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Business Models for Coal Plant Decommissioning

August 2021

Jennifer D Lessick
Bethel W Tarekegne
Rebecca S O'Neil

U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
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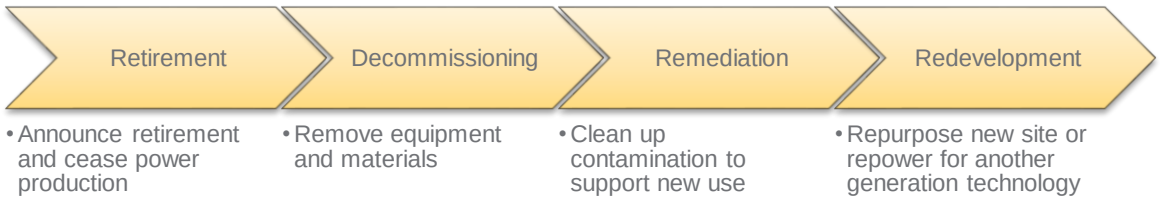
Executive Summary

Aging coal-fired power plants are retiring across the United States. Researchers at Pacific Northwest National Laboratory studied coal-fired power plant decommissioning business models to support program development for the U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy to engage with communities affected by power plant retirement processes. Evaluating and reducing the impact on coal-dependent communities from phasing out coal production is a crucial part of nationwide economic development and community-directed engagement in the clean energy future.

This report describes the steps in the typical coal-fired power plant decommissioning process (as depicted below), including analysis of the following key factors:

- *Drivers* including policy and regulations, competition with other fuels, and corporate emissions goals.
- *Types* of coal plant decommissioning including plant retirement without full decommissioning, repurposing with fuel switching, redeveloping to use existing transmission, and decommissioning and repurposing with other commercial activities.
- *Costs* of coal plant decommissioning, including variations across regulated and deregulated markets and the funding resources to support decommissioning activities.



The details described in this report relied heavily on the availability of local news reports and communications regarding plant decommissioning, because the researchers identified a lack of formal literature surrounding business models for coal plant decommissioning and a need for a more robust source material collection. Future research regarding coal plant decommissioning can include conducting quantitative studies of power plant decommissioning drivers, procedures, and costs; conducting quantitative and qualitative assessments of the effects decommissioning has on surrounding communities, investors, and other stakeholders; and identifying best practices for community involvement in the decommissioning process.

Acknowledgments

The authors wish to thank those who reviewed the report for their thoughtful comments and suggestions.

Acronyms and Abbreviations

ARO	Asset Retirement Obligation
EPA	Environmental Protection Agency
POWER	Partnerships for Opportunity Workforce and Economic Revitalization

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1.0 Introduction

Most coal power plants in the United States (U.S.) are at least 30 years old and have an average life of 40 years.[1] New coal plant constructions have been mothballed across the nation, and the only coal facility built in the past decade was the 17 MW facility at the University of Alaska Fairbanks in 2018.[2,3] New and economically advantaged generating facilities are taking over the role of producing energy. According to the Energy Information Administration, 102 GW of coal-fired power plants were retired between 2010 and 2019, and an additional 17 GW are slated to be retired by 2025 (Figure 1).[4]

While nuclear and hydroelectric facilities operate under a federal license, from the U.S. Nuclear Regulatory Commission and the Federal Energy Regulatory Commission respectively, coal facilities are typically authorized by state permits. Decommissioning processes are therefore nonstandard, and plants may be "mothballed" rather than fully decommissioned, meaning that they are in operational stasis. Some coal power plant owners are faced with the choice to either continue operation, likely at a loss, through the end of a plant's expected life or to idle until it is economically feasible to reactivate production. In situations where power plants are idled or closed temporarily, workers and environmental remediation efforts could be left in limbo. In certain cases, substitution fuels have been examined such as the torrefied[5] biomass fuel switch test at the Boardman power plant in Oregon to maintain operation.[6] In other cases, power plant operators elect to commit to decommissioning the facility.

Operators commonly assess four options (associated terms defined in Table 1) as part of the decommissioning process:[7]

- Maintain the facility at minimal levels and plan for potential restart (*mothballing*).
- Implement the "cold and dark" option where the owner does a partial demolition and retains and secures the site. In this case, the owner retains environmental liabilities and financial obligations (*decommissioning*).
- Decommission and repower or repurpose the site (*remediating and repurposing*).
- Sell the plant as is and the new owner will decide how and when to repurpose the site (see Section 3). In this case, the new owner takes responsibility for the financial obligation and environmental liabilities of the site. If bankruptcy occurs, the previous owner will take the responsibility of the environmental liabilities.

