Louisa Eberle (*pro hac vice*)
Gregory Wannier (*pro hac vice*)
Sierra Club Environmental Law Program
2101 Webster Street, Ste 1300
Oakland, CA 94612
louisa.eberle@sierraclub.org
greg.wannier@sierraclub.org

Timothy M. Hogan
Jennifer B. Anderson
Arizona Center for Law in the Public Interest
514 W. Roosevelt Street
Phoenix, AZ 85003
Counsel for Sierra Club

BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

BOB BURNS – Chairman
BOYD DUNN
SANDRA KENNEDY
JUSTIN OLSON
LEA MÁRQUEZ PETERSON

IN THE MATTER OF THE APPLICATION OF TUCSON ELECTRIC POWER COMPANY FOR THE ESTABLISHMENT OF JUST AND REASONABLE RATES AND CHARGES DESIGNED TO REALIZE A REASONABLE RATE OF RETURN ON THE FAIR VALUE OF THE PROPERTIES OF TUCSON ELECTRIC POWER COMPANY DEVOTED TO ITS OPERATIONS THROUGHOUT THE STATE OF ARIZONA AND FOR RELATED APPROVALS.	DOCKET NO. E-01933A-19-0028 **NOTICE OF FILING REDACTED DIRECT TESTIMONY OF SIERRA CLUB**

Pursuant to the Procedural Orders issued by the Arizona Corporation Commission on May 20, 2019 and September 19, 2019, Sierra Club hereby files the Redacted Direct Testimony of Avi Allison, to be presented at the January 16, 2020 Hearing in this matter. A confidential version of this testimony is being provided under seal to the assigned Administrative Law Judge, the Utilities Division, and Tucson Electric Power. The Company will provide the confidential version to those parties with whom it has entered into a Protective Agreement in this matter.

RESPECTFULLY SUBMITTED this 11th day of October, 2019.

Louisa Eberle (*pro hac vice*)
Sierra Club Environmental Law Program
2101 Webster Street, Ste 1300
Oakland, CA 94612
louisa.eberle@sierraclub.org

Gregory Wannier (*pro hac vice*)
Sierra Club Environmental Law Program
2101 Webster Street, Ste 1300
Oakland, CA 94612
greg.wannier@sierraclub.org

Timothy M. Hogan
Jennifer B. Anderson
Arizona Center for Law in the Public Interest
514 W. Roosevelt Street
Phoenix, AZ 85003

COUNSEL FOR SIERRA CLUB

Original e-Filed and 8 copies delivered on this 11th day of October, 2019 with:

Docket Control
Arizona Corporation Commission
1200 W. Washington St.
Phoenix, AZ 85007

Copies of the foregoing mailed / emailed this 11th day of October, 2019 to:

Robin Mitchell
legaldiv@azcc.gov
utildivservicebyemail@azcc.gov

Michael Patten
docket@swlaw.com
bcarroll@tep.com
jthomes@swlaw.com
mpatten@swlaw.com
mdecorse@tep.com
mderstine@swlaw.com

Patrick Black
khiggins@energystrat.com
pblack@fclaw.com
lferrigni@fclaw.com

Alex Dely
DelyCIHF@hotmail.com

Adam Stafford
stacy@westernresources.org
adam.stafford@westernresources.org
steve.michel@westernresources.org

Kurt Boehm
john@mooreinjurylaw.com
kboehm@bkllawfirm.com

Daniel Pozefsky
dpozefsky@azruco.gov
procedural@azruco.gov

Timothy Hogan
ezuckerman@swenergy.org
thogan@aclpi.org
briana@votesolar.org
Sandy.bahr@sierraclub.org
schlegelj@aol.com
Nhorseherder@gmail.com
katie.chamberlain@sierraclub.org
louisa.eberle@sierraclub.org
janderson@aclpi.org
peter.morgan@sierraclub.org
sbatten@aclpi.org
czwick@wildfireaz.org
cmassey@swenergy.org
mark@sanjuancitizens.org
mike@sanjuancitizens.org
carol.davis@dine-care.org
lori.goodman@dine-care.org
robyn.jackson@dine-care.org

Lawrence Robertson, Jr.
Tubaclawyer@aol.com
greg.bass@calpinesolutions.com
scott.olson@directenergy.com
Mary.lynch@constellations.com
george.waidelich@albertsons.com

Scott Wakefield
swakefield@hclawgroup.com
Stephen.Chriss@walmart.com

Melissa Kreuger
Melissa.Krueger@pinnaclewest.com
Debra.Orr@aps.com
Thomas.Mumaw@pinnaclewest.com
Theresa.Dwyer@pinnaclewest.com

Kyle Smith
karen.white.13@us.af.mil
kyle.j.smith124.civ@mail.mil

Louisa Eberle
louisa.eberle@sierraclub.org
greg.wannier@sierraclub.org

Eric Hawkins
kcathers@trico.coop
vnitido@trico.coop
eric@durazzo-eckel.com

Nicholas Enoch
nick@lubinandenoch.com
kaitlyn@lubinandenoch.com
corey@lubinandenoch.com
cristina@lubinandenoch.com

