Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

The Future of the Martin Drake Power Plant

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A Report for Green Cities Coalition and

Southeastern Colorado Renewable Energy Society

Executive Summary

This report was commissioned by Green Cities Coalition and Southeastern Colorado Renewable Energy Society to inform decision-making regarding the Martin Drake Power Plant in Colorado Springs. The Colorado Springs City Council has ordered that Martin Drake units 6 and 7 should be decommissioned no later than December 31, 2035, and that it would consider earlier dates. In response, Colorado Springs Utilities (CSU) is evaluating 2025 or 2030 decommissioning for units 6 and 7. Based on the information available to us, we conclude that the Colorado Springs Utilities Board should consider Martin Drake for decommissioning earlier than 2035—and certainly prior to making large capital investments in the plant. Our conclusion is based on the following findings:

- **Martin Drake is highly inefficient and struggling to compete on cost.** Low natural gas prices and the declining cost of renewable energy have significantly hampered the competitiveness of coal throughout the United States—and Martin Drake is no exception. Its operating costs are also likely to increase in the future, relative to other energy resources.

- **Martin Drake will struggle more if it must compete with a larger pool of low-cost resources.** Joining the Southwest Power Pool (SPP)—a large wholesale, low-cost energy market—will likely lower costs for Colorado Springs residents. However, Martin Drake would probably be operated less often under this new regime.

- **CSU should properly evaluate low-cost, low-risk alternatives to continuing to operate Martin Drake.** CSU's November 2017 analysis showed higher costs for retiring the units earlier than 2035. However, key assumptions leading to this conclusion are not transparent. CSU's proposed alternatives to Martin Drake rely on new natural gas generation and exclude low-cost renewable energy. A neighboring utility (Xcel) with more efficient coal units than Martin Drake found a new wind farm to be the most cost-effective investment.

- **Decommissioning the plant would not put reliable electric service at risk.** CSU has plenty of time to plan for transmission upgrades and is already planning upgrades regardless of the plant's future.

- **Martin Drake's location within Colorado Springs is cause for grave concern.** The plant continues to emit harmful pollutants, particularly affecting the economically disadvantaged population in its immediate vicinity.

The conclusions made in this report are limited by their reliance on publicly available data; while CSU is owned by the Colorado Springs community, it did not make critical documents available for review—such as the actual operating costs of the individual units. CSU should be open and transparent with the methodology and assumptions used in its analysis. Colorado Springs residents—the owners of CSU—should be able to participate in the process and exert influence over how the analysis is being done, and should be provided with all data and documentation related to the analysis.

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1. Introduction

This report was commissioned by Green Cities Coalition and Southeastern Colorado Renewable Energy Society to inform the Colorado Springs City Council's decision-making regarding the Martin Drake Power Plant. The plant is operated by the community-owned Colorado Springs Utilities (CSU) and regulated by the Colorado Springs City Council in their additional role of Colorado Springs Utilities Board. Martin Drake has two coal-fired units currently operating, unit 6 (77 MW) and unit 7 (131 MW), built in 1968 and 1974, respectively. Drake Unit 5 (51 MW), built in 1962, was retired in 2016.

A critical decision point is approaching that will determine the future of Martin Drake's remaining units. In reviewing CSU's most recent electric integrated resource plan (EIRP), the City Council stipulated that Martin Drake units 6 and 7 should be decommissioned no later than December 31, 2035, and that it would consider earlier dates than 2035. In response, CSU is evaluating 2025 and 2030 decommissioning for units 6 and 7.

The conclusions made in this report rely on publicly available data. We conclude that Martin Drake should be considered for decommissioning before 2035—and certainly prior to making large capital investments in the plant. We demonstrate that Martin Drake will be less competitive in the future and discuss lower-cost alternatives to burning coal on-site. Finally, we discuss health and emissions impacts that would be avoided if the plant were to cease burning coal.

The Applied Economics Clinic (AEC) is a non-profit consulting group housed at Tufts University. AEC provides expert testimony, analysis, modeling, policy briefs and reports for public interest groups on the topics of energy, environment, consumer protection, and equity. AEC has four professional staff with a combined professional experience of more than 45 years working on these issues, each specializing in economic analyses.

2. Transparency

In conducting this study, we made several Colorado Open Records Act (CORA) requests to CSU. Responses by CSU to these CORA Requests were not provided within required deadlines and were incomplete. For example, CSU did not provide a breakdown of fixed and variable operations and maintenance (O&M) costs for the Martin Drake units. These costs are important to determining the economic viability of the plant and comparing its costs to those of other resources.

The authors of this report have evaluated many coal plants across the United States. In its response to our CORA requests, CSU claimed that it could not provide O&M information on a unit basis "as it would place the company at a competitive disadvantage" – meaning that the company does not want competitors to see it. The information requested is standard data, and such documentation is typically provided publicly or through a confidentiality agreement by the utility. In this way, essential third-party review can and does occur to protect the public interest without risk to owners. CSU is a community-owned utility that does not have direct competition. Colorado Springs residents—the owners of Martin Drake—should expect more (not less) transparency than that commonly provided by investor-owned power plants throughout the United States. These

residents should be privy to key information on how Martin Drake and CSU are operated.

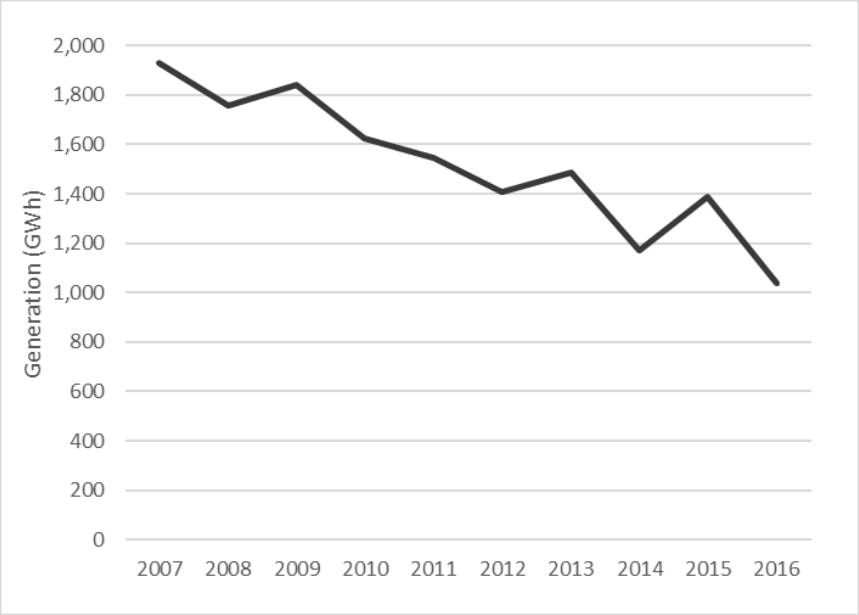
3. Current and Future Economics of Martin Drake

In recent years, the competitiveness of Martin Drake has changed with new market conditions and the installation of environmental controls. Soon, the possibility of joining a large wholesale energy market could significantly change how and when CSU's generating units are operated.