[1] U.S. EIA. Most coal plants in the United States were built before 1990. April 2017
[2] Scientific American. Will the U.S. ever build another big coal plant? August 2017.
[3] Anchorage Daily News. There's only one coal plant being built in the nation, and it's at UAF. September 2017.
[4] U.S. EIA. More U.S. Coal-fired power plants are decommissioning as retirements continue. July 2019.
[5] Relating to Torrefaction, which is a thermal process that converts biomass into a coal-like material to improve its properties before it can be used together or as a replacement for coal.
[6] POWER. Successful torrefied biomass test burn at a coal power plant. March 2018.
[7] Resources for the Future. Decommissioning US Power Plants: Decisions, costs, and key issues. October 2017.

Table 1 Decommissioning Options

Terms	Definitions
Retirement/Shutdown	Announce retirement/closing and cease power production.
Mothballing	Deactivate and preserve the production facility for possible future use or sale.
Decommissioning	Remove equipment and materials. Close or comply with permits, as necessary. Demolish buildings.
Remediation	Clean up contamination to support new use.
Redevelopment	Repurpose or construct a new site or repower for another generation technology.

This report explores the drivers for coal plant decommissioning, the types of decommissioning that owners undertake, and the process and financial obligations that are entailed in the decommissioning of a coal power plant. The details in this report rely heavily on the availability of local news reports and communications regarding plant decommissioning because of the lack of national datasets and uniform guidelines for coal plant decommissioning processes.

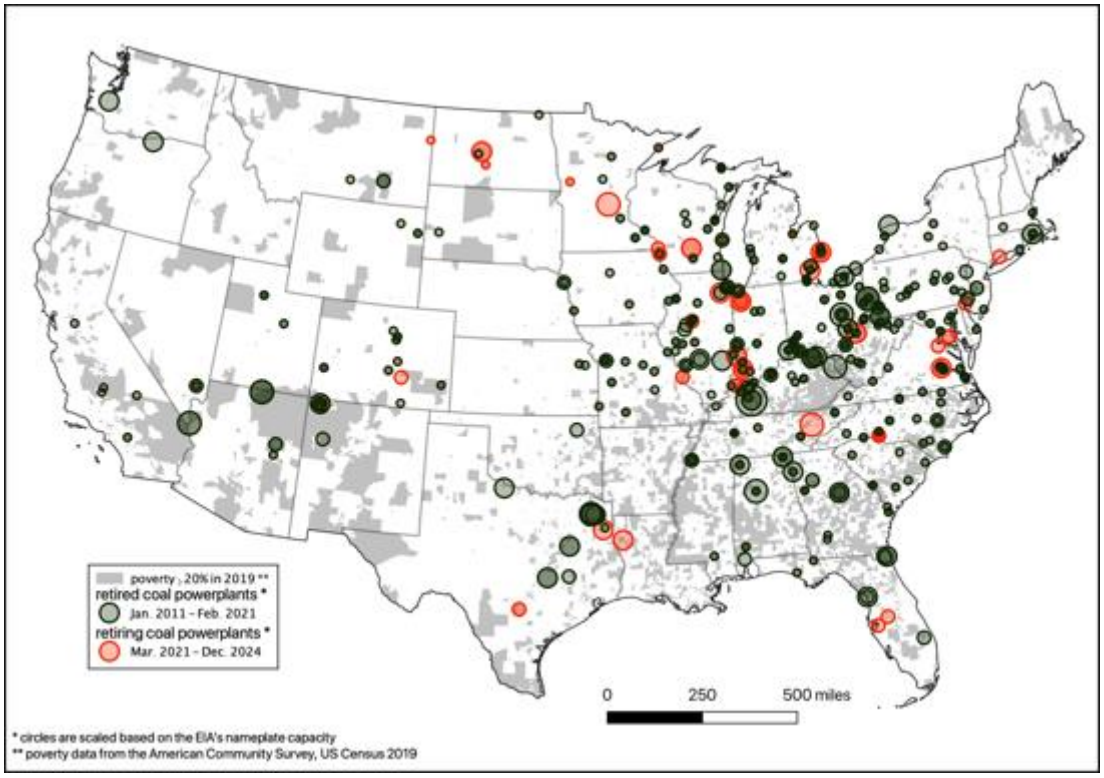

Figure 1 Status of coal-fired power plant retirements, 2011 – 2024. Recent and planned retirements are overlayed on poverty rate as indicator of economic vulnerability. (Data: EIA, US Census; Analysis: PNNL)

2.0 Drivers for Coal Plant Decommissioning

There are several reasons why a power plant owner would choose to retire a coal plant, including costs or decisions associated with policy and regulations, cost competition with other fuels, and corporate emissions reduction goals.

