BEFORE THE ARIZONA CORPORATION COMMISSION

PUBLIC
[Confidential Materials Redacted]

Direct Testimony of David A. Schlissel

In Docket No. E-01345A-19-0236

On Behalf Of

Tó Nizhoní Áni, San Juan Citizens Alliance, and Diné CARE ("Citizen Groups")

October 2, 2020

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I. Introduction

Q. Please state your name and business address.

A. My name is David A. Schlissel. I am the President of Schlissel Technical Consulting, Inc. and the Director of Resource Planning Analysis for the Institute for Energy Economics and Financial Analysis. My business address is 45 Horace Road, Belmont, MA 02478.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of Tó Nizhoní Áni, San Juan Citizens Alliance, and Diné CARE ("Citizen Groups").

Q. Please summarize your educational background and recent work experience.

A. I graduated from the Massachusetts Institute of Technology in 1968 with a Bachelor of Science Degree in Engineering. In 1969, I received a Master of Science Degree in Engineering from Stanford University. In 1973, I received a Law Degree from Stanford Law School. In addition, I studied nuclear engineering at the Massachusetts Institute of Technology during the years 1983-1986.

Since 1983 I have been retained by governmental bodies, publicly owned utilities, and private organizations in 38 states to prepare expert testimony and analyses on engineering, economic, and financial issues related to electric utilities. My clients have included state utility commissions, attorneys general, consumer advocates, publicly owned utilities, and local, national and international environmental and consumer organizations.

I have filed expert testimony before state regulatory commissions in Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Rhode Island, South Carolina, South Dakota, Texas, Vermont, Virginia, West Virginia, and Wisconsin; before the U.S.

Federal Energy Regulatory Commission and Atomic Energy Commission; and in state and federal court proceedings.

A copy of my current resume is included as Attachment DAS-1. Additional information about my work is available at **www.schlissel-technical.com** and **www.ieefa.org**.

Q. Have you previously testified before this Commission?

A. Yes. I testified before the Arizona Corporation Commission in Dockets Nos. U-1345-85, U-1345-90-007, U-1551-93-272, E-01345A-01-0822, E-01345A-03-0437, E-01345A-0816, E-01345A-10-0474, and E-01922A-12-0291.

Q. What is the purpose of your testimony in this proceeding?

A. I have been asked to evaluate whether the Four Corners Power Plant ("Four Corners") Units 4 and 5 should and will likely be retired earlier than 2031 and to discuss the need for planning and funding for a just transition away from those units towards a more sustainable energy economy for the impacted communities.

Q. Please summarize your findings.

A. My main findings are as follows:

1. It is reasonably likely that Four Corners Units 4 and 5 will be retired earlier, perhaps significantly earlier, than the currently planned 2031 shut-down date.

2. Increasing amounts of low-cost, reliable renewable resources and battery storage have been added to the Western grid in recent years, and much more will be online in coming years.

3. Natural gas prices and energy market prices at the Palo Verde Hub have been low in recent years and are expected to remain low for the foreseeable future.

4. Four Corners has become an unreliable generator in recent years.

5. Four Corners has become an expensive generator and is extremely likely to remain an expensive generator if it continues to operate through 2031.

6. For example, between 2014 and 2019, producing power at Four Corners has cost APS's ratepayers $550 million more than they would have had to pay if APS had purchased the same amounts of energy at the Palo Verde Hub. If the plant continues to operate through 2031, ratepayers are at risk of having to pay between $934 million and $1.33 billion more for power from the plant than it would cost to buy the same power from the Palo Verde Hub or through power purchase agreements with renewable resources and battery storage.

7. At the same time that APS's ratepayers have been paying far too much for power from Four Corners, the company has been profiting as its investment in the plant has grown dramatically. Moreover, APS and its owner, Pinnacle West Capital Corporation will continue to profit handsomely if Four Corners is allowed to continue to operate until 2031. For example, using APS's data, I estimate that APS and Pinnacle West would earn almost $600 million pre-tax in the years 2020 to 2035 from having its investment in Four Corners in APS's rate base.

8. There is increasing acknowledgement that climate change is a real and immediate threat, as illustrated by the historic fires experienced in California and Oregon during the last couple of months, and that actions to reduce carbon dioxide (CO_2) emissions must be taken as quickly as possible.

9. In recent years, an increasing number of other large coal plants in the U.S. have been retired earlier than their owners had previously planned. Many of these retirements have been due, at least in the main, to low natural gas and energy market prices and/or growing availability of low-cost renewable resources.

10. I support the Commission's decision to require APS to present an evaluation of retiring Four Corners earlier than 2031. The Company has not completed such an analysis at any time in more than six years.

11. Should the Commission decide not to require APS to retire Four Corners in 2023 or at any other time prior to 2031, there are several other actions I recommend it take.

    a. Require APS to submit an analysis every two years that evaluates the economics of retiring Four Corners earlier than its currently planned 2031 retirement date.

    b. Direct APS to begin discussions with the affected communities and to plan for a just transition away from the coal plant that recognizes that Four Corners might be retired prior to 2031 and develop a set of actions to help the community prepare for that transition.

    c. Require APS to bear the risks that the actual Four Corners operating performance is worse than APS has presented in its 2020 Integrated Resource Plan and/or that operating and maintenance costs (including capex) are higher.

Q. What materials have you reviewed and what analyses did you review as part of the preparation of your testimony?

A. I have reviewed the Direct Testimony submitted by Arizona Public Service Company ("APS") and the materials provided by APS in response to discovery submitted by the Citizen Groups and other active parties to this docket. In addition, I have reviewed other publicly available documents that address Four Corners and/or natural gas and energy market prices in the Southwest and the development of renewable resources and energy storage in the Mountain and Pacific states.

II. APS Has Unreasonably Failed to Study the Potential Retirement of Four Corners Before 2031.

Q. Has APS evaluated any alternatives that retire Four Corners prior to 2031?

A. No. The Company has acknowledged that it has not evaluated the retirement of Four Corners prior to 2031 in its 2017 or 2020 Integrated Resource Plans.[1] APS also has acknowledged that other than the analyses conducted in conjunction with the Commission's IRP process, it "has not conducted any forward-looking economic analysis of either or both of Four Corners Units 4 and 5 since the SCR project began in early 2014."[2] Indeed, the Company has not even undertaken any analyses or assessments of the economic costs and benefits of continuing to operate Four Corners Units 4 or 5 at any time since January 1, 2019.[3]

Q. Was this prudent or reasonable?

A. No. A number of Four Corners plant-specific and overall energy market circumstances had changed dramatically in the years since APS began the Four Corners SCR project in early 2014. First, the prices of installing and buying power from renewable solar resources, including projects with battery storage, had declined dramatically. In addition, natural gas and energy market prices were low, and expected to remain that way. At the same time, Four Corners has become a much less reliable and a significantly more expensive generator. In sum, these changed circumstances made alternatives more economically competitive than continued operation of Four Corners and should have led APS to evaluate retiring the plant earlier than 2031.