Coal generation is struggling to compete on cost and will likely continue to struggle

The Martin Drake plant includes unit 6 (77 MW) and unit 7 (131 MW), built in 1968 and 1974, respectively. Over the last ten years, the amount of electricity provided by Martin Drake to Colorado Springs shrunk—as shown in Figure 1. In 2016, the plant produced about half what it produced in 2007. In 2007, the plant provided 42 percent of Colorado Springs' total energy needs where it now provides 23 percent.[1] There was a decrease in generation in 2014 due to an unplanned outage caused by a fire. There was also a notable decrease in 2016 due to unit 5 ceasing operation in March of that year. Even without these events, however, the plant's generation has been trending downward. Generation at the three units decreased by 28 percent from 2007 to 2015.

Figure 1: Martin Drake Annual Generation (GWh)



Source: EIA 923 Report

Utilities select which generating units to operate based on their costs: the cheapest generators to operate run frequently while the most expensive units only operate during periods of high customer

[1] EIA, 861 sales. Available at: https://www.eia.gov/electricity/data/eia861/

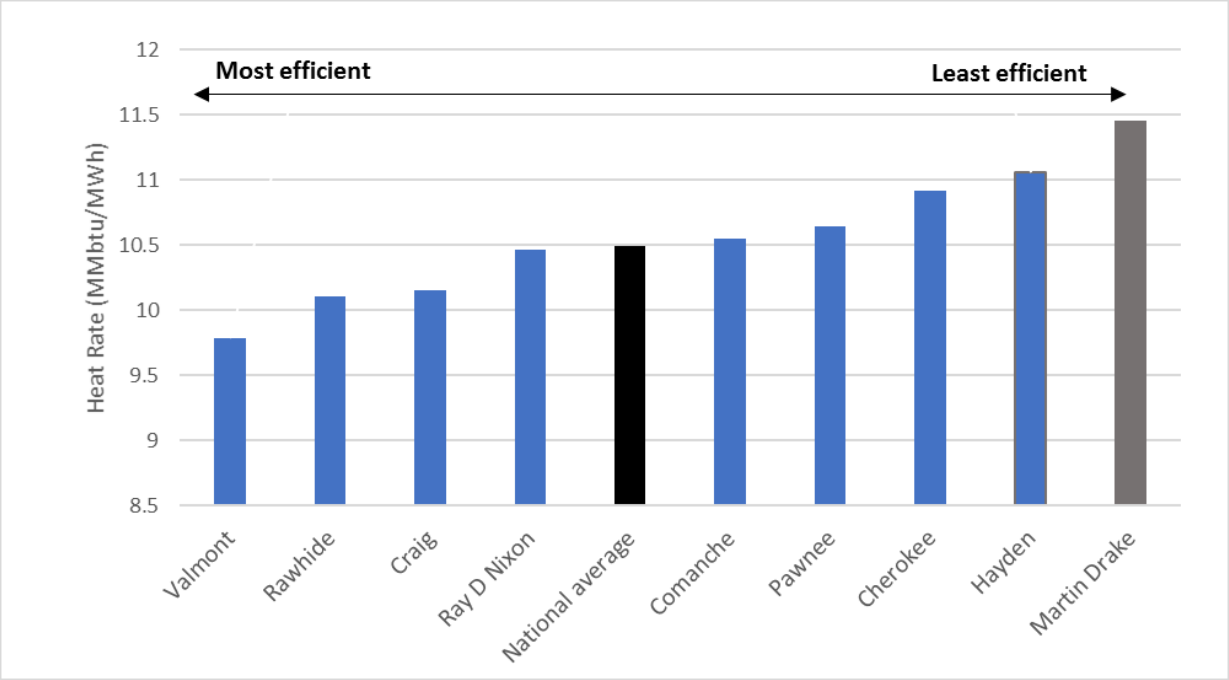
demand for electricity. This method of choosing which units to "dispatch" first—called "economic dispatch"—assures the lowest costs for customers. If CSU is operating its plants according to this principle, Martin Drake must be costlier to run than other resources at CSU's disposal—including other generation it owns and purchases from. If Martin Drake were inexpensive to run, CSU would run the plant more frequently—as it did in the past. Martin Drake's higher costs in comparison to other CSU resources must explain why the plant has become of diminishing importance to CSU's system.

One reason Martin Drake is more costly than other resources is that it is highly inefficient. Plant efficiency is measured by a plant's "heat rate" which quantifies how much heat (in million British Thermal Units or MMBtu) is required to generate a unit of electricity (megawatt-hour or MWh). Martin Drake's heat rate thus far in 2017 is 11.53 MMBtu per MWh. In 2016, the plant's heat rate was 11.47 MMBtu per MWh.[2] The heat rate of coal plants in Colorado is shown below in Figure 2. Martin Drake is clearly the least efficient coal plant in the state. This means that—with all else being equal—Martin Drake requires much more coal to generate the same amount of electricity as other coal plants in Colorado. Nationally, the average heat rate for a coal unit is 10.5 MMBtu per MWh—meaning that Drake requires 9 to 10 percent more fuel than a typical coal unit to generate the same amount of electricity.[3] The extra fuel needed to produce each MWh of electricity makes Martin Drake more expensive to operate.

[2] EIA plant level data. Available at: https://www.eia.gov/electricity/data/browser/

[3] EIA, Table 8.1. Average Operating Heat Rate for Selected Energy Sources. Available at: https://www.eia.gov/electricity/annual/html/epa_08_01.html

Figure 2: Efficiency of Coal Plants in Colorado in 2016 (heat rate in MMBtu/MWh)

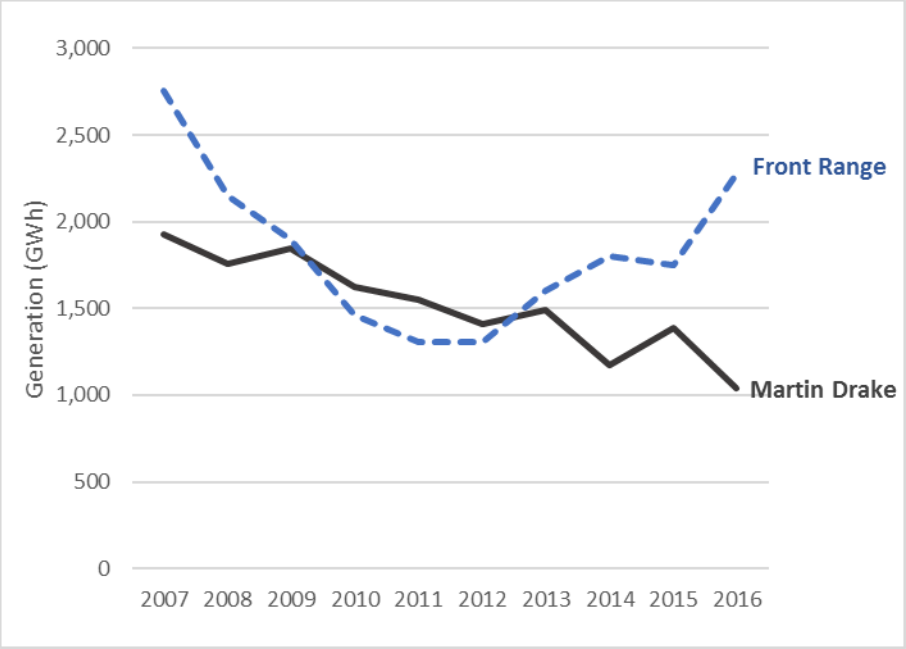


Source: 2016 EIA plant level data (https://www.eia.gov/electricity/data/browser/); National average is from 2015 EIA data (https://www.eia.gov/electricity/annual/html/epa_08_01.html)