2.1 Policy and Regulations

Coal power plants accrue many costs associated with environmental compliance, and regulatory violations may lead to forced plant decommissioning. Clean Air Act limitations on mercury, heavy metal, acid gas, and sulfur dioxide emissions and Clean Water Act limitations on water pollutants, discharge, and intakes may require facilities to operate in a less economically efficient fashion due to necessary pollution controls infrastructure, or may require more frequent upgrades and other major investments in pollution mitigation.[1] If a plant exceeds limits placed on pollutants, the plant may be forced to retire. For example, if the temperature of post-cooling discharge water exceeds limits specified in the plant's permit, those violations can potentially cause the plant to curtail production until the limits specified in the permit are met.[2]

The U.S. Environmental Protection Agency or other non-governmental organizations can also litigate to retire plants. For example, Duke Energy was forced to retire 11 of the 13 units at the Allen power plant in 2015 following a 15-year litigation process regarding lack of installation of proper pollution control technology.[3] In addition to federal regulation, state Public Utility Commissions may also decide to force plants to decommission if electricity demand does not meet online generating resources. For example, the Mississippi Public Utility Commission is currently forcing Mississippi Power to retire 950 MW of unneeded coal capacity following an overestimation of demand needed over the utility's planning period.[4]

In addition, many states have implemented Renewable Portfolio Standards that offer economic incentives and prioritization of other generating resources. These policies are reinforced by tax breaks and other financial incentives for certain generating resources.[5] In this policy environment, many electric utilities subject to these requirements and economic incentives have indicated an intent to retire coal plants in order to deploy more renewable energy resources.

2.2 Cost Competition with Other Fuels

There are several reasons why coal generation has become less economically attractive than alternative sources of power. Environmental compliance costs, aging infrastructure that requires updates, and exponentially decreasing costs of other fuels have contributed to utility decisions to retire coal plants. A particularly important point of cost comparison is the comparison of the costs of coal and natural gas. The Energy Information Administration Annual Energy Outlook 2021 highlights the impact of low natural gas prices on coal-fired power plant retirements because generation from gas sets the wholesale market price.[6] In addition, Lazard's 2020

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[1] 33 U.S.C §1251 et seq. (1972) "Clean Water Action 316(b)"

[2] Ibid.

[3] U.S. EPA. Duke Energy Corporation Clean Air Act (CAA) Settlement. September 2015.

[4] Energy and Policy Institute. Mississippi regulators force Mississippi Power to close unneeded coal and gas plants. February 2021.

[5] DSIRE. Renewable Portfolio Standards. September 2018

[6] U.S. Energy Information Agency. Annual Energy Outlook. February 2021.

Levelized Cost of Energy Analysis shows a lower cost per unit of energy for solar, wind, and natural gas when compared to coal in both the subsidized and unsubsidized analysis.[1] Utility resource portfolio decision-making is often contingent on fuel cost competition, and coal-fired generation has been unable to prove economically beneficial enough to maintain its historically dominant role in utility electricity generation portfolios.

According to a report published by Energy Innovation, Policy, and Technology, LLC and Vibrant Clean Energy, existing coal-fired generation is increasingly more expensive than local (within 35 miles) wind and solar power.[2] When using 2018 levelized cost of energy estimates, wind and solar showed pricing across the United States as low as $15/MWh for wind and $28/MWh for solar, whereas the lowest pricing for majority of coal plants was $33/MWh. The report conducted a study to replace all the annual megawatt-hours generated by individual coal plants with local wind or local solar to identify sites that are available for deployment. Using this method, the report determined that more than 49 GW of coal were “at risk” from local wind and 69 GW of coal were “at risk” from local solar in 2018.[3] In this study, “at risk” indicates that replacement with the local renewable energy resource would be at least 25 percent cheaper than the costs of running existing coal plants.