Roi Lusk
Roi.Lusk@tucsonaz.gov
Jennifer.Stash@tucsonaz.gov

Michele Van Quathem
mvq@mvqlaw.com

Charles Wesselhoft
Charles.Wesselhoft@pcao.pima.gov

Brandon Cheshire
brandon@sunharvest.com

Thomas Loquvam
ArizonaEnergyPolicyGroup@gmail.com
thomas@loquvam.com

By: */s/* Katie Chamberlain

BEFORE THE
ARIZONA CORPORATION COMMISSION

IN THE MATTER OF THE APPLICATION OF TUCSON ELECTRIC POWER COMPANY FOR THE ESTABLISHMENT OF JUST AND REASONABLE RATES AND CHARGES DESIGNED TO REALIZE A REASONABLE RATE OF RETURN ON THE FAIR VALUE OF THE PROPERTIES OF TUCSON ELECTRIC POWER COMPANY DEVOTED TO ITS OPERATIONS THROUGHOUT THE STATE OF ARIZONA AND FOR RELATED APPROVALS.	**DOCKET NO. E-01933A-19-0028**

Direct Testimony of Avi Allison

REDACTED VERSION

On Behalf of Sierra Club

October 11, 2019

TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION AND PURPOSE OF TESTIMONY

Q Please state your name and occupation.

A My name is Avi Allison and I am a Senior Associate with Synapse Energy Economics, Incorporated ("Synapse"). My business address is 485 Massachusetts Avenue, Suite 2, Cambridge, Massachusetts 02139.

Q Please describe Synapse Energy Economics.

A Synapse is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government agencies, and utilities.

Q Please summarize your work experience and educational background.

A At Synapse, I provide consulting and research services on a wide range of issues related to the electric industry. My areas of focus include resource planning, power plant economics, rate design, economic impact analysis, and regional capacity markets. I have provided consulting services for a variety of public sector and public interest clients including the U.S. Environmental Protection Agency, the Michigan Public Service Commission, the Michigan Agency for Energy, the New York State Energy Research and Development Authority, the Rhode Island Office of Energy Resources, the Efficiency Maine Trust, the Maine Office of the Public Advocate, the California Department of Justice, the Washington State Office of the Attorney General, Consumers Union, Sierra Club, Natural Resources Defense Council, and other organizations.

I have provided testimony in resource planning, rate case, and power cost dockets in Michigan, Indiana, and Arkansas.

I hold a Master of Environmental Management from Yale University and a Bachelor of Arts in economics from Columbia University. A copy of my current resume is attached as Exhibit AA-1.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of Sierra Club.

Q Have you testified previously before the Arizona Corporation Commission?

A No, I have not.

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

A The purpose of my testimony is to evaluate the reasonableness of Tucson Electric Power Company's (TEP or the Company) recent and proposed expenditures on existing and new fossil fuel generation facilities. Specifically, I address:

1. TEP's proposal to purchase the Gila River Unit 2 natural gas combined cycle (NGCC) and include the approximately $165 million in capital costs associated with that purchase in the Company's rate base;

2. The economic status of TEP's Springerville and Four Corners coal plants; and

3. TEP's proposal to invest $172 million to construct ten new gas-fired reciprocating internal combustion engine (RICE) units.

Q Please identify the documents upon which you base the opinions presented in your testimony.

A My findings rely primarily upon the testimony, exhibits, and discovery responses of TEP witnesses. I also rely to a limited extent on external documents such as industry publications and government data.

2. FINDINGS AND RECOMMENDATIONS

Q Please summarize your findings.

A My primary findings include the following:

1. **TEP's decision to contract for and purchase Gila River Unit 2 was imprudent**. When deciding whether to invest in Gila River Unit 2, TEP neglected to evaluate the unit relative to any non-fossil fuel resource alternatives, despite the Company having access to abundant, low-cost renewable resources. In addition, TEP never demonstrated a need for the services provided by Gila River Unit 2, and TEP's decisions to contract for and purchase the unit have caused the Company to have excess capacity.

2. **TEP has not demonstrated the prudence of continuing to invest in and operate its Springerville and Four Corners coal units**. I estimate that each of the Springerville and Four Corners units incurred net losses of [redacted] relative to a market proxy from 2017 through 2018.Yet TEP has never conducted economic retirement analyses of any of these units.

3. **TEP has failed to demonstrate the prudence of its decision to construct ten new RICE units.** TEP has not adequately justified the need for, timing of, or magnitude of its RICE unit investments. TEP's analyses did not compare the planned RICE units to a sufficient range of alternatives and did not establish a near-term need for the amount of proposed RICE units for either ramping capacity or voltage support purposes.

4. **TEP's analyses and decisions with respect to its Gila River Unit 2 and RICE investments reflect a planning process that is biased in favor of natural gas resources.** These decision-making processes are inconsistent with sound resource planning practices and run counter to previous Commission guidance against an excessive focus on natural gas resources.