Not only is Martin Drake less efficient than other Colorado coal generation, even more efficient coal plants throughout the United States are struggling to compete on cost with natural gas and renewable generation. The price of natural gas has been low since 2012 and futures markets expect these low prices to continue at least through 2020.[4] CSU's one combined-cycle natural gas plant, Front Range, has increased its output in recent years—as Martin Drake's output has declined (see Figure 1). In 2010, CSU acquired full control of Front Range and due to low natural gas prices in the past several years, it has contributed far more than Martin Drake to CSU's energy needs. Again, if CSU is using the principle of economic dispatch to save customers money, Front Range's generating costs must be lower than that of Martin Drake.

[4] NYMEX natural gas futures from November 20, 2017 included Henry Hub prices of $3.04 in 2018, $2.92 in 2019, and $2.87 in 2020. Available at: http://www.cmegroup.com/trading/energy/natural-gas/natural-gas.html

Figure 3: Martin Drake and Front Range Annual Generation (GWh)



Source: 2016 EIA plant level data (https://www.eia.gov/electricity/data/browser/)

The costs of renewable energy—particularly solar and wind—have fallen over time and are expected to continue to do so.[5] Moody's Investor Services has found that "wind power economics are driving coal generation up the dispatch curve and into earlier retirement" and that "around 56 gigawatts of regulated coal-fired capacity in the Midwest has operating costs that are higher than the all-in costs of new wind power."[6] Utilities are certainly aware of this trend, including those operating in the Mountain West. For example, Xcel is currently building a 600 MW Rush Creek Wind Project not far from Colorado Springs.[7] Xcel predicts that the variable costs of its coal units (variable O&M and fuel) will be between $21 and $23 per MWh for the years 2019 through 2025.[8] All five of Xcel's coal units in Colorado (Cherokee, Comanche, Hayden, Pawnee, and Valmont) are more fuel-efficient than Martin Drake—see Figure 2. Thus, they are likely cheaper to operate than Martin Drake. Xcel found that investing in the new wind farm would save ratepayers between $213

[5] National Renewable Energy Laboratory (NREL). *2017 Annual Technology Baseline*. 2030 Current Market Conditions. Available at: https://atb.nrel.gov/electricity/2017/summary.html

[6] Walton, Robert. Utility Dive. "Moody's: Falling wind energy costs threaten Midwestern coal plants." March 23, 2017. Available at: https://www.utilitydive.com/news/moodys-falling-wind-energy-costs-threaten-midwestern-coal-plants/438759/

[7] Mortenson. "Mortenson to Build Largest Single-Phase Wind Project in North America". March 8, 2017. Available at: http://www.mortenson.com/company/news-and-insights/2017/mortenson-to-build-largest-single-phase-wind-project-in-north-america

[8] Direct Testimony of James Hill. Colorado Public Utilities Commission. Proceeding 16A-0117E. p.55. Available at: https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/CO-Rush-Creek-Direct-Testimony-of-Jim-Hill.pdf

million and $744 million, depending on the scenario, over a 40-year period.[9] Most of these savings came from "avoided fuel and Variable Operations and Maintenance ("VOM") costs from coal and gas-fired units."[10] Xcel found that this investment would save ratepayers substantial money, even under a future with low natural gas prices.

Market trends have significantly hampered the competitiveness of coal throughout the United States—and Martin Drake is no exception. The operating costs of the plant are likely to increase in the future, relative to other energy resources. CSU expects the costs of its coal from the Powder River Basin (PRB) to grow in coming years.[11] The latest forecast of PRB coal from the Energy Information Administration (EIA) is consistent with CSU's forecast trend: EIA shows these prices rising by 10 percent from 2016 to 2020 (over and above inflation) and expects prices to continue to outpace inflation in subsequent years.[12]

CSU analyzed Martin Drake in its 2016 Electric Integrated Resource Plan (EIRP). After running many scenarios and portfolios, CSU concluded:

> *While still more costly than keeping the units online, the most economical option was a phased decommissioning schedule with Drake 5 in 2018, Drake 6 in 2023, and Drake 7 in 2029.*[13]

It is unclear, however, whether it is still "the most economical option" to keep these units running given changes in market conditions since this analysis was conducted. CSU made its EIRP determination by weighting scenarios with high natural gas prices, high demand, and high energy market prices more heavily than other scenarios.[14] This creates results that are biased towards keeping Martin Drake operating. In recent years, Colorado (and most of the nation) has seen low natural gas prices, low demand and low energy prices. CSU also included a list of arbitrary criteria (e.g. "intangible considerations") in its decision-making.[15] The composition of these criteria was also weighted arbitrarily. For instance, "societal benefits"—such as health impacts of emissions—were weighted less than "transmission reliance" and "portfolio diversity." Market conditions for Martin Drake have worsened since the EIRP. CSU could be expected to recommend earlier retirement of these units using reasonable assumptions and methodology.

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[9] *Id.* p.5

[10] *Id.* p.78

[11] CSU. Electric Cost Adjustment (ECA) and Gas Cost Adjustment (GCA) and Electric Capacity Charge (ECC) and Gas Capacity Charge GCC). October 17, 2017. p.3.

[12] EIA 2017 Annual Energy Outlook, Power River Basin ($2016 per short ton). Available at: https://www.eia.gov/outlooks/aeo/

[13] CSU 2016 EIRP, p. viii

[14] *Id*. p.43

[15] *Id.*

The addition of emissions controls makes the plant less competitive

In 2016, CSU installed flue gas desulfurization (FGD) or "scrubbers" on Martin Drake to reduce SO_2 emissions for a capital cost of $174 million.[16] In the preliminary cost assessment, CSU underestimated scrubbers' capital costs by $44 million. The cost to purchase and finance the scrubbers will impact residents' bills for many years to come. In addition, the scrubbers have operating costs, which make Martin Drake more expensive to run. In their 2016 EIRP analysis, CSU predicted that the fixed O&M cost of the scrubbers (one component of total operating costs) would be about $850,000 per year for Unit 6 and slightly over $1 million a year for Unit 7.[17]

For every megawatt hour the scrubbers operate, it incurs variable O&M costs. The 2016 EIRP predicted these costs to be $1.58 per MWh for Unit 6 and $1.46 per MWh for Unit 7. We are unable to assess the actual scrubbers' operating costs as we were not provided this data, nor do we have data on the scrubber's operations in a typical year.[18] However, the operating costs of the scrubbers are new costs that will make the units less competitive with respect to natural gas and renewable generation. The plant is also installing ultra-low NOx burners for controlling nitrogen oxide emissions. The plant's O&M costs in 2016 were $21.5 million.[19] If it were decommissioned additional variable and fixed O&M for the plant, including running the scrubbers and ultra-low NOx burners, would be avoided.