2.3 Corporate Emissions Goals

According to the Smart Electric Power Alliance, as of 2020, 69 electric utilities had publicly stated carbon emission reduction targets. Usually, these targets signal a change in portfolio generating sources from higher carbon-emitting sources like coal power[4] to lower carbon-emitting sources like natural gas, wind, or solar power. For example, Southern Company[5], Duke Energy[6], and Tennessee Valley Authority[7] have all stated plans to decommission some portion of coal-fired capacity in order to meet carbon emission or sustainability goals. In addition, the Sierra Club published a report in 2021 analyzing climate pledges from 79 operating utilities. The utilities studied accounted for 68 percent of remaining coal generation and have already publicly committed to retire 25 percent of that coal-fired generation by 2030, and have plans to replace that capacity with new natural gas, wind, and solar plants.[8]

3.0 Types of Coal Plant Decommissioning

Decommissioning of coal-fired units can be complex and expensive, encompassing a decommissioning process that entails cleanup and waste removal, remediation, and redevelopment efforts. Unlike nuclear power plants, coal decommissioning is not regulated with uniform national procedures and guidelines to be followed during the plant decommissioning process, leaving room for many different outcomes affecting communities, shareholders, and utility companies. Once the decision has been made to retire a generating coal plant, the plant owner has several options, including retiring the plant without decommissioning, repurposing the

[1] LAZARD. Lazard’s Levelized Cost of Energy Analysis Version 14.0 October 2020.
[2] Energy Innovation. The Coal Cost Crossover: Economic Viability of Existing Coal Compared to New Local Wind and Solar Resources. March 2019.
[3] *Ibid.*
[4] U.S. EIA. Carbon Dioxide Emissions Coefficients. February 2016.
[5] Southern Company. Southern Company Net Zero Report. September 2020.
[6] Duke Energy. Transforming the Future: Sustainability Report. April 2019.
[7] Tennessee Valley Authority. Fiscal Year 2019 Sustainability Report. July 2020.
[8] Sierra Club. The Dirty Truth About Utility Climate Pledges. January 2021.

plant with a fuel switch, repurposing to handle load pockets or remote transmission, or redeveloping the site for other commercial activity.

3.1 Plant Retirement without Decommissioning

Power plant retirement without decommissioning is a process that may or may not include remediation and redevelopment of the plant property. Estimates of retired coal plants that remain unremediated and unrepurposed are as high as 95%.[1,2] Many of these retired power plants, like the Pennsylvania-based Shamokin Dam power plant (Figure 2), may remain structurally intact but will no longer generate power, and have no announced plans to decommission the site and redevelop it for alternative use.[3]

The reason so many coal plants remain structurally intact post-retirement relates to the costs associated with cleaning up accumulated toxic coal ash and waste. Developers are rarely willing to take on that risk (as described in Section 3.4). Because of costs associated with decommissioning and the lack of regulation putting the burden on plant owners to do so, remediation and redevelopment futures are either nonexistent or uncertain for many coal plants across the country. In response to this, many states and localities have developed task forces, like the Lansing Town Council described in Section 3.4, to remedy how to move forward with abandoned plants, but many do not have the funds to remediate and redevelop the sites.[4]

Figure 2 Shamokin Dam, PA, coal plant was closed in 2014, and the site still holds the infrastructure intact. (Source: NPR)

One example of a fully retired coal plant that featured a complex remediation effort is the Navajo Generating Station, which was retired in 2019. At the end of the power plant lease period in

[1] UCS. A Dwindling Role for Coal. October 2017.
[2] Utility Dive. Shuttered coal plant fixer-uppers for sale all over the U.S. January 2018.
[3] NPR. Finding New Opportunity for Old Coal-Fired Power Plant Sites. May 2019.
[4] Ithaca.com. What's next for the Cayuga power plant. January 2020.

