happen fairly, the utility is under regulation by the regulator. The power plant has a goods and services exchange with the utility, it provides jobs to the community but needs the community to fulfill them. The power plant is also under the direction of the regulator. The regulator has regulatory power over both the utility and the power plant but the extent of the rules that can be made is dictated by the power they are given by the federal government, or elected representatives. The elected representatives dictate the extent to which the regulator can regulate, while acting in the favor of their constituents. If the constituents are satisfied, they will continue to show support and vote for the elected representatives. In the actor-network as defined above, not one actor has full power over all the others. Each actor relies on the other to perform his role. From this predictability emerges a stable network that functions for the benefit of all.

Figure 1: The Energy Industry Network (Canning, 2023)



Buffalo Creek Disaster

On the morning of February 26th, 1972, Buffalo Creek dam number three failed. It let out enough fluid to make a wave 20 to 30 feet high that moved at a speed of seven feet per second and traveled a total of 17 miles. The wave swept through the Buffalo Creek Valley in Logan County, WV subsequently killing 118 people, injuring 1119, and leaving almost 4000 homeless. This is the worst impoundment failure that has ever occurred in the United States. At the time of the disaster, the dam was owned by Buffalo Mining Company, whose parent company was Pittston Coal Company (Coon et al., 2022). Applying the previously established actor-network to this situation, the dam takes on the role of plant, the Buffalo Mining Company becomes the utility, the active regulators are the US Bureau of Mines and the Department of Natural Resources, the community is Buffalo Creek Valley, and the elected representatives are the local governments and West Virginia state government. In this case, the network is destabilized by the

plant and the utility prioritizing short term monetary gains over the long-term goals of the network.

The failure of the dam was foreseen. It had been inspected in 1966 by the US Bureau of Mines, who concluded that the dam had a possibility of breaching and would cause significant damage. No action was taken by the Buffalo Mining Company. The dam was inspected again in 1971 by the West Virginia Department of Natural Resources who also determined the dam was deficient as it lacked a properly functioning overflow system. Again, no action was taken by the Buffalo Mining Company. The dam got to the point where a member of the community wrote to the company to ask them to fix the dam. Still, no action was taken by the Buffalo Mining Company; in addition, as the dam started to fill up the night before the failure occurred, no warning was issued to the surrounding area of the case (Coon et al., 2022). This failure caused a significant amount of distress in the community, forced the local and federal governments to spend significant amounts of money and time into supporting the community and fixing the infrastructure. The failure, as legally determined, was caused by the lack of action on the Buffalo Mining Company (Coon et al., 2022). However, a failure in the function of the network preceded the dam failure and is the root cause.

A failure in the proper function of the network occurs when a network becomes unstable because of an actant making choices that do not align with the common goal, and therefore are unpredictable. That is what happened in this case. The regulating bodies for the Buffalo Mining Company did not have the necessary extent of power to enforce the regulation. Therefore, in the initial translation of the network agreements between the regulator and the utility were not properly formed. The lack of these agreements created a power imbalance between the regulator and the utility allowed the utility to shift its goal away from the communal network goal. In this

case, the utility focused on the financial savings it would have in the short term, rather than providing reliable electricity. Performing translation on the network to increase regulatory power would re-establish the necessary balance in the network to realign goals and protect the community. This was done by the passing of the 1977 Surface Mining Control and Reclamation Act which established a balance between coal mining and environmental protection (Coon et al., 2022). After the passing of this act, there have only been two similar failures in the US, both of much smaller magnitudes.

In the case of the Buffalo Creek Failure, the relationships in the network were not properly formed during translation. Certain actors took advantage of this as their personal goals did not align with the overarching group goal. Buffalo Mining Company became the most powerful entity in this network as it was able to ignore regulators and the community, despite the set forth efforts. In turn, the company created a failure of the magnitude it did and caused significant. The company took advantage of weaknesses in the network and used them to its own advantage. This focus on the personal goal is what allowed the company to have that much power. According to the Buffalo Creek disaster, the utility is the most powerful entity in the network.

Grant Town – Joe Manchin

In Grant Town, WV, there is a refuse coal power plant, this plant takes coal waste and burns it to create energy (Cravey, 2022). This plant is owned by Ambit, who sells electricity to the utility FirstEnergy, under the oversight of the FERC. In this case the actors are Grant Town refuse coal plant as the power plant, the utility is FirstEnergy, the regulator is the FERC, the community is Grant Town itself, and the elected representative is the local, state and federal

governments, most notably Joe Manchin. These actors represent the actors in the actor-network that functions around the Grant Town plant.