"Sunk" capital costs are not a good reason to keep operating a power plant

Prudent utilities cannot and do not protect customers' interests by tying themselves to "sunk" investments that are too late to change. It is a common fallacy that because investments have already been made on a plant, customers' bills will be lower if it is kept in operation. An example from outside of the utility world is when you decide to keep investing in an old, unreliable car because you have put a lot of money into the car in the past. It may be cheaper to buy a new car, even though you have invested time and money into the old one.

The large investments that have been recently made in Martin Drake do not preclude the option of decommissioning the plant. This decision must be made by comparing the costs of owning and operating the plant going forward versus other alternatives. To best serve the interests of Colorado Springs residents, CSU and the Utilities Board/City Council should ignore sunk costs. Capital already invested in Martin Drake, like the recently installed SO_2 scrubbers, cannot be reversed or

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[16] CSU response to CORA request. Document entitled "September_Close_Project_Costs".

[17] CSU response to CORA request. Document entitled "ESD_-_Environmental_Input_Cost_Methodology_2016".

[18] In its response to requests for actual scrubbers' costs, CSU noted that: "…the records provided reflect the best information Utilities currently has with respect to operating expenses for the scrubbers, but the data underlying these records was generated during a period of time where Utilities was testing, commissioning, and fine tuning of the scrubbers and may not be reflective of normal operating conditions." They also stated that "CSU will be reporting scrubber-related operating costs for the first time when it files its 2017 EIA reports in 2018."

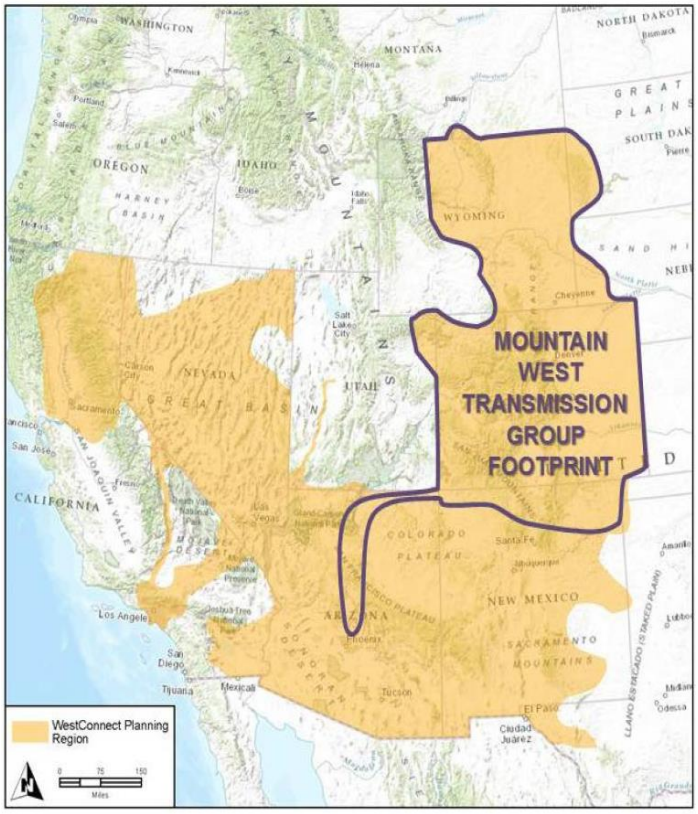
[19] CSU response to CORA request. Document entitled "2016 Energy Supply 4-blocker". Information was not provided at the unit-level and did not distinguish between fixed and variable O&M.

erased. Decisions should be made based on costs going forward.

A larger wholesale electricity market will make it even harder for Martin Drake to compete

CSU is in discussions with utilities serving Arizona, Colorado, Montana, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Utah and Wyoming—called the Mountain West Transmission Group (MWTG)—about forming a Regional Transmission Organization (RTO).[20] The geographic footprint of this group is shown in Figure 4 below.

Figure 4: Map of Proposed Regional Transmission Organization



Source: Reproduced from Chang et al, "Production Cost Savings Offered by Regional Transmission and a Regional Market in the Mountain West Transmission Group Footprint"

If this group joins together as an RTO, CSU would be part of a larger wholesale energy market, making it easier to sell and purchase power. Forming the RTO would also mean that CSU's units, including Martin Drake, would be dispatched by the RTO rather than by CSU. According to the MWTG (of which CSU is a member):

[20] This group includes: CSU, Basin Electric Power Cooperative, Black Hills Corporation, Platte River Power Authority, Public Service Company of Colorado, Tri-State Generation and Transmission Cooperative, and Western Area Power Administration's Loveland Area Projects and Colorado River Storage Project.

> *Savings from operating in a RTO market typically come from the economy of scale in centralized generation unit commitment and energy dispatch. Rather than multiple individual utilities optimizing generation dispatch across their disparate systems, generation dispatch is optimized for the entire system as if it were a single utility system.*[21]

As part of MWTG, Martin Drake would compete not only with CSU's Front Range, but with generators throughout the region—such as more-efficient coal plants (see Figure 2) and other low-cost resource types. CSU customers will have access to lower cost power and are likely to benefit from this arrangement. A Brattle Group study of the costs of forming the MWTG concluded:

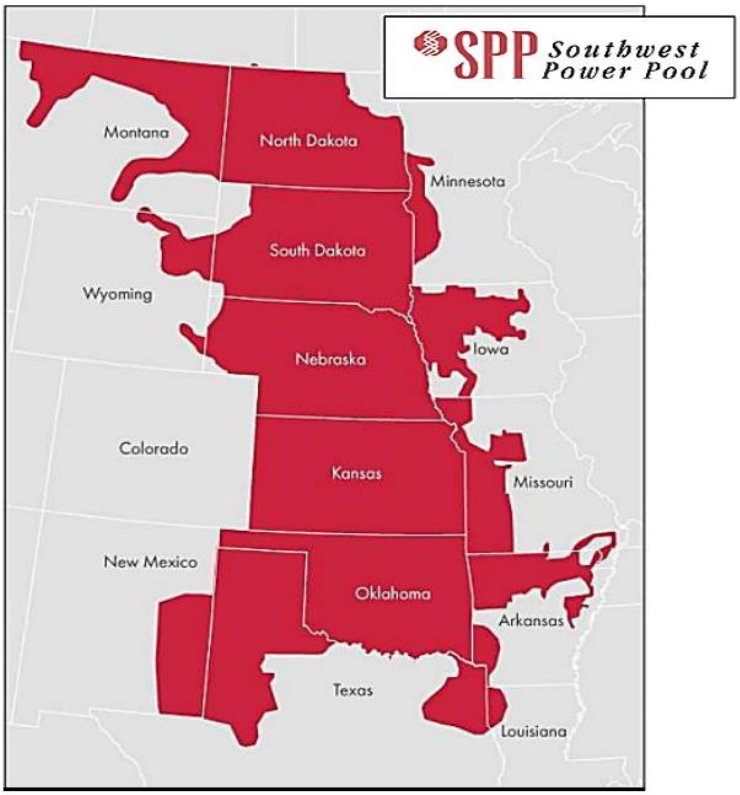
> *The implementation of a regional market will increase efficiency in generation commitment and dispatch, resulting in more generation output from resources with lower costs, including the costs associated with start-ups and operating subject to minimum generation. At the low natural gas prices currently witnessed in the marketplace (and replicated in the model assumptions), moving from the Status Quo (2016 Case A) to a Regional Market (2016 Case C), the Mountain West region would produce less power from the region's coal plants and more from gas-fired generation.*[22]