2017, the operating utility, Arizona Public Service, along with the plant owners, the Salt River Project, stated that the plant had become too expensive to run compared to lower cost, lower carbon alternatives that were preferable for the utility's generation portfolio.[1] The 40-year-old, 2,043 MW plant retired after Peabody Energy, the plant's coal supplier, was unsuccessful in finding new owners.[2] The shutdown, which began in late 2020, will consist of an expensive remediation and reclamation process executed by Salt River Project, including a complete restoration of the land to its original state. In early 2021, Salt River Project released the decision to turn the land occupied by the facility completely over to the Navajo Nation after land remediation is completed.[3] In recognition of the detrimental health and environmental effects the plant had caused to the surrounding community during its operation, this decision includes a $144.45 million long-term plan to transition economically affected communities in light of job losses due to plant closure.[4] The Navajo Nation has not yet confirmed a plan for redevelopment efforts, and many believe the land will remain undeveloped post-reclamation.[5]

3.2 Repurposing with Fuel Switch

Retired coal power plant sites have substantial transmission infrastructure that may be attractive to potential development of alternative forms of energy generation (e.g., solar, natural gas, storage), or otherwise risk stranded infrastructure and new transmission needs. Interconnection rights are lucrative and utilities repurposing their transmission rights will save hundreds of millions of dollars and face shorter timeline in the approval process. For example, Xcel Energy estimated it would cost customers approximately $350 million[6] in transmission upgrades to connect a solar project[7] replacing its Sherco coal plant elsewhere on the grid. However, while many utilities have announced plans to replace retired coal generation with alternative forms of energy at the portfolio scale, it has been less common[8] for the actual coal plant site to be redeveloped for this purpose.[9]

One way to repurpose a coal plant with a fuel switch is to site a new plant close by and use existing transmission infrastructure. Idaho Power has recently announced the decommissioning of the North Valmy coal power plant, and aims to replace the capacity lost from its coal plant with a 20-year solar power purchase agreement from Jackpot Holdings, LLC. The utility-scale solar array will not be located directly at the site of the North Valmy plant, but the array will be sited close by, and will be able to use the existing transmission line that delivers energy from North Valmy coal today.[10]

Portland Gas and Electric was forced to retire the Boardman Coal Plant by the end of 2020 following environmental compliance orders under the Clean Air Act.[11] The utility explored

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[1] Greentech Media. The Navajo Generating Station Coal Plant Officially Powers Down. November 2019.
[2] *Ibid.*
[3] Vox. After decades of activism, the Navajo coal plant has been demolished. December 2020.
[4] azcentral. APS offering $144M to Arizona tribes and others affected by coal plant closures. November 2020.
[5] *Ibid.*
[6] E&E News. https://subscriber.politicopro.com/article/eenews/1063731765. May 2021.
[7] businesswire. https://www.businesswire.com/news/home/20200617005810/en/Xcel-Energy-proposes-one-of-largest-packages-of-energy-investments-in-state-history. June 2020.
[8] Solar or storage has not been common but switcing with natural gas or biomass is relatively available.
[9] *Ibid, page 3.*
[10] Idaho Power. Idaho power invests in clean, affordable solar energy. March 2019.
[11] *Ibid, page 1.*

options for incorporating torrefied biomass as a fuel replacement, running four successful test-burns at the coal site.[1] The replacement plan at Boardman has since been cancelled, but the trend of replacing coal with biomass has been increasing globally. One of the largest coal plants in the United Kingdom, the Drax power plant, is beginning efforts to transition from burning coal to burning biomass, and another coal plant in Denmark has proposed a plan to convert to 100% biomass. Alternatively, China has announced intentions to replace several coal plants with nuclear reactors.[2]

3.3 Redevelopment to Handle Load Pockets or Remote Transmission

Many coal plants are located in areas that are also suitable for redevelopment to handle load pockets or remote transmission. For example, the former Brayton Point coal plant (Figure 3), a four-unit 1,600 MW station on the southern coast of Massachusetts, was retired in 2017. The site quickly became a magnet for redevelopment proposals, partly due to the attractive locational aspects of the site, including transmission capabilities for 2,000 MW of power and access to major infrastructure point Interstate 95 (I-95), and the introduction of the Massachusetts Plant Revitalization Task Force.

Remediation efforts on Brayton Point to date have entailed asbestos and waste abatement, demolishment of the cooling towers, crushing of onsite concrete, recycling of metal demolition debris, and site re-grading. Because of the site's proximity to a planned offshore wind farm 35 miles away, Anbaric Development Partners has announced its intention to build the Anbaric Renewable Energy Center, a logistics hub with a 1,200 MW high-voltage direct current converter and 400 MW of battery storage. The project hopes to maximize the potential of Massachusetts' offshore wind energy resource.[3]

Figure 3 The Brayton Point coal plant site (50 miles from Boston, Massachusetts) is an ideal location for redevelopment, given its access to I-95, proximity to a planned offshore wind farm, and 2,000 MW of transmission capabilities. (Source: MassCEC)

[1] *Ibid.*

[2] BBC. The UK plans to end coal-fired electricity by 2025. August 2018.