Grant Town, as the only remaining refuse coal plant in West Virginia, purchases coal from Enersystems Inc. as the fuel for the plant (Waldman, 2022a). Enersystems Inc., which specializes in the sale of waste coal, is owned by Senator Joe Manchin's family, specifically run by Manchin's son (Waldman, 2022b). Senator Joe Manchin himself made five hundred thousand dollars from Enersystems Inc in 2021 (Waldman, 2022). Joe Manchin serving as both the elected representative and a beneficiary of the success of the power plant reduces the effectiveness of the network as the actants in the network are no longer fully separate. Therefore, the agreements made between the two actants no longer must be followed. In this case, Senator Manchin then has an initiative to make decisions that would benefit him instead of his company. This change in alliance was seen when Manchin was the governor of West Virginia and would raise the energy rates to keep Grant Town in business, and by association his family business (Waldman, 2022b). Manchin acting on interests both personally and for his constituents creates alters the network by performing translation to create a network benefiting Manchin instead of the population as a whole.

Actions that show Manchin's alliance with the plant instead of for his constituents have occurred throughout his career. During his time on the State Legislature, he backed a bill that gave tax breaks to refuse coal plants in West Virginia, Grant Town is the only remaining plant. Additionally, he used his political position to remove a clean energy program from the Build Back Better bill, a clause that could have closed coal plants sooner (Waldman, 2022b). This unbalance in the network has created one where the power shifts to be in the hands of the elected

official and the network is no longer functioning towards the common goal for all its members. In this case, the community suffers as they are paying higher rates for electricity.

Joe Manchin having questionable motives is not the only point of contention for the plant. Fly ash, a waste product that is produced when coal is burned, from Grant Town is being used to reduce acid mine drainage by applying it to mine remediation sites. The main issue with this remediation method is that the fly ash that comes out of Grant Town has a high level of heavy metals, which will then leak into the surrounding ground water (Heyman, 2017). An environmental issue like this should be controlled by a regulator, who is controlled by the elected representative. However, as the elected representative has become the same actant as the regulator less action will be taken to ensure enforcement of the regulatory guidelines, and again put the community in harm's way. This time, the community is subject to possibly toxic groundwater, used for drinking water when not connected to city plumbing.

Grant Town – First Energy

Joe Manchin is not the only actor in this network that is subject to corruption. FirstEnergy, the utility in the network, will be forced to pay $230 million based on its part in a bribery scheme in Ohio (Diaz, 2021). FirstEnergy had been paying off Ohio State Senators to get a bill passed, which would have included a one-billion-dollar bailout for two plants in Ohio. To fund this bill, a new fee would have also been added to the electricity bills in Ohio (Diaz, 2021). On top of the bribery that was occurring in the state government, FirstEnergy executives had an inside connection with the Ohio state regulator. This inside connection allowed FirstEnergy to influence bills that passed and dispose of unsatisfactory audit reports (Gillispie, 2021). FirstEnergy had gone through the process of translation in its own network enrolled actors from

both the regulator and the elected representatives. The translation of the internal network of the actant FirstEnergy decreased the functionality of the energy industry assemblage and FirstEnergy became the most powerful. In this case, the community becomes the victim as it loses the protection it has through the regulatory body as well as the elected representatives. Although the previous situation happened in Ohio, as it is the same utility, it is likely that the company has or would be willing to take similar measures in the neighboring states it serves, like West Virginia.

The Primary Actor and the Powerful Entity

In both case studies above, the actant in the network that became the most powerful is always the entity that is willing to perform translation on its own network to create connections between actants in the assemblage of the energy industry network. The translation of the internal networks alters the overarching assemblage, and allows actants to act unpredictably and focus on an internal goal. In the instance of the Buffalo Creek disaster the utility took advantage of the lack of regulatory enforcement, chose to not fix the dam, and in turn caused widespread damage to the local community. In the case of Grant Town, Joe Manchin translated his personal network to become an elected representative as well as a beneficiary of a power plant and was able to increase profits for himself. His internal translation has combined actants in the energy industry assemblage and therefore offset the balance of the network. FirstEnergy took a similar route to Manchin where they translated their internal network and were able to financially benefit themselves because of it. Therefore, the most powerful entity in the energy industry is the one that is willing to perform internal translation, which will likely push the boundaries of legality and ethics, and when this happens the entity no longer becomes a properly functioning member of the network. One entity that does not take advantage of the network for their own gain is the community. This is because the communities' personal goals most align with the goal of the

overarching network: to deliver safe and reliable electricity to the community. The community then becomes the primary actor, or the actor that started enrollment in the network in the first place.

This analysis is performed thoroughly; however, it is still subject to some limitations from the choice in analysis methods. Using case studies gives a detailed explanation of the energy industry, but only focused on the relationship of one or two plants and the entities in the network with them. The energy industry has countless generating methods and plants, direct implementation of the findings here is not possible, but with further research on the specific plant the findings here can be applied. Additionally, all of the chosen case studies are only in West Virginia. This is beneficial as West Virginia is an energy focused state, so there is much to study, however, the focus on energy is not the same elsewhere. Consideration of location is necessary when adapting the work of this study. Future work in this area should be focused on how the addition of renewable energy to the industry is changing the network. Renewable energy is generated and maintained in a different way than traditional energy sources, and with this change a translation in the network will inevitably occur. Analysis of this change will further enable the application of these results onto renewable energy.