The study commissioned by CSU and other utilities found that customers would save on costs through the formation of the RTO because coal would be called on less often and natural gas would produce more often. The more often units dispatch, the easier it is for them to recover fixed and capital costs as well, because they are making more in wholesale energy revenue. The Brattle Group report does not specify which units would operate less frequently. An RTO like MWTG, however, would decide on which units to operate based on economic dispatch and there are many lower cost power plants that would be dispatched before Martin Drake. Moreover, since the analysis of the new RTO was released in 2016, MWTG has pursued integration with an existing RTO, the Southwest Power Pool (SPP)—shown in
Figure 5.

[21] Mountain West Transmission Group. Frequently Asked Questions (Updated through September of 2017). Available at: https://www.wapa.gov/About/keytopics/Documents/mountain-west-faq.pdf

[22] Chang, Judy et al. 2016. *Production Cost Savings Offered by Regional Transmission and a Regional Market in the Mountain West Transmission Group Footprint.* December 1, 2016. Available at: https://www.wapa.gov/About/keytopics/Documents/mountain-west-brattle-report.pdf

Figure 5: Map of Southwest Power Pool

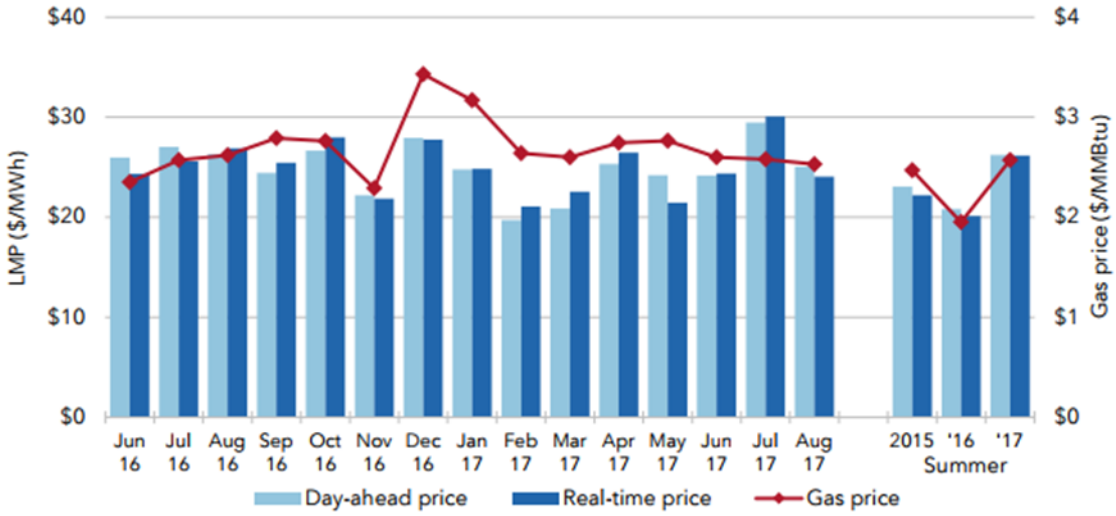


Source: Reproduced from SPP

CSU and other MWTG utilities have been actively planning with SPP, targeting a "go-live" date for this new, larger RTO of October 2019.[23] The combined MWTG-SPP RTO would be a much larger market than the initial RTO proposed by MWTG. It would have more than 100 GW of generating capacity—compared with 21 GW for the MWTG or the 1 GW system currently operated by CSU alone. The SPP region currently has low natural gas prices and a low wholesale price of electricity, as shown below in Figure 6.

[23] Mountain West Transmission Group. Frequently Asked Questions (Updated through September of 2017). Available at: https://www.wapa.gov/About/keytopics/Documents/mountain-west-faq.pdf

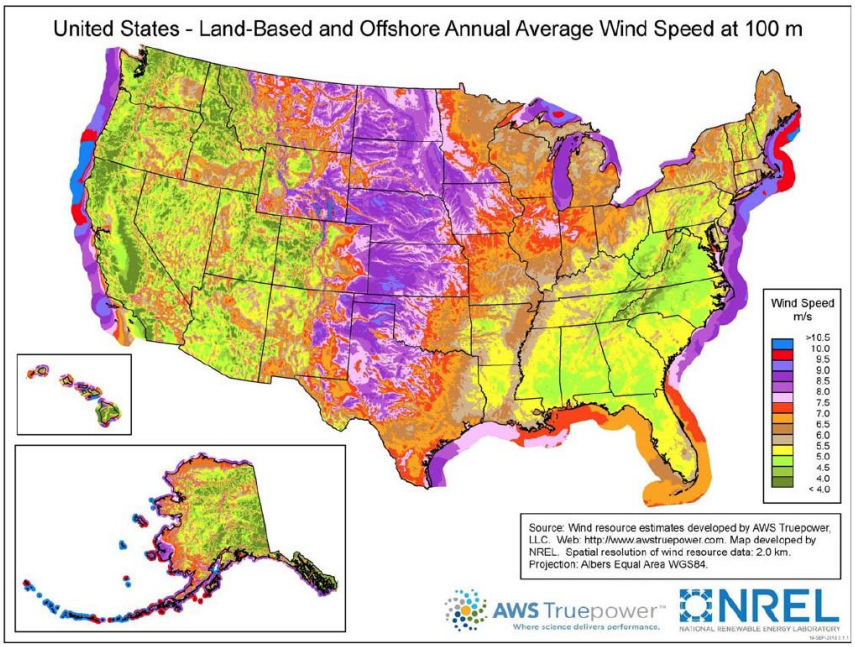
Figure 6: Southwest Power Pool (SPP) Natural Gas and Energy Prices



Source: SPP State of the Market Summer 2017

While SPP's low natural gas prices contribute to its low wholesale energy prices, the region also contains some of the best wind resources in the United States—shown below in Figure 7. The purple and blue colors in this figure indicate high wind speeds in the middle of the country, an area that corresponds closely with the SPP territory shown above in
Figure 5.