[3] Massachusetts Clean Energy Center. Information on the Brayton Point power plant site.

3.4 Repurposing with Other Commercial Activity

Aside from the locational benefits associated with fuel switches and remote transmission, coal plants are often located in areas that can also benefit other commercial activities. With access to railroad, waterways, ports, highways, utility grids, and an existing industrial workforce, commercial development in replacement of the plant can be an attractive option for developers. However, coal plant remediation efforts are costly and lengthy, and commercial developers are usually cautious about accepting the risk associated with cleanup. This gap has been largely filled by development firms that specialize in the cleanup of especially costly sites like coal plants. Commercial Development Company (CDC) and Hilco Redevelopment Partners are examples of firms that target industrial real estate, including power plants, for redevelopment, taking on the risk of remediation and selling the land for development, whether it involves a fuel switch or another commercial activity.

An example of this is the $100 million-plus project taken on by Hilco Redevelopment on the Crawford Power Generating Station outside of Chicago, Illinois.[1] Shuttered in 2012, the facility, located along Interstate 55 and the Ship Canal, was demolished and replaced with 1 million square feet of warehouse space (Figure 4).[2]

Figure 4 Named “Exchange 55,” a distribution center offers a Leadership in Energy and Environmental Design-certified warehouse building, over 1,000 jobs for the surrounding community, and accommodation of rooftop solar panels, electric vehicle charging infrastructure, and green landscaping. (Source: Exchange-55.com)

The owners of both the Widows Creek power station in Alabama[3] and the State Line power plant in Illinois[4] have announced plans to convert the sites into data center locations powered by renewable energy. Similarly, the Cayuga Operating Company has announced a proposal to redevelop the Cayuga coal plant in New York State into a data center location.[5] The Lansing Town Council passed a resolution to establish an advisory committee to oversee the future of

[1] Chicago Tribune. Former Little Village coal plant to be demolished, replaced with distribution center. February 2018.
[2] Exchange 55. A 21st century transformation in Little Village.
[3] The Guardian. Google to convert Alabama coal plant into renewable-powered data center. June 2015.
[4] Energy News Network. Northwest Indiana defunct coal plant slated for massive data center. April 2018.
[5] The Ithaca Voice. Plans in motion to convert Cayuga power plant to data center. May 2019.

the plant, thereby ensuring an open line of communication between community stakeholders and the operating company.[1]

4.0 Costs of Coal Plant Decommissioning

The costs of full decommissioning include expenses related to decommissioning and redevelopment costs. The initial decommissioning costs include asbestos and hazardous material abatement, structural demolition, salvage and scrap recovery, remediation, restoration of the site to a safe condition, engineering project management, and public engagement.[2] For the next stage of redevelopment, the costs could range from those for site planning, acquisition, and new construction to commercial operation. The most substantial costs among these are the costs of closing coal ash facilities.[3]

Once the plant owner decides to decommission a coal plant, financing the plant decommissioning activities is the key next step in the process. The financing mechanisms for coal decommissioning vary across states. These distinctions mainly depend on whether the state has a regulated or deregulated energy market.

4.1 Funding Decommissioning in Regulated Markets

For states that have regulated energy markets (or cost-of-service regions), the decommissioning cost could be transferred to ratepayers depending on the decision of their public service commissions.[4] In these states, the utilities perform a cost estimate for decommissioning the plant in the future and that cost is added into the rate base to generate the funds over time. This process allows plant owners to accrue funds in advance of plant decommissioning, which also protects the state from a company's liability default. This method, however, could lead to ratepayers financing the development, operation, and decommissioning of the plant. To address such scenarios and minimize ratepayer risk and responsibility, states like North Carolina and Nevada have passed laws that regulate the types of decommissioning costs that utilities may (or may not) recoup through rates. For example, in Nevada, utilities are required to develop plans that adhere to a "timely cleanup" and failure to comply with this requirement means the state will withhold the utility's right to recoup decommissioning costs through rates.[5]

4.2 Funding Decommissioning in Deregulated Markets

For states that have deregulated energy markets (or competitive regions), plant owners do not directly recoup decommissioning costs from ratepayers. These companies are expected to plan and incorporate decommissioning costs as part of their cost of doing business and report them as an asset retirement obligation (ARO).[6] An ARO, simply defined as the "obligation associated with the retirement of a tangible long-lived asset,"[7] is part of the annual financial report submitted to the U.S. Securities and Exchange Commission by publicly listed generating