[1] APS Response to Data Request SC 1.6 (Exhibit DAS-2).

[2] APS Supplemental Response to Data Requests SC 1.8 (Exhibit DAS-3) and SC 1.26 (Exhibit DAS-4).

[3] APS Response to Data Requests Citizen Groups 2.20 (Exhibit DAS-5) and 2.22 (Exhibit DAS-6).

Q. Has APS evaluated an early retirement of Four Corners before 2031 as part of its 2020 IRP?

A. No. Four Corners was designated as "must-run" in every scenario APS considered in its 2020 IRP. As a result, the generation from and the costs associated with Four Corners are essentially the same in all of the resource cases and gas, load and carbon price scenarios presented in the IRP, and all assume the same 2031 retirement date. Some of these results don't make sense. For example, APS assumes that the plant generates the same amounts of power regardless of the level of the prices of CO_2 used in the analysis – e.g., the low carbon ($0 per MWh), base case, or high carbon cases. Similarly, there is no meaningful change in the operation and costs of Four Corners in the low gas price scenario where one would expect that more generation from the higher cost Four Corners plant would be displaced if the assumed price of natural gas were lower.

Q. You are aware that the Commission has directed APS to study a scenario in which Four Corners is retired in 2023 and to present the results later in this proceeding?

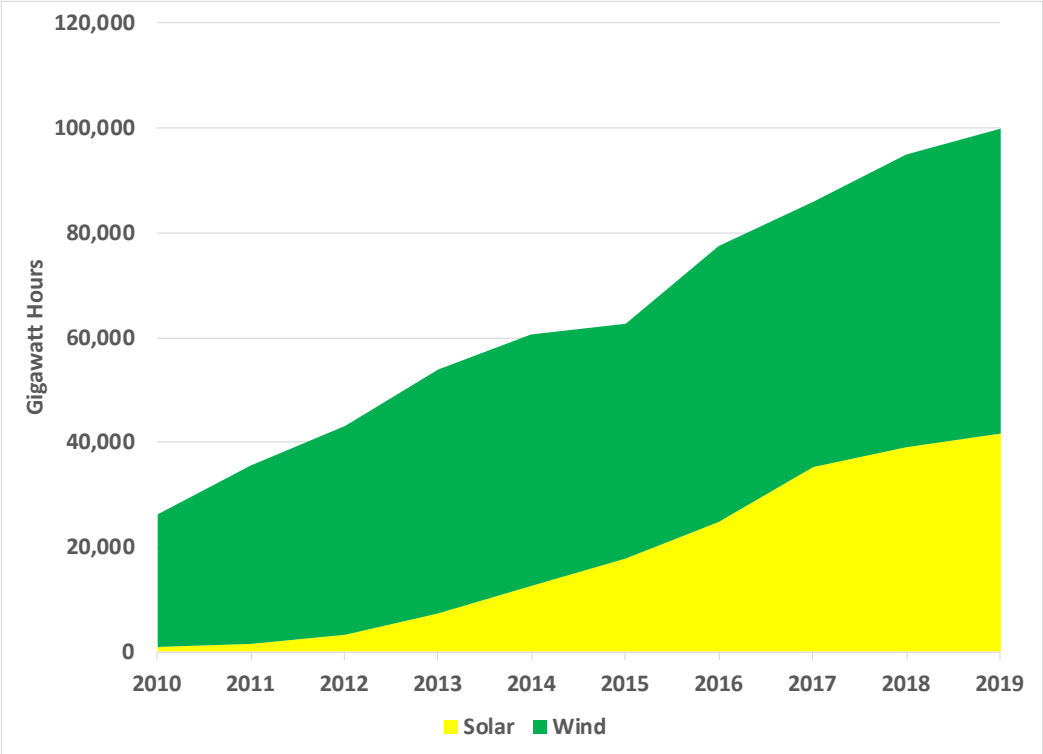
A. Yes. I think the Commission's action is a good step in the right direction. However, I am concerned that parties will not have enough time to analyze the new APS filing with the 2023 retirement date or have a reasonable opportunity to respond.

III. The Western United States Has Increasingly Relied on Low-Cost Renewables and Battery Storage.

Q. Has there been increasing competition for existing coal-fired generators in recent years from low cost renewable resources, particularly solar?

A. Yes. Solar and wind and solar generation has increased four-fold between 2010 and 2019 in the Western U.S., due to dramatic price declines and state mandates.

Figure 1: Increasing Generation in the Western U.S. from Solar and Wind Resources[4]



Q. Are more renewable resources expected to be added to the Western grid in coming years?

A. Yes. Much more renewable generation is on the horizon regionally as states push utilities to boost their renewable generation and as energy markets favor the economic competitiveness of wind and solar. California, for example, now mandates that 33% of electricity sales in 2020 and 60% of sales in 2030 come from renewable resources.[5] Colorado is pushing a roadmap to 100% renewable energy in the state by 2040 and Nevada passed legislation last year requiring the state's utilities to meet a 50% renewable energy standard by 2030.

New Mexico last year enacted a law that requires utilities to get 50% of their power from renewables by 2030 and 80% by 2040, and hearing examiners for the

[4] Generation data from EIA Electric Power Monthly.

[5] State of California. Renewables Portfolio Standards Program. Stats. 2018, Ch. 312, Sec. 2. (SB 100) (effective January 1, 2019); Cal. Pub. Util. Code § 399.11.