Figure 7: Wind Resource in the United States



Source: National Renewable Energy Laboratory (NREL)

Once wind resources are built, the marginal cost to operate them is close to zero. More wind on the system suppresses energy prices across the board. According to SPP:

> *Lower prices are more prevalent in the north due to less expensive generation in the area, and in the west-central part of the footprint due to abundant low-cost wind generation in that area.*[24]

The region has also improved its integration of wind resources. Bruce Rew, Vice President of Operations for SPP, stated that:

> *Now we have the ability to reliably manage greater than 50 percent [wind penetration]. It's not even our ceiling. We continue to study even higher levels of renewable, variable generation as part of our plans to maintain a reliable and economic grid of the future.*[25]

Integration of SPP with MWTG will allow Colorado Springs to access far more low-cost wind than when supplied by CSU alone. Indeed, a study on the integration of MWTG with SPP found "a significant level of benefits" for the two regions "ranging from $11.7 million to $28.8 million" in energy cost savings for one year.[26] Regarding the future of Martin Drake under a wholesale energy market regime, CSU stated that:

> *In the next several years, changes in the industry like the Mountain West Transmission Group (MWTG) effort may significantly change assumptions and drive certain alternatives to the top.*[27]

Martin Drake's future economics will rely on how it can compete under a much larger, more cost-competitive marketplace. It CSU has not analyzed Martin Drake under such a future, it certainly should do so going forward.

4. Alternatives to Martin Drake

CSU is currently conducting an analysis of alternatives to the plant, including the potential for decommissioning the plant in 2025 and 2030. The reasoning behind the choice of these retirement dates is unclear. To select retirement dates that will provide the greatest benefits to Colorado Springs residents, CSU should:

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[24] SPP. *State of the Market Summer 2017*. Available at: https://www.spp.org/documents/54958/spp_mmu_qsom_summer_2017.pdf

[25] Hunt, Hannah. 2017. "Strong winds blow away records across the U.S." November 7, 2017. Available at: http://www.aweablog.org/strong-winds-blow-away-records-across-u-s/

[26] The Glarus Group. *Mountain West Transmission Group – Southwest Power Pool DC Intertie Value Study*. p. 23. Available at: https://www.wapa.gov/About/keytopics/Documents/mountain-west-spp-dc-intertie-value-study.pdf

[27] December 2016 Board Meeting minutes, p.120

1. **Re-evaluate frequently:** The decision of when and how to replace the operation of a large capital assets should be evaluated frequently. It is possible that retiring Martin Drake much earlier could be advantageous.

2. **Account for the changing market landscape:** Joining a large wholesale, low-cost energy market will likely lower costs for Colorado Springs residents, in part because Martin Drake will be operated less often. CSU should conduct, and make publicly available, an analysis of Martin Drake's future in the context of CSU joining a MWTG-SPP market.

3. **Facilitate public review:** CSU should be open and transparent with the methodology and assumptions being used in its analysis. Colorado Springs residents—the owners of CSU—should be able to participate in the process and exert influence over how the analysis is being done during the process and should be provided with all data and documentation related to the analysis.

Transmission improvements (if needed) are an alternative to generation

CSU has claimed that significant transmission investment would be needed if the remaining Martin Drake units were to be decommissioned[28] and has put forth various estimates of these transmission costs. In December 2016, CSU presented a range of transmission and replacement alternatives from $4 million to $79 million together with the following caveats:

- Transmission investments may be required for reliability in any scenario, meaning that the $4 million to $79 cost may be necessary whether Martin Drake retires or not.

- Transmission costs could be delayed by operating the Birdsall gas and oil generator, which is typically called upon during times of high demand.[29]

These costs cannot be attributed solely to the loss of Martin Drake. The degree to which transmission investments are contingent on Martin Drake's retirement should be made abundantly clear in future analyses. If regulation of voltage on the grid is a concern, then static VAR compensators (SVCs) and synchronous condensers could provide this service. The latter have been used in areas of high population after large generator retirements, such as in southern California after retiring the San Onofre nuclear plant[30] and outside of Cleveland after retiring the East Lake coal plant.[31]

It is unclear how necessary Martin Drake is for electric reliability in Colorado Springs. Although, this

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[28] CSU. Memo to Utilities Board. December 12, 2016.

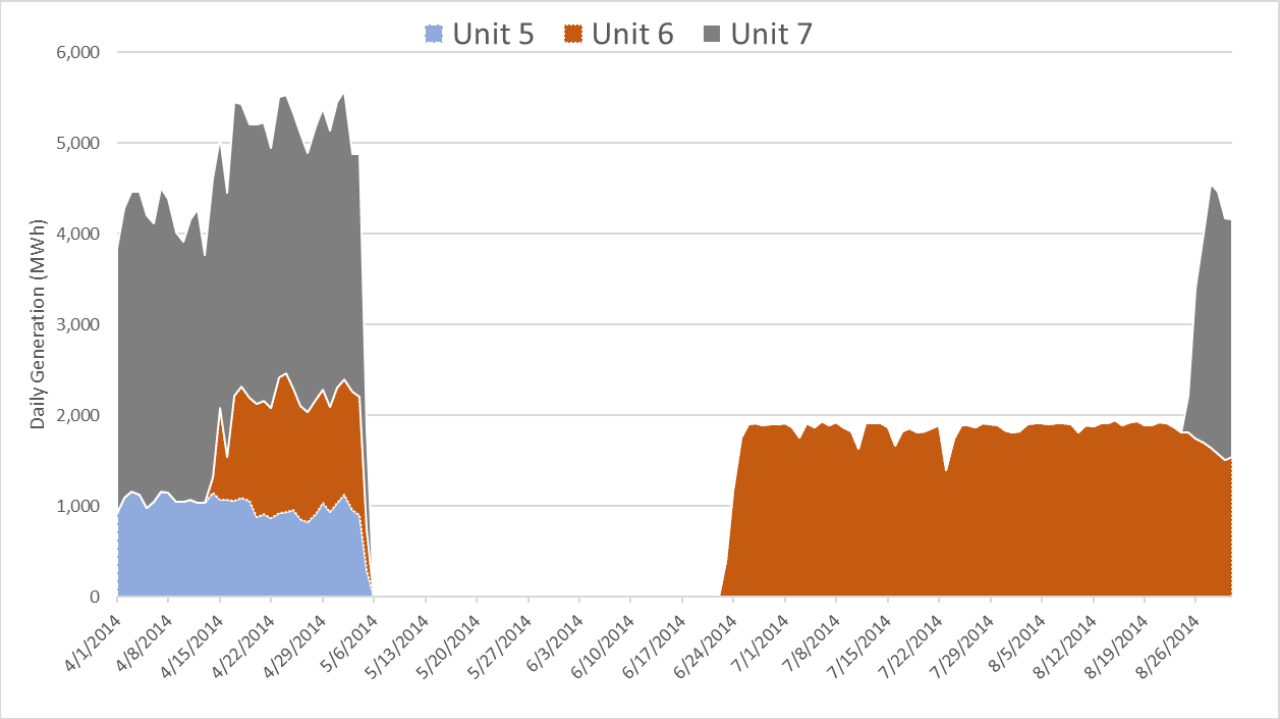
[29] CSU. Drake Decommissioning Updates. December 12, 2016.