[1] *Ibid, page 4.*
[2] POWER. Coal power plant post-retirement options. September 2016.
[3] S&P Global. Cost questions loom as utilities prepare to close hundreds of coal ash sites. June 2019.
[4] *Ibid, page 1.*
[5] *Ibid, page 1.*
[6] *Ibid, page 1.*
[7] WebCE. Asset Retirement Obligations.

companies. As the EPA regulations on coal combustion residual (CCR) cleanup requirements change and become more stringent,[1] plant owners will adjust their AROs to reflect these changes. The plant owner's estimates of ARO costs are critical to avoiding bankruptcy. For these reasons, in deregulated markets there is an increased chance for a retired plant site to be left idle. For example, in Pennsylvania, plant owners chose the "cold and dark" option instead of investing to decommission[2] the Mitchell Power Station. The plant, located south of Pittsburgh, was closed in 2013 after 65 years of operation. Policy, environmental, and economic factors with resulting costs led to the plant's cessation of operation.

4.3 Funding to Support Decommissioning

Power plants are a significant revenue asset for the local economy in which they operate, and their geographic setting determines their decommissioning options. Pre-existing access to infrastructure—natural gas pipelines, electricity transmission, or other major infrastructure—is a good indicator of whether new generating units are likely to be built at the site. For plant sites in city centers or near other amenities, there is a strong demand for the land. In those cases, there is a higher chance that the site will be revitalized for residential, commercial, or industrial development.

For rural areas and locations where land is not as limited or at the same premium, the incentive for decommissioning and remediation is minimal, and facilities tend to sit idle for longer periods. This is especially true in rural areas under deregulated markets where decommissioning costs are the responsibility of the plant owner. In such cases, the plant owner (or the shareholders) could choose to go "cold and dark" because the return on investment from decommissioning is negligible. Local fiscal implications of idled facilities are substantial for rural areas, because large power plants make up a sizable portion of the local economy.[3]

Federal, state, and local governments offer various incentives for redeveloping plant sites. For example, in 2017, the EPA's Brownfields and Land Revitalization program provided grants and technical assistance amounting to $59 million in decommissioning process support for local governments.[4,5] At the local level, the City of Baltimore offers a city property tax rate reduction for redeveloping a plant site.[6] There are also state-level efforts designed to address the impacts of the energy transition process, especially as it relates to communities affected by these changes. State-level policies can be organized into a set of responsive strategies: transition planning, fund development, worker protections, and requirements for new development. [7]

4.4 Communities and Decommissioning

Communities may have a sense of connection with plant facilities because large power plants have a symbolic meaning to the place, which leads to a sense of loss in these communities as

[1] U.S. EPA. Disposal of coal combustion residuals from electric utilities rulemakings.
[2] AP News. As coal-fired power plants switch off, new businesses sought. April 2018.
[3] *Ibid, page 1.*
[4] U.S. EPA. Brownfields grant fact sheet.
[5] *Ibid, page 1.*
[6] Baltimore Development Corporation. Brownfields tax credit.
[7] UNC Center for Climate, Energy, Environment and Economics. Communities in transition: State responses to energy-sector job losses. December 2019.

plants are retired.[1] In Adams County, Ohio, the closure of the Stuart and Killen plants was a loss for the surrounding communities. For some who built and worked at the facilities, the power plants were a reflection or representation of their contribution to their community.[2] In addition, if retired plants are not repurposed with quality job-creating activity, the associated workforce might be jobless during the transition. For regions with idled power plants, there is the added burden of decreased property values.[3]

4.4.1 Worker Compensation and Workforce Development

Various worker compensation and workforce development resources exist for those negatively affected by the coal power plant decommissioning process and the subsequent job losses. The Partnerships for Opportunity Workforce and Economic Revitalization (POWER) grant program is an example of an initiative at the federal level that invests in workers and jobs to address legacy costs in coal communities.[4] In 2016, 11 federal agencies including the U.S. Department of Energy's Jobs Strategy Council participated in and allocated resources to the POWER initiative. A similar program is the Economic Development Administration's Assistance to Coal Communities (ACC) program, which has awarded $30 million to support 35 projects in 16 states. The awarded projects are locally driven efforts to create programs that support job creation, capital investment, economic diversification, workforce development, and re-employment opportunities.[5]