New Mexico Public Regulation Commission have approved the replacement of Public Service Company of New Mexico's share of the San Juan Generation Station with 650 MW of solar resources and 300 MW of battery storage.[6] Similarly, last spring, NV Energy announced plans to add 1,000 MW of new solar resources plus 100 MW of battery storage, all by 2021.[7]

Even in states with less aggressive policy mandates, market pressure and cost concerns are forcing utilities to transition away from fossil fuel generation resources. For example, SRP has announced plans to add 1,000 MW of new solar resources by 2025.[8] Similarly, APS's 2020 integrated resource plan (IRP), calls for adding 2,894 MW of capacity by the end of 2024 — 575 MW of demand-side management; 193 MW of demand response; 408 MW of distributed energy resources; 962 MW of renewable resources; and 750 MW of energy storage.9 Also, TEP's 2020 IRP adds 2,457 MW of new wind and solar resources, including 457MW coming online by 2021.[10]

Q. How have the prices of solar power purchase agreements (PPAs) changed in recent years?

A. As the amount of installed renewable generation has climbed, the prices of buying power from solar and wind resources have declined precipitously.

Data from Lawrence Berkeley National Laboratory (LBNL) shows that the prices of solar PPAs have fallen dramatically in all regions of the country, declining by

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[6] New Mexico Public Regulation Commission, Case No. 19-00195-UT, Order on Recommended Decision on Replacement Resources – Part II, July 29, 2020.

[7] Greentech Media. NV Energy Contracts to Build More Than 1,000MW of New Solar, 100MW of Battery Storage. May 31, 2018.

[8] *SRP Plans 1,000 Megawatts of New Solar Energy by 2025*. November 15, 2018.

[9] Arizona Public Service Company *2020 Integrated Resource Plan*, at page 135 of 553.

[10] Tucson Electric Power Company *2020 Integrated Resource Plan*.

more than 80%.[11] The decline has been even steeper in the Southwest where capacity-weighted utility-scale solar prices dropped by nearly 90%, from an average of $168.49 per MWh in 2009 (in 2018 dollars) to an average of just $23.51 per MWh in 2019 (also in 2018 dollars).[12] Significantly, the LBNL survey also found that 23 of the recent utility-scale solar PPAs included battery storage of 4-5 hours and that these projects were not much more expensive than the PPAs from the solar-only projects.[13] And solar PPA prices are expected to continue to decline over time.

For example, in 2018 — in a sign of things to come — the Central Arizona Project (CAP) signed a 20-year PPA for solar energy at a price of $24.99 per MWh.[14] Shortly after CAP announced that PPA, NV Energy announced that it had agreed to a 300 MW solar PPA at $23.76/MWh for 25 years, a price that was believed to have set a new record.[15] NV Energy subsequently signed a PPA for power from a project that includes 300 MW of solar and 135 MW of 4-hour storage with a price that averages about $35/MWh.[16]

Two new PPAs signed earlier this year by El Paso Electric were for much lower prices than even the NV Energy PPA. One will provide 100 MW of solar resources for $15/MWh. The other will provide 100 MW of solar resources and

[11] Lawrence Berkeley National Laboratory (LBNL). Utility-Scale Solar 2019 Edition. December 2019. Prices cited here are levelized in 2018 U.S. dollars and include any contract escalation clauses.

[12] LBNL. Utility-Scale Solar 2019 Edition. December 2019.

[13] LBNL. Utility-Scale Solar.

[14] Greentech Media. Arizona Water Provider Approves Record-Low-Cost Solar PPA to Replace Coal. June 8, 2018.

[15] Utility Dive. NV Energy 2.3 cent solar contract could set new price record. June 13, 2018.

[16] Greentech Media. NV Energy Announces 'Hulkingly Big' Solar Plus Storage Procurement. June 25, 2019.

50 MW of storage for $30/MWh. Both of these projects are sited in New Mexico.[17]

Q. What has driven these declines in solar PPA prices?

A. The sharp declines in solar PPA prices have largely been driven by a steady drop in installation costs as median installed photovoltaic (PV) project prices fell by nearly 70% between 2010 and 2019.

Q. What impact does adding battery storage to a solar project have on the PPA price?

A. According to an analysis by the LBNL, the size of the incremental PPA price adder for 4-hour battery storage has varied linearly with the sizing of battery capacity relative to the PV capacity of the project, ranging from ~$5/MWh for batteries sized at 25% of PV capacity up to $15/MWh for batteries sized at 75% of PV capacity.[18]

Q. Have similar declines be seen in wind PPA prices?

A. Yes. A similar trend is evident in the wind industry. Prices for the best wind resources in the Interior region of the U.S. were roughly $60/MWh in 2009-2010; today, PPAs in those same areas are often in the $15-$20/MWh range. Wind prices in the rest of the country have fallen sharply as well, dropping from an average of around $85-$90/MWh in 2010 to the mid-$30/MWh range today.[19]

These wind PPA price declines have been the result of a 40% average decline in the cost of installing wind projects and improvements in wind turbine operating performance. For example, wind turbine capacity factors have increased

[17] El Paso Electric Solar PPAs.

[18] LBNL. Utility-Scale Solar.

[19] U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy. 2018 Wind Technologies Market Report. August 8, 2019.

significantly as a result of design improvements such as higher hub heights and larger turbine blades.

The economic viability of Four Corners is further undermined by the growth of the Western Energy Imbalance Market (EIM), which will provide access to lower-cost solar, wind, and battery storage resources in all of the western states by 2022. The EIM was launched in 2014 to help increase energy dispatch across balancing areas, to reduce the need to curtail renewable generation in CAISO (the California Independent System Operator), and to lower the frequency and magnitude of negative market prices. All of Four Corners' current owners except for Navajo Transitional Energy Company either are members of the EIM, as are PacifiCorp and several other utilities in the West, or are planning to join in the next year or two.

The EIM provides member utilities access to trade low-cost renewable generation across a broad geographic footprint, pushing the market cost of power down for everyone. In addition, by giving utilities access to more renewable generation, the EIM will inevitably reduce the market share for higher-cost, more polluting resources such as Four Corners. Another problem for Four Corners (and for other coal plants) is that California (the West's largest electricity market by far) requires a greenhouse adder to be tacked onto power offered for sale into the state, further undercutting potential coal-based sales.