[30] Davidson, Chris and Weikko Wirta. 2014. "AES Uses Synchronous Condensers for Grid Balancing". Power Magazine. March 1, 2014. Available at: http://www.powermag.com/aes-uses-synchronous-condensers-for-grid-balancing/

[31] EIA. 2013. "Transmission upgrades compensate for coal-fired retirements in Ohio electric region". September 3, 2013. Available at: https://www.eia.gov/todayinenergy/detail.php?id=12791

was tested inadvertently in the Spring and Summer of 2014 when units 5, 6, and 7 were out of commission for a month and a half—see Figure 8. Unit 7 was out for three and a half months total and unit 5 did not come back on-line until early 2015.

Figure 8: 2014 Forced Outage at Martin Drake



Source: EPA Air Markets Program Data (https://ampd.epa.gov/ampd/)

The sudden shut down of these units caused a brief outage for 22,000 customers, however, replacement power was procured, and Colorado Springs' lights stayed on for the month and a half that Martin Drake was unavailable.[32] Colorado Springs was (and presumably still is) able to rely on the greater region for its electricity supply.

This incident is also a reminder of the risk of relying on large generators that can fail at a moment's notice. CSU was able to procure replacement power while the plant was out due to its connection with the larger electric grid. CSU's claim that this replacement energy cost residents more also takes away from the argument that Martin Drake is needed for reliability because the 2014 outage was an unplanned accident. If the company were to plan ahead for replacement power and/or transmission upgrades, it is possible that residents could save money in the long-run.

[32] Ballard, Doris Davis. "Massive fire at Martin Drake coal-fired plant due to human error". PennEnergy. June 9, 2014. Available at: http://www.pennenergy.com/articles/pennenergy/2014/06/massive-fire-at-martin-drake-coal-fired-plant-due-to-human-error.html

Wind power is low-cost and low-risk

Currently, 20 percent of all U.S. capacity comes from renewable resources.[33] The costs of renewable energy—particularly wind and solar—have been coming down and are expected to continue to decline.[34] CSU should consider these replacement options, including attempting to procure these sources before federal tax incentives lapse. For instance, wind projects that begin construction in or before 2019 can take advantage of the federal Production Tax Credit (PTC).

Neighboring utilities have been taking advantage of low wind costs. In 2011, the Colorado Public Utilities Commission (PUC) approved a 25-year contract for Xcel Energy, Colorado's largest utility and adjacent territory to CSU, to purchase 200 MW of wind power from Limon wind energy at a cost of $27.50 per MWh.[35] In 2013, the PUC approved a 25-year contract for Xcel Energy to purchase 600 MW of wind power from the Rush Creek Wind Project.[36] Xcel is obtaining this energy at a cost of $28.68 per MWh and has proposed to acquire 1,550 MW of new wind to serve its Minnesota territory. Xcel concluded that:

> *…the proposed wind portfolio provides significant benefits. In fact, all projects provide significant cost savings to our customers, both individually and as a portfolio, even under the conservative sensitivity cases studied.*[37]

In contrast, CSU assumed very high capital costs for wind in its EIRP: $2,371 per kW for capital costs and $100.55 per kW-year for fixed O&M—relying on EIA assumptions from 2013.[38] Since 2013, the cost of wind has markedly decreased. Lazard, an industry standard report shows a range of on-shore wind capital costs of between $1,200 and $1,650 per kW.[39] Even the high end of this range is significantly lower than what CSU has assumed for building wind farms. Lazard also shows a range of fixed O&M for wind at $30 to $40 per kW-year. The 2016 CSU EIRP assumed more than twice the highest range of these costs. This EIRP analysis assumed an unreasonably high premium for wind capital and operating costs that, unsurprisingly, led CSU to conclude that the resource was not cost-effective.

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[33] Federal Energy Regulatory Commission (FERC). Office of Energy Projects, Energy Infrastructure Update September 2017. p.5. Available at: https://www.ferc.gov/legal/staff-reports/2017/sep-energy-infrastructure.pdf

[34] National Renewable Energy Laboratory (NREL). *2017 Annual Technology Baseline*. 2030 Current Market Conditions. Available at: https://atb.nrel.gov/electricity/2017/summary.html

[35] Jaffe, The Denver Post, November 21, 2011, http://www.denverpost.com/2011/11/21/colorado-puc-green-lights-xcel-contract-for-more-wind-power/.

[36] Decision No. C13-1566 in Proceeding No. 11A-869E, https://www.scribd.com/document/209873385/Colorado-PUC-Decision-on-Solar-as-Least-Cost-Resource-12-20-13-1.

[37] Wind Generation Acquisition Supplement. Minnesota Public Utilities Commission Docket No. E002/M-16-777. March 16, 2017. p.44.

[38] CSU 2016 EIRP, p.18

[39] Lazard. Lazard's Levelized Cost of Energy Analysis – Version 11.0. November 2017. p.19. Available at: https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf

Building additional resources is not the only option for Colorado Springs to procure wind energy. CSU has the advantage of being adjacent to high wind areas (see Figure 7). In the likely event that CSU joins SPP, it would have easier access to low-cost wind resources and could take advantage of the market energy price suppression provided by wind. The national average for a wind power purchase agreement (PPA) was $20 per MWh in 2016.[40] Whether it joins SPP or not, CSU could enter into PPA's with generators that would provide cost certainty and protection against the fuel price volatility to which companies reliant on fossil generation are vulnerable.

Demand-side management is low-cost and low-risk

Demand-side management (DSM) reduces the need for generation and is often the lowest-cost resource compared to supply-side resources.[41] It not only reduces total energy requirements but, to the extent that it reduces peak demand, it also lowers capacity requirements. DSM carries almost no risk as it requires no fuel and little maintenance. CSU could certainly do more in this area. For instance, in the EIRP, the company's reference case assumed only 6 percent cumulative efficiency savings of 2011 sales by 2020. Increasing efficiency savings would delay the need for new capacity in the medium to long-term.