In addition to federal support for worker compensation and workforce development, community-led programs can fill gaps felt in the workforce caused by plant closures. One example is the $55 million Centralia Coal Transition Fund supported by TransAlta that was an outcome of a collaboration with environmental groups, the state, and community groups.[6] The investment is designed to fund businesses, nonprofit organizations, and local governments in Washington State. The fund supports weatherization, economic and community development, and energy technology development projects. Most notably, the economic and community development fund provides up to $20 million for projects that retrain workers and enhance economic opportunities, with a special emphasis on communities that have recent, or are soon to have, coal plant closures.[7] Operating utilities or plant owners may also financially aid communities in worker compensation efforts, like the Arizona Public Service payout to Navajo workers after the Navajo Generation Station closure, as described in Section 3.

4.4.2 Community Entities Designed to Oversee Decommissioning

As described in Section 3, the Lansing Town Council has appointed an advisory board to oversee the decommissioning of the Cayuga Coal Plant in order to engage community stakeholders in decision-making processes. Similarly, the Fisk and Crawford Reuse Taskforce was created in Chicago to gather community input and devise a shared vision for the

[1] The Washington Post. In small towns across the nation, the death of a coal plant leaves an unmistakable void. March 2019.
[2] CNN Politics. Small Ohio town counts on Trump to stave off plant closures. February 2017.
[3] U.S. EPA. Building vibrant communities: Community benefits of land revitalization. October 2009.
[4] World Resources Institute. Steps to aid US fossil fuel workers in the clean energy transition. January 2021.
[5] U.S. EDA. Assistance to coal communities (ACC). October 2017.
[6] NW Energy Coalition. How a community, a company, and environmental groups are building the future. November 2018.
[7] Centralia Coal Transition Grants. Economic and community development.

redevelopment of the Fisk coal plant site in Pilsen and the Crawford coal plant site in Little Village.[1] The Little Village Environmental Organization and Pilsen Environmental Rights and Reform Organization community groups advocated for the closure of the plants and led the efforts in devising the Task Force's Guiding Principles.[2] Community-led decommissioning requires meaningful engagement with community and place-based organizations. Such collaboration is likely to lead to the best outcome for all involved. The key learnings from the Task Force's guiding principles include the following:

- Broad-based stakeholder input on the redevelopment of the sites should be encouraged.
- During site redevelopment, pollution and waste should be minimized, with an emphasis on sustainability.
- Redevelopment should create quality, living-wage jobs for residents of the communities.
- Potential sources of public and private resources for reclamation and redevelopment should be identified early and actively pursued.
- Parties involved in future redevelopment should be aware of what the communities prefer as replacement assets for the sites.

5.0 Conclusions

Coal-fired power plants across the United States are retiring at gigawatt scales, and the pace of plant decommissioning is accelerating.[3] This report highlights the drivers and common options for the decommissioning and repurposing of coal power plant sites, whether driven by policy and regulations, competition with other fuels, or stakeholder pressure. An overview of the types of plant decommissioning is provided, along with the associated processes and costs related to regulated and deregulated markets, and sources of funding for decommissioning.

In addition to the need for uniform data on plant decommissioning efforts, the effects of decommissioning on the communities in which the plants to be retired are located give rise to needs for workforce and economic redevelopment. The analysis found that coal-dependent communities have limited-to-no role in plant decommissioning processes. They do not know what and how the energy transition future will unfold for their local economy and livelihoods. Hence, best practices for equitable decommissioning of plants might be needed to guide the process. Decommissioning processes are expected to be enhanced by experience, lessons learned, and insights increasingly gained in the field.

Future research areas in this field may include a more comprehensive tracking system surrounding coal plant decommissioning, planned and post decommissioned sites, and redevelopment. This can foster understanding of the scope of the communities affected by retired plants and can initiate further study of the effects of those retirements. In addition, research can support in identifying best practices in engaging with community stakeholders about coal plant decommissioning plans and economic transition.

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[1] Pace University School of Law. Transition support mechanisms for communities facing full or partial coal power plant retirement. March 2017.
[2] Fisk & Crawford Reuse Task Force. Fisk and Crawford Generating Stations: Process, principles and recommendations. September 2012.
[3] Interagency Working Group. Initial Report to the President on Empowering Workers Through Revitalizing Energy Communities. April 2021.

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