IV. Natural Gas and Energy Market Prices Have Been Low in Recent Years and Are Expected to Remain that Way for the Foreseeable Future

Q. What have low natural gas prices meant for Four Corners past and future economic competitiveness?

A. Similar to what has happened throughout the U.S., gas prices at the Southern California Border (SoCal Border) have declined significantly since 2008 and they are expected to remain low for the foreseeable future. This trend has undermined the profitability of Four Corners by reducing fuel costs for gas plants in Arizona

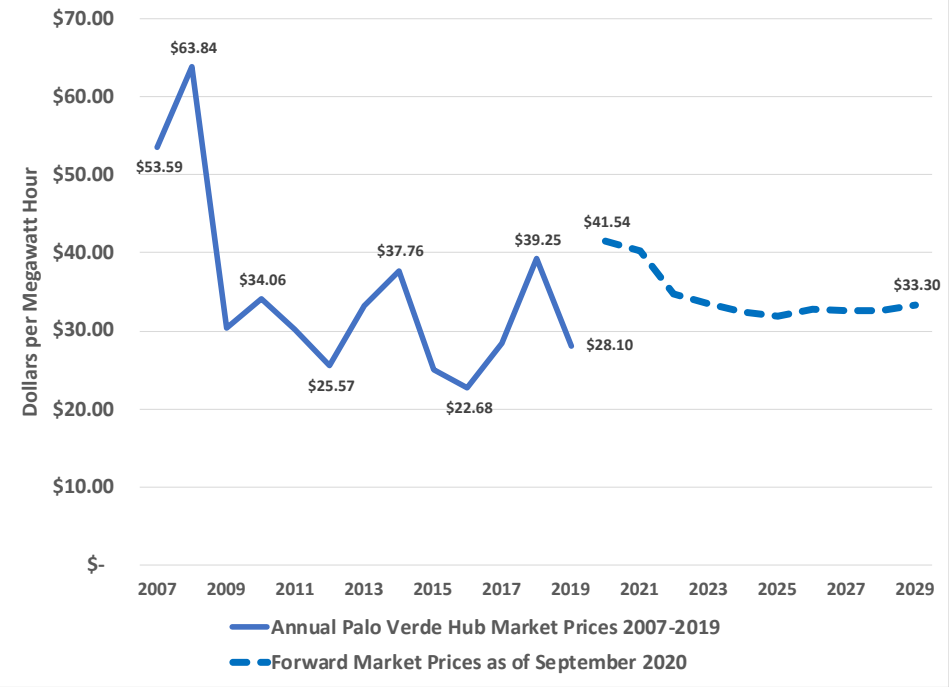
and by keeping energy market prices low, and it will continue to do so in coming years.

Figure 2: Recent and Forward Gas Prices at SoCal Border Hub, 2007-2029[20]

Because low gas prices reduce the costs of running gas-fired plants, they adversely impact the profitability of coal plants like Four Corners in two interacting ways. First, low gas prices lead to increased generation at gas-fired plants, thereby displacing generation that otherwise would be produced at Four Corners. At the same time, low gas prices have meant that energy market prices also have been low, and can be expected to remain that way for the foreseeable future.

[20] Gas price data downloaded from S&P Global Market Intelligence in September 2020.

Figure 3: Recent and Forward 24x7 Energy Prices at the Palo Verde Hub[21]



Low energy market prices provide a short-to-medium-term option for replacing the energy from Four Corners. They also could be a piece of a longer-term portfolio of resources used to replace the generation from the plant.

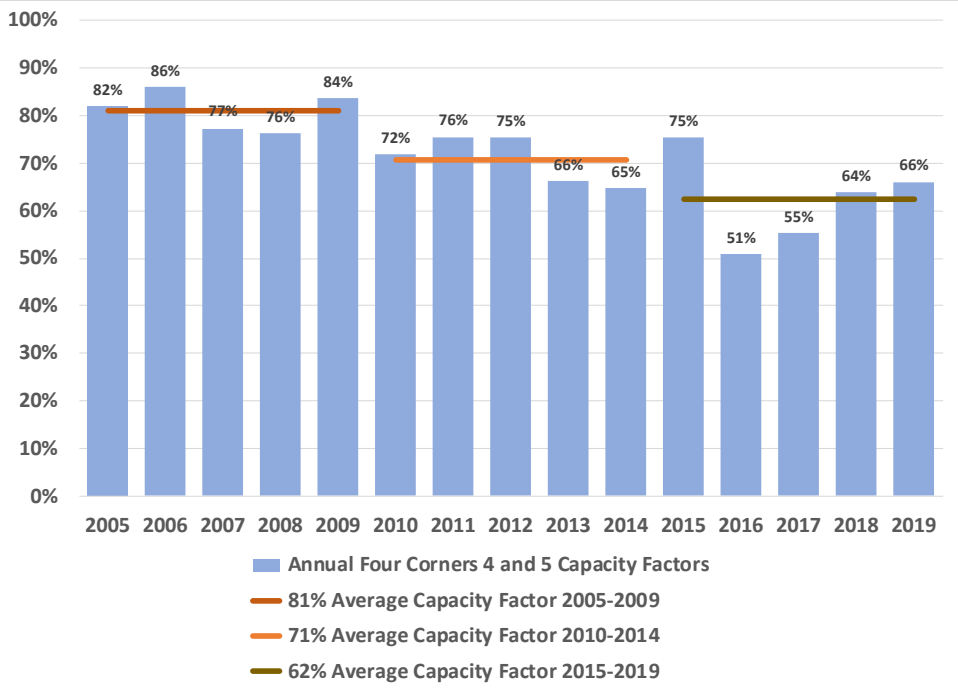
V. Four Corners Has Been an Unreliable Generator in Recent Years

Q. How well has Four Corners operated in recent years?

A. As shown in Figure 4, below, Four Corners' generation has declined substantially since the years 2005-2009.

[21] Palo Verde Hub energy market price data from S&P Global Market Intelligence in September 2020.

Figure 4: Four Corners Annual Capacity Factors[22]



Although the downward trend in capacity factors (and, consequently, generation) can be seen in the annual capacity factors shown in Figure 4, it is even more apparent when you look at average five-year capacity factors. These have declined from 81% in the years 2005-2009 to 71% in 2010-2014 and, finally, to 62% in the most recent five-year period from 2015-2019.

Q. What has caused this long-term decline in operating performance?

A. There are a number of reasons for the long-term decline in Four Corners capacity factors: lower natural gas prices starting in about 2009, growing competition from declining cost renewable resources, and increasingly unreliable operations. In addition, Four Corners' production costs have increased dramatically over the past decade. As I will explain below, none of these factors is likely to abate in the foreseeable future. In fact, they are far more likely to get worse as additional low-

[22] Industry data is from the North American Electric Reliability Corporation's *Generating Unit Statistical Brochure 4* for the years 2010-2014 and 2013-2017. Four Corners capacity factors downloaded from S&P Global Market Intelligence based on EIA Form 923 data.

cost renewable resources continue to be added to the electric grid and as the cost of producing power at Four Corners continues to rise. In addition, there's no reason to believe that Four Corners will suddenly operate more reliably.