Conclusion

The use of ANT has established a baseline and stable network of five actors in the energy industry. As seen in the case studies, in the face of extreme events, decisions made by actors to take advantage of weaknesses or play more than one actor come to the surface and show where the power in the network really lies. The network and concepts established in this paper are to provide a baseline when analyzing the energy industry in the future. To prevent climate change, the establishment of a renewable grid must happen. Many changes to the current grid and system

must occur before a successful renewable grid can be in place. This analysis provides a map to what entities will be the most influential in the switch to renewables and how to support this change. The energy industry is complex, with many layers of producers, consumers, and regulators. This analysis shows that with the right network significant changes to renewables can and will be implemented.

References

Chester Energy & Policy. "DOE Spotlight: Federal Energy Regulatory Commission," January 25. https://www.chesterenergyandpolicy.com/blog/doe-fed-energy-regulate-commission.

Cleary, Kathryne, and Karen Palmer. "US Electricity Markets 101." Resources for the Future, March 17, 2022. https://www.rff.org/publications/explainers/us-electricity-markets-101/.

Coon, Crystal. "The Buffalo Creek Disaster." West Virginia University Libraries, February 3, 2022. https://storymaps.arcgis.com/stories/a2f1ea2c8ba9494b821d76458b15b41c.

Cravey, Eric. "W.Va. Supreme Court Reverses Lower Court Ruling in Case Involving Grant Town Power Plant and Coal Company." Times West Virginian, April 19, 2022. https://www.timeswv.com/news/local_news/w-va-supreme-court-reverses-lower-court-ruling-in-case-involving-grant-town-power-plant/article_c1e35328-bf54-11ec-ae9d-eb32e32f7a37.html.

Cresswell, Kathrin M., Allison Worth, and Aziz Sheikh. "Actor-Network Theory and Its Role in Understanding the Implementation of Information Technology Developments in Healthcare." *BMC Medical Informatics and Decision Making* 10, no. 1 (November 1, 2010): 67. https://doi.org/10.1186/1472-6947-10-67.

Diaz, Jaclyn. "An Energy Company Behind A Major Bribery Scandal In Ohio Will Pay A $230 Million Fine." *NPR*, July 23, 2021, sec. Law. https://www.npr.org/2021/07/23/1019567905/an-energy-company-behind-a-major-bribery-scandal-in-ohio-will-pay-a-230-million-.

"Electricity in the U.S. - U.S. Energy Information Administration (EIA)," July 15, 2022. https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php.

FirstEnergy. "About Us," May 13, 2022. https://firstenergycorp.com/about.html.

Gillispie, Mark, and Julie Carr Smyth. “Texts Detail How Ohio Regulator Gave FirstEnergy inside Help | AP News.” AP News, October 21, 2021. https://apnews.com/article/business-ohio-utilities-chuck-jones-8ed70a1e68d63a86c75cb67afbb8d903.

Heyman, Dan. “Critics Attack ‘Bailout of Dirty, Expensive’ Power Plant.” Public News Service, June 22, 2017. https://www.publicnewsservice.org/index.php?/content/article/58234-1.

Nickerson, Charlotte. “Latour’s Actor Network Theory,” February 26, 2023. https://simplysociology.com/actor-network-theory.html.

Thór Jóhannesson, Gunnar, and Jørgen Ole Bærenholdt. “Actor–Network Theory.” In *International Encyclopedia of Human Geography (Second Edition)*, edited by Audrey Kobayashi, 33–40. Oxford: Elsevier, 2020. https://doi.org/10.1016/B978-0-08-102295-5.10621-3.

Tuttle, D. P., Gülen, G., Hebner, R., King, C. W., Spence, D. B., Andrade, J., ... & Duncan, R. (2016). The History and Evolution of the US Electricity Industry. White Paper UTEI.

U.S. Energy Information Administration. “West Virginia State Profile and Energy Estimates,” December 15, 2022. https://www.eia.gov/state/?sid=WV#tabs-4.

“UTAustin_FCe_History_2016.Pdf.” Accessed April 23, 2023. https://energy.utexas.edu/sites/default/files/UTAustin_FCe_History_2016.pdf.

Waldman, Scott. “How Manchin Used Politics to Protect His Family Coal Company.” POLITICO, February 8, 2022a. https://www.politico.com/news/2022/02/08/manchin-family-coal-company-00003218.

Waldman, Scott. “Joe Manchin-Connected Power Plant Hasn’t Paid Rent in a Decade - E&E News.” E&E News ClimateWire, February 14, 2022b. https://www.eenews.net/articles/joe-manchin-connected-power-plant-hasnt-paid-rent-in-a-decade/.

Zinaman, Owen, and Mackay Miller. “The Evolving Role of the Power Sector Regulator: A Clean Energy Regulators Initiative Report.” *Technical Report*, 2014.