Q Do you have any recommendations to offer the Commission?

A Yes. Based on my findings, I offer the following recommendations:

1. The Commission should not permit TEP to place Gila River Unit 2 into rate base. In addition, the Commission should require TEP to evaluate the possibility of exiting its current long-term Gila River Unit 2 tolling agreement, which was never properly supported.

2. The Commission should not allow recovery of test year capital costs at the Springerville and Four Corners plants until TEP has presented rigorous analyses justifying the continued operation of those plants.

3. The Commission should require TEP to present economic retirement assessments for each of the Springerville and Four Corners units in its 2020 Integrated Resource Plan (IRP).

4. The Commission should not permit TEP to place the RICE units into rate base. In the alternative, the Commission should not permit TEP to earn a return on its poorly justified investments in the RICE units.

3. GILA RIVER UNIT 2 INVESTMENT

Q Please summarize this section.

A In this section, I assess TEP's request to include its proposed $165 million purchase of the natural gas-fired Gila River Unit 2 in rate base. I show that the analyses that TEP conducted

to inform its investments in Gila River 2 were insufficient and flawed. Specifically, I show that:

1. TEP never evaluated its decisions to contract for and then purchase the capacity of Gila River 2 relative to investing in non-fossil resource alternatives.

2. TEP's recent efforts to establish that Gila River 2 is more cost effective than a combination of solar and storage resources are deeply inadequate. In fact, the evidence indicates that TEP has access to a variety of non-fossil fuel resources that cost less and emit less than Gila River 2.

3. TEP has not established a need for the services provided by Gila River 2. On the contrary, TEP's purchase of Gila River 2 resulted in the Company having far more natural gas capacity far earlier than was supported by TEP's resource planning analyses.

4. TEP's analyses and decisions regarding Gila River 2 run counter to previous Commission guidance against overly focusing on natural gas resources.

Q Please describe Gila River 2.

A Gila River 2 is a 550 megawatt (MW) existing NGCC generation unit located near Gila Bend, Arizona.[1]

Q Please summarize TEP's recent and planned actions with respect to Gila River 2.

A In October 2017, TEP entered into a tolling agreement with Salt River Project through which TEP purchased all 550 MW of capacity, energy, and ancillary services from Gila River 2 for

[1] TEP Application, p. 3.

a period of 20 years. This agreement included a three-year option for TEP to purchase the unit for approximately $165 million. [2]

Q Has the Commission previously approved of TEP's Gila River 2 tolling agreement?

A No.[3]

Q What is TEP's rate case request regarding Gila River 2?

A TEP is now planning to exercise its option to acquire Gila River 2.[4] Through this rate case, TEP is seeking approval to place its planned investment in Gila River 2 into rate base. [5]

i. TEP has not established that investing in Gila River 2 was a prudent choice relative to non-fossil fuel alternatives.

Q What evidence did TEP's application and direct testimony present in support of its plan to acquire Gila River 2?

A TEP's application and testimony present three types of evidence in support of the Company's plan to acquire Gila River 2. First, TEP presents an analysis indicating that purchasing Gila River 2 is a lower-cost option than building a new NGCC unit.[6] Second, TEP presents evidence suggesting that investing in Gila River 2 will result in cost savings and emission reductions relative to the continued operation of its existing Navajo and San Juan coal units.[7] Finally, TEP presents an analysis indicating that purchasing Gila River 2 is preferable to

---

[2] Direct Testimony of David Hutchens, p. 7.
[3] TEP Response to Data Request No. SC 1.21(b). All public discovery responses referenced in this testimony are compiled and attached as Exhibit AA-2 ["Ex. AA-2"].
[4] Direct Testimony of David Hutchens, p. 7.
[5] *Id*., p. 11.
[6] Direct Testimony of Michael Sheehan, p. 22.
[7] *Id*., pp. 24-25.

continuing with the Company's existing tolling agreement.[8] Specifically, TEP witness Michael Sheehan states that the levelized cost of energy (LCOE) associated with Gila River 2 would be $38.80 per megawatt-hour (MWh) under the continuation of the tolling agreement but would be $38.15 per MWh under an ownership scenario.[9]

Q Are there any holes or flaws in the evidence TEP presented in its case in support of its proposed investment in Gila River 2?

A Yes. TEP's case for the prudence of the proposed Gila River 2 investment relies on an analysis framework that is far too narrow. TEP's application and testimony do not include any evidence that obtaining power from Gila River 2—whether through a tolling agreement or through unit ownership—was preferable to investing in alternative resources such as solar, wind, storage, demand-side resources, or peaking gas resources. In fact, in discovery TEP acknowledged that, when deciding whether to invest in Gila River 2, it did not conduct any economic analyses comparing Gila River 2 to renewable, battery storage, or demand-side resource alternatives.[10] At most, TEP's analyses suggest that Gila River 2 would be a prudent investment if TEP were limited to only investing in coal or NGCC resources. But TEP's resource options are not limited to only those two types of resources, nor were they so limited at the time TEP entered the Gila River 2 tolling agreement.