Q. Do the capacity factors in Figure 4 reflect the shutdowns of Four Corners 4 and 5 to complete the construction of the new SCRs?

A. No. The capacity factors in Figure 4 do not include the approximate three months of Unit 5 downtime in 2017 or the three months of Unit 4 downtime in 2018, which APS has said were needed to complete the SCR construction.

Q. How well has Four Corners operated so far in 2020?

A. The amount of power generated at Four Corners has continued to decline in 2020, as the two units achieved only a 47% capacity factor during the first six months of this year, down from the 63% less electricity the plant achieved during the same months in 2019.

Q. What is the basis for your conclusion that Four Corners has been an unreliable generator in recent years?

A. There are a number of measures typically used in the industry to assess power plant performance. Four Corners' performance under these measures clearly has been unreliable and much poorer than that of comparable coal plants.

Q. Please explain.

A. Two measures of plant operating performance regularly used in the industry are a plant's equivalent availability factor (EAF) and its equivalent forced outage rate (EFOR).

A plant's availability factor (AF) measures the number of hours a plant is able to provide electricity to the grid, at any power level, during a certain period (e.g., monthly or yearly), divided by the total number of hours in that period. No distinction is made between full outages (when the plant is shut down) and partial outages (when its power level is reduced but is not fully shutdown).

However, a plant's EAF reflects the power levels at which it *actually* operates. Therefore, unlike availability, equivalent availability reflects power "derates" — that is, reductions in the plant's power output even though it remains connected to the grid and capable of providing some power. Consequently, a plant's EAF measures how much of the time a plant operates and takes into account planned and unplanned reductions in power output, providing a meaningful method of tracking plant operations and comparing similar facilities.

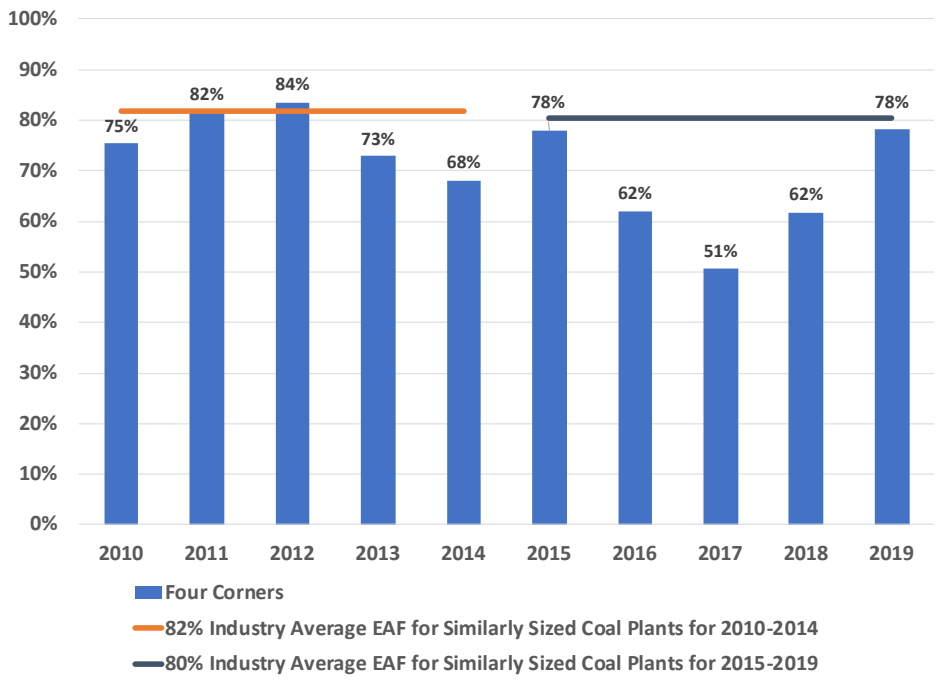
A plant's EFOR then measures how much of the time the plant is fully or partially required to reduce power as the result of unplanned equipment problems.

Q. How has Four Corners' annual EAF compared to the operating performance of comparable coal plants in the U.S.?

A. As shown in Figure 5, Four Corners' annual EAF declined substantially between 2010 and 2018, before jumping up in 2019, meaning that the units have been available to operate at full power less and less over time. In fact, Four Corners average EAF for the five-year period 2015-2019 was 66%, or ten percentage points below the 76% EAF the units had achieved in the previous five-year period from 2010-2014.

Figure 5 also shows that Four Corners' EAF has been significantly worse than the 82.2% industry average EAF for similarly sized coal units.

Figure 5: Four Corners Annual Equivalent Availability Factors[23]



Q. Is it possible that the Four Corners EAF figures for 2017 and 2018 reflect the Unit 4 and Unit 5 unavailability due to the downtime needed to complete the SCR project?

A. Yes. However, even if that downtime was included, the unit's EAF still would have been lower than it had been in previous years and lower than the average EAFs for similarly-sized coal units.

Q. How have Four Corners' Equivalent Forced Outage Rates in recent years compared to the industry average EFOR experienced by similarly sized coal plants?

A. As shown in Confidential Figure 6, Four Corners' annual EFORs have been substantially higher than the industry average EFOR, meaning that the plant's

[23] Industry data is from the North American Electric Reliability Corporation's *Generating Unit Statistical Brochure 4* for the years 2010-2014 and 2013-2017. Four Corners EAF data is from Public Service Company of New Mexico's annual FERC Form 1 filings.

power output has been significantly reduced for unplanned full or partial outages for much more of the time. In fact, in only a single year, 2011, did either of the two remaining Four Corners units achieve an EFOR as low as the industry average EFOR for similarly sized coal units. In other years, the EFOR of the Four Corners units were double, triple, and in some years, four times as high as the industry average.

Confidential Figure 6: Four Corners Annual Equivalent Forced Outage Rates[24]

Q. What does APS assume in its 2020 Integrated Resource Plan concerning the future operating performance of Four Corners Units 4 and 5?

A. APS assumes that the EFOR of both Four Corners units will decline dramatically starting in 2020. For Four Corners Unit 4, that means APS assumes its EFOR will drop from the 21% average it experienced in the years 2010-2018 to an average of

[24] Industry data is from the North American Electric Reliability Corporation's *Generating Unit Statistical Brochure 4* for the years 2010-2014 and 2015-2019. Four Corners data is from APS's Highly Confidential Response to SC-1.15, Excel File APS10RC00881 (Exhibit DAS-7HC).

only 11.5% in the years 2020-2031. For Four Corners Unit 5, APS assumes that its EFOR will decline from 22.3% to 14.8%.[25]

Q. Is this a reasonable assumption?

A. I generally believe it is reasonable to assume that a plant's future operating performance will reflect its performance in recent years. It is possible that APS and the other Four Corners owners will spend the money needed to enable the units to operate more reliably in future years. However, their future reliability remains an open question at this time.