Other alternatives to Martin Drake

Enhanced transmission, new wind generation and DSM are not the only alternatives to Martin Drake. A suite of options could include solar photovoltaic on rooftops and large-scale solar would provide low-cost energy at peak times. CSU is also considering natural gas generation as a replacement for the plant.[42] While natural gas prices are low, and expected to be low for several years, this option does carry a fuel price risk along with a 30-year investment (or more). Moreover, unsubsidized large-scale solar is now on par with the low-end of costs for a new natural gas combined cycle plant.[43]

5. Health and Emissions Impacts

Martin Drake is one the last remaining coal plants located within a large U.S. city's limits. The air quality impacts of Martin Drake are more immediate than for most coal plants, which are located far from population centers. The concentrated population surrounding the plant is vulnerable to local emissions from coal combustion. The pollution emitted from the Martin Drake plant is

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[40] Wiser, Ryan et al. 2016 Wind Technologies Market Report. Lawrence Berkeley National Laboratory (LBNL). Available at: https://emp.lbl.gov/sites/default/files/2016_wind_technologies_market_report_final_optimized.pdf

[41] Hoffman, Ian M., et al. 2017. *Trends in the Program Administrator Cost of Saving Electricity for Utility Customer-Funded Energy Efficiency Programs*. Lawrence Berkeley National Laboratory (LBNL). January 2017. Available at: https://emp.lbl.gov/publications/trends-program-administrator-cost

[42] CSU. Drake Decommissioning presentation. November 17, 2017.

[43] Lazard. Lazard's Levelized Cost of Energy Analysis – Version 11.0. November 2017. p.19. Available at: https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf

associated with a range of diseases, including:

- Sulfur dioxide (SO_2) is known to cause many respiratory illnesses including asthma and pulmonary inflammation.[44]
- Nitrogen oxide (NO_X) emissions combine with volatile organic compounds (VOCs) to form particulate matter and ground-level ozone, which damages the lungs.[45]
- Particulate matter (PM) pollution results in sudden infant death syndrome as well as various cardiovascular and respiratory illnesses.[46] There is no known "safe" levels of PM pollution and those people exposed to higher PM concentrations, such as those within a 3-mile radius, are at higher risk.[47]

There has been controversy over Martin Drake's environmental compliance, with allegations of monitoring and verification issues detailed in a civil action case brought by WildEarth Guardians in September 2017.[48] In the suit, WildEarth Guardians alleges 147 events of unexcused continuous opacity monitoring systems (COMS) downtime for Martin Drake Units 5, 6 and 7 for the period April 11, 2011 through December 13, 2015. These charges were supported by the rebuttal expert affidavit of Dr. Ranajit Sahu, who maintained that "the causes of [COMS] downtime did not fall into the excusable categories allowed under the governing regulations" as these instances "were avoidable, had adequate preventive maintenance been conducted."[49]

The SO_2 emissions impact of Martin Drake are still unclear. In January 2017, *The Denver Post* reported that Colorado Springs was "among the most-populated of at least 13 areas the EPA still lists as "unclassifiable" on meeting the 75 parts per billion SO_2 limit."[50] After the Sierra Club hired experts to measure SO_2 concentrations and found that levels were 8.4 times higher than the national limit, city and state officials hired their own consultant, AECOM Technical Services, to produce a report on air quality.[51] However, the final report is not yet available to the public.

The health impacts of Martin Drake on Colorado Springs residents are an important consideration in determining its future. The population within three miles of the plant has lower income and lower

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[44] Epstein et al., 2011. *Full cost accounting for the life cycle of coal*. Ecological Economics Review. Annals of the New York Academy of Sciences, Issue 1219. p. 85. Available at: http://www.coaltrainfacts.org/docs/epstein_full-cost-of-coal.pdf

[45] *Id.*

[46] *Id.*

[47] *Id.*

[48] Civil Action No. 1:17-cv-00357-CMA-CBS.

[49] Dr. Ranajit Sahu Rebuttal Expert Affidavit. Civil Action No. 1:17-cv-00357-CMA-CBS. September 12, 2017. p.2.

[50] Finley, January 15, 2017, The Denver Post, http://www.denverpost.com/2017/01/15/colorado-springs-power-plant-sulfur-dioxide-pollution/.

[51] *Id*.

education than the residents of the city at-large.[52] Therefore, they are more vulnerable to the host of negative impacts from the plant and less able to address them—by, for instance, paying healthcare costs.

Martin Drake is also a significant contributor of carbon dioxide (CO_2), which is a greenhouse gas. In 2016, the plant emitted 1.3 million short tons of CO_2.[53] The plant contributed 1.5 percent of all energy-related carbon emissions in Colorado; or 3.6 percent of all carbon emissions from the state's power sector.[54] Governor Hickenlooper recently signed an executive order to reduce overall greenhouse gas emissions in the state by 26 percent by 2025, compared to 2005 levels."[55] He also claimed that he would sign an agreement with a group of other states to reduce emissions and promote renewable energy. The state of Colorado, including neighboring utilities to CSU, are moving towards a cleaner, cheaper energy system. Instead, CSU wishes to continue to operate an old and highly-polluting plant: Martin Drake.

6. Conclusion

CSU is currently evaluating decommissioning Martin Drake units 6 and 7 in 2025 or 2030, earlier than its currently slated 2035 decommissioning. After reviewing CSU responses to CORA requests, other public data on generation and emissions, and energy market trends, we find that an earlier decommissioning is in the best interest of Colorado Springs residents for several reasons:

- **Martin Drake's importance to the overall CSU system is diminishing.** If CSU joins the Southwest Power Pool (SPP), as appears likely, the plant will struggle to compete with lower-cost resources. By the same token, joining SPP also makes lower-cost energy available to CSU to serve its customers.

- **Martin Drake's importance for reliability is unclear.** CSU will make transmission investments in the coming years regardless of the plant's retirement. Joining SPP should also facilitate smoother energy flow for CSU and the region at-large.

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[52] Thomas, Stephanie. The Social Justice Case for Shutting Down Drake. Available at: http://www.citizensproject.org/2012/12/12/the-social-justice-case-for-shutting-down-drake/.

[53] EPA Air Markets Program Data (AMPD). Available at: https://ampd.epa.gov/ampd/

[54] EIA. Energy-Related Carbon Dioxide Emissions at the State Level, 2000-2014. Table 3: 2014 State energy-related carbon dioxide emissions by sector. Available at: https://www.eia.gov/environment/emissions/state/analysis/. Data cited is for 2014--the latest available for statewide emissions. Martin Drake's 2014 emissions were 1.36 million short tons. Available at: https://ampd.epa.gov/ampd/

[55] Finley, Bruce. Denver Post. "Colorado signs on to U.S. Climate Alliance, joining states committed to exceeding Trump's rejected Paris climate targets". July 11, 2017. Available at: http://www.denverpost.com/2017/07/11/colorado-signs-us-climate-alliance-joining-states-committed-paris-climate-agreement/

- **CSU should look at low-cost, lower-risk alternatives to continuing to operate Martin Drake.** Their recent analysis showed higher costs for retiring the units early. However, this analysis is not transparent, and the results raise concern because a neighboring utility (Xcel) with more efficient coal units found that a new wind farm was cost-effective compared to coal and natural gas.

- **The plant's location within the city limits is cause for grave concern.** Martin Drake continues to emit harmful pollutants, negatively affecting the economically disadvantaged population in its immediate vicinity.

Overall, we find that Colorado Springs residents would benefit from a closer look at earlier retirement dates and suitable alternatives for Martin Drake. The interests of residents would be better served by CSU's cooperation in a transparent review of its resource planning by third-party experts.