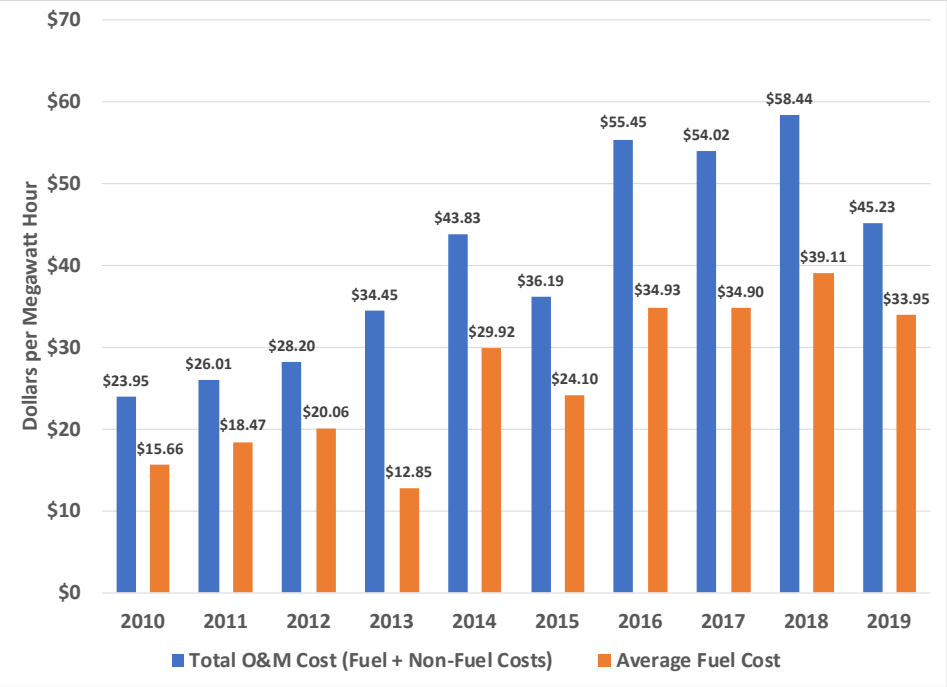
VI. Four Corners Has Become An Increasingly Expensive Generator

Q. What is the basis for your conclusion that Four Corners has become an increasingly high cost generator?

A. As shown in Figure 7, the average annual cost of operating & maintaining (O&M) Four Corners has increased significantly between and 2019/2019.

[25] APS response to Citizen Groups Data Request 2.14.b. (Exhibit DAS-8HC)

Figure 7: Increasing Cost of Generating Electricity at Four Corners[26]



Q. What has driven the substantial increase in Four Corners' per MWh O&M costs shown in Figure 7.

A. As shown in Figure 7, rising coal fuel costs have been a major driver of the increase in Four Corners' O&M costs. The plants average per MWh O&M costs also have increased as a result of its long-term decline in generation.

Q. Please explain.

A. If Four Corners generates fewer MWh of electricity from one year to the next, that means that even if its total fixed O&M costs (in dollars) remain the same, it's average per MWh O&M will be higher because these fixed costs would be spread over fewer units of output.

Q. Does Figure 7 include all of the costs of producing power at Four Corners?

A. No. Figure 7 only includes the normal operating & maintenance expenses. It does not include any annual capital expenditures (capex) invested in the plant.

[26] Four Corners O&M data is from APS's annual FERC Form 1 Filings.

Q. Are there other Four Corners costs that are paid by APS's ratepayers that are not included in Figure 7?

A. Yes. Figure 7 also does not include other significant Four Corners-related costs paid by APS's ratepayers including annual depreciation expenses, annual property taxes, interest costs, and annual profits earned by APS's shareholders due to the inclusion of Four Corners in the Company's rate base.

Q. For illustration, how much have ratepayers paid in recent years for Four Corners' annual depreciation expenses?

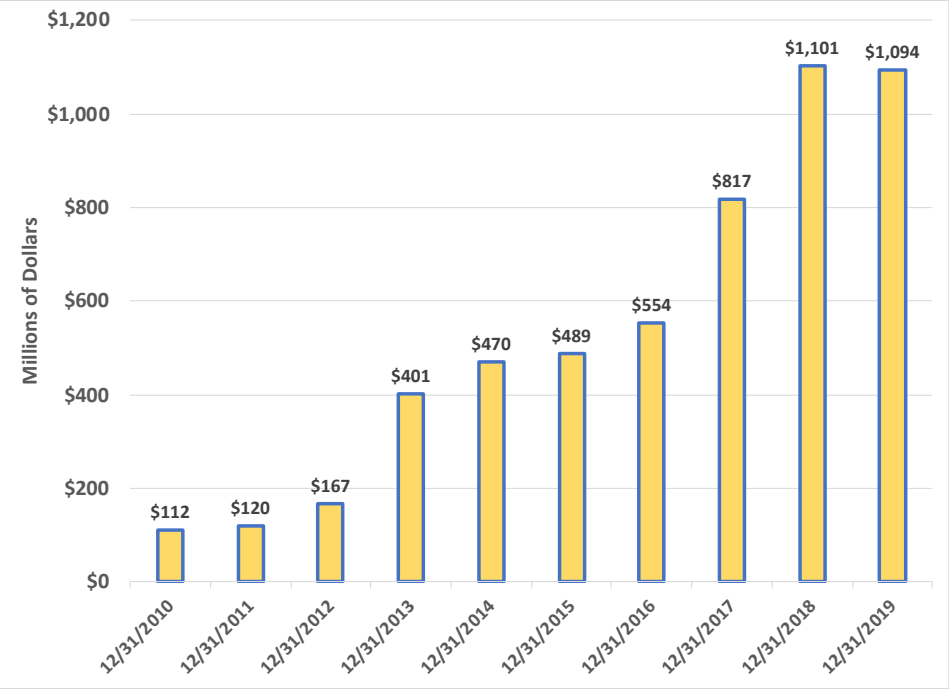
A. According to APS, the annual depreciation expense attributable to Four Corners has risen dramatically from $4.747 million in 2010 to $35.575 million in 2018 and $37.355 million in 2019.[27]

Q. How much of APS's investment in Four Corners has been in rate base?

A. APS's investment in Four Corners has grown dramatically from 2010 through 2019, as shown in Figure 8.

[27] APS response to Data Request Sierra Club 1.3 (Exhibit DAS-9).

Figure 8: Increasing APS Rate Base Investment in Four Corners[28]



Q. Which decisions have driven this increase in APS's net investment in Four Corners?

A. The decisions to acquire Southern California Edison's share of Units 4 and 5 and to add SCR NOx control equipment are the main drivers of the increase in net investment shown in Figure 8.

Q. Who has benefitted from this growth in rate base investment?

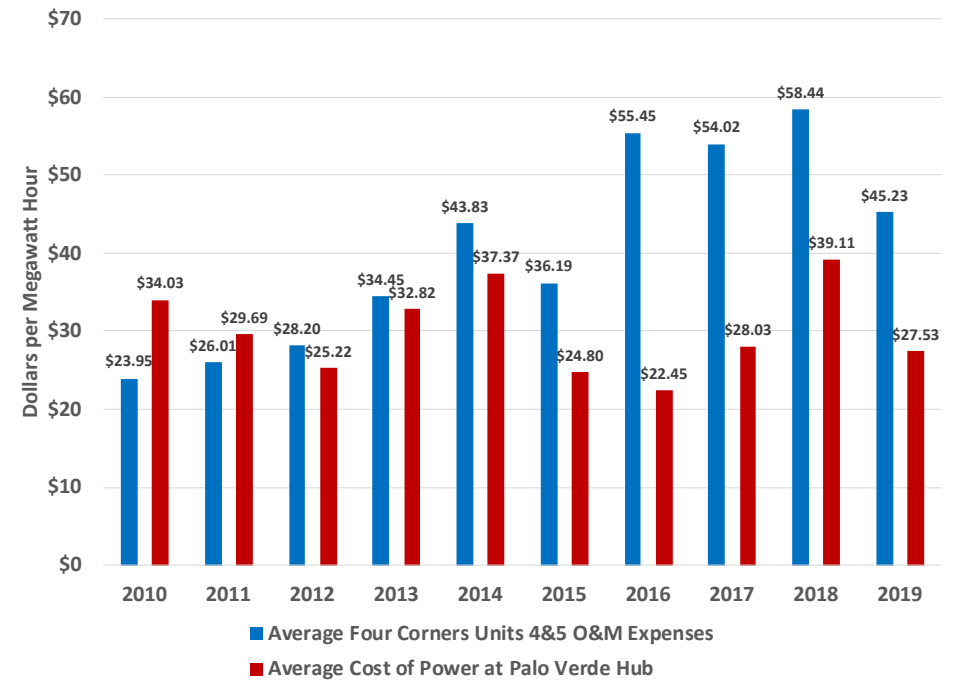
A. Other things being equal, a utility's profits generally increase in direct proportion to the amount of investment in its rate base. Thus APS, and its owner, have profited from the increased investment in Four Corners since 2010.

[28] Source: APS Responses to Sierra Club Data Request 1.3 (Exhibit DAS-9) and Citizen Groups Data Request 2.10 (Exhibit DAS-10).

Q. As they have increased, how have Four Corners' annual production costs compared to the prices at which power has sold at the Palo Verde Hub?

A. Prior to 2012, it was less expensive to ratepayers for APS to produce electricity at Four Corners (only including normal O&M expenses). However, since 2012, Four Corners' average O&M cost per MWh has been higher than the average price of buying power at the Palo Verde Hub.

Figure 9: Four Corners Production Costs in the Years 2010-2019 vs. Prices of Power at the Palo Verde Hub[29]



Q. What have the fact that the O&M costs at Four Corners have been higher than market prices meant for APS's ratepayers?

A. In just the six-year period, 2014 to 2019, APS's ratepayers paid over $550 million more for the power they received from Four Corners than they would have paid if APS had purchased the same amount of energy from the market at Palo Verde.

[29] Four Corners O&M data is from APS's FERC Form 1 filings and the Palo Verde Hub prices were downloaded from S&P Global Market Intelligence in September 2020.

VII. Four Corners is Likely to Remain an Expensive Generator if APS Continues to Operate the Plant through 2031

Q. How have you evaluated the impact of continuing to operate Four Corners through 2031 on ratepayers?

A. I compared the annual costs of producing power at Four Corners with the costs of buying the same power from the market at the Palo Verde Hub.

Q. Are you assuming that buying power from the Palo Verde Hub is the long-term solution to replacing Four Corners?

A. No. APS will need a long-term plan that replaces Four Corners whether the plant is retired in 2023 or 2031, or somewhere in between. For the purpose of my analysis I have assumed that APS would initially rely on market purchases to supply needed energy if Four Corners were retired in 2023. However, it certainly would be even less expensive, and more beneficial in the fight against the threat posed by climate change, for APS to move as quickly as it can to develop a renewable + battery storage plan for replacing the plant. If APS did this, the numbers I present in Confidential Figure 10 and Figure 11, below, likely would understate the economic benefits that ratepayers would receive from retiring Four Corners.

Q. What source have you used for the costs of continuing to produce power at Four Corners through 2031?

A. I used the Four Corners' generation and variable and fixed fuel and O&M costs that APS used in its 2020 IRP.[30] Finally, I added the annual Four Corners' projected capex figures that APS provided in response to Citizen Groups Data Request 2.14 (Exhibit DAS-12HC).

[30] In particular, the data in the Highly Confidential Excel spreadsheets provided by APS in response to Sierra Club Data Request 6.4 (Exhibit DAS-11HC).

Q. What about the other costs associated with Four Corners such as property taxes, income taxes, return on rate base, and depreciation?

A. I assumed that some of these costs (e.g., property, interest, and depreciation) would continue to be paid by ratepayers irrespective of when Four Corners is retired. It also is unclear to me how the Commission might decide to treat the return on rate base, that is, whether APS or ratepayers would bear those costs or share them in some way. For this reason, I decided to focus exclusively on the production costs and capex expenditures that APS projects it will make at Four Corners over the next few years.

Q. What source have you used for the forward prices for power at the Palo Verde Hub?

A. I used forward prices from OTC Global Holdings which I downloaded from S&P Global Market Intelligence.

Q. Did you consider any fuel contract termination costs in your analysis?

A. Yes. I added the annual fuel contract termination costs that APS provided in its response to Sierra Club Data Request 3.1 (Exhibit DAS-13).

Q. What were the results of your analysis?

A. The results of my comparison between the projected costs of operating Four Corners during the years 2020-2031 and the prices of buying the same power from the Palo Verde Hub are presented in Confidential Figure 10, below. Figure 10 also includes Four Corners' all-in busbar cost.

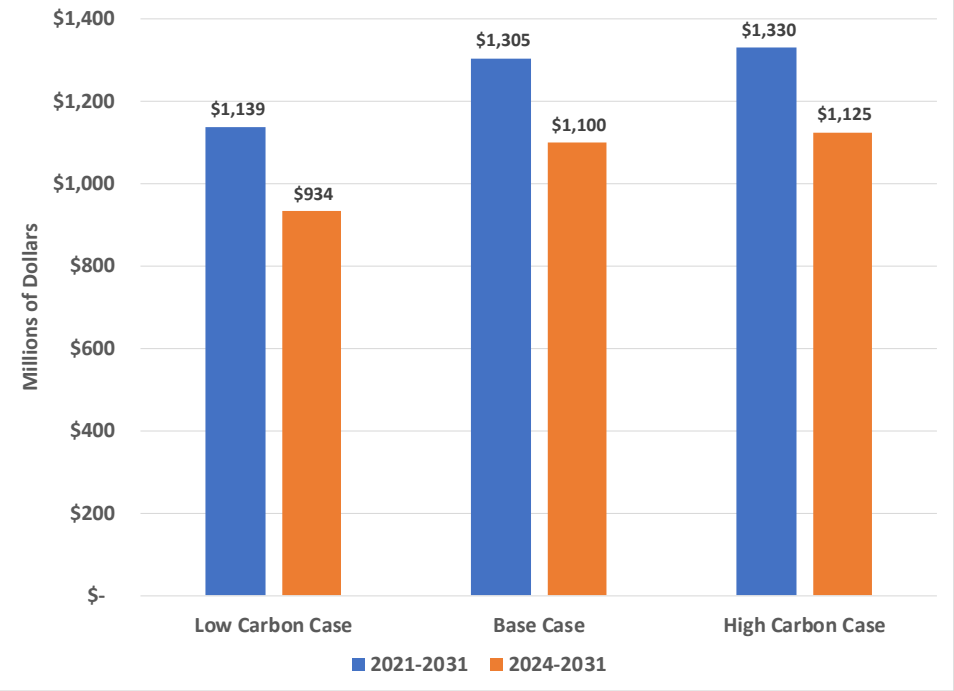
Confidential Figure 10: Four Corners Base Case Annual Costs in the years 2020-2031 vs. Prices of Power at the Palo Verde Hub[31]

Q. How much more expensive would it be for ratepayers if APS continues to generate power at Four Corners during the years 2024-2031 instead of purchasing power at the Palo Verde Hub?

A. Figure 11, below, shows how much more in total ratepayers would pay for power generated at Four Corners during the years 2021-2031 and 2024-2031 compared to what they would pay if APS purchased the same power at the Palo Verde Hub.

[31] Source: APS Responses to Citizen Groups' Data Request 2.10 (Exhibit F) and Sierra Club Data Request 1.3 (Exhibit G).

Figure 11: Additional Power Production Costs that Ratepayers Would Bear if Four Corners Operates Until 2031



Q. What would be APS's parent company, Pinnacle West Capital Corporation, earnings from Four Corners if the plant continues to operate through 2031 and APS investment remains in rate base?

A. Using the data from APS's Highly Confidential Responses to Data Request Sierra Club 6.4 (Exhibit DAS-11HC) and Citizen Groups 2.14 (Exhibit DAS-14HC), I estimate that at the same time that ratepayers would be paying an extra billion dollars, or more, for the power from Four Corners, Pinnacle West would earn almost $600 million pre-tax from having its investment in the plant in rate base.

Q. Is it possible that the cost of generating power at Four Corners will be higher than APS has assumed in its 2020 IRP?

A. Yes. It certainly is possible that one or both of the Four Corners units could experience an extended outage or outages, require significantly more capex, or need more maintenance than APS now anticipates. Any of these would increase the cost of operating the plant through 2031.

Indeed, Four Corners Unit 1 already is 51 years old. Unit 5 is 50. By 2023, the Units will be 54 and 55 years old, respectively. By 2031, they will be 62 and 61 years old. This is important because older plants, on average, tend to cost more to operate and maintain and are less reliable according to analyses by the U.S. Department of Energy's Argonne National Laboratory and the National Energy Technology Laboratory, which have found that coal plant heat rates increase with plant age, while plant availability declines.[32] Heat rate is a measure of a power plant's efficiency in generating electricity; a higher heat rate means that a plant is less efficient. And, in general power plants tend to become less efficient as they age. Plant availability measures the percentage of possible operating hours in which a plant was actually available to generate power, and plants tend to become less available to generate power as they age, in part because they tend to experience more unanticipated problems and unplanned outages.

At the same time, older plants tend to cost more to maintain, as equipment and components degrade or fail and must be repaired or replaced.

Q. Have other coal plants in the U.S. been retired prior to their planned retirement dates?

A. Yes. According to data from S&P Global Market Intelligence, some 82 GW of coal-fired capacity has been retired since 2011. More than 56% of this capacity was younger than 51, the current age of Four Corners Unit 4, when it was retired. An additional 34 GW of coal retirements or conversions to burn gas are currently scheduled for the years 2020-2025.

For example, the three units at the Navajo Generating Station were only 43-45 years old when they were retired last year. And just this past May, Great River Energy (GRE) announced that it is planning to retire its 40-year-old Coal Creek

[32] *See, e.g.*, U.S. Dep't of Energy Staff Report to the Secretary on Electricity Markets and Reliability at 155 (Aug. 2017), *available at* https://www.energy.gov/sites/prod/files/2017/08/f36/Staff%20Report%20on%20Electricity%20Markets%20and%20Reliability_0.pdf.

coal plant in North Dakota. GRE explained announced that its plans to phase retire Coal Creek in 2022, increase market energy purchases, add significant renewable energy and explore grid-scale battery technology would "significantly [reduce] member-owner wholesale power costs."[33]

Q. Does this complete your testimony?

A. Yes.

[33] Great River Energy plans to replace coal with low cost renewables and market energy purchases. May 7, 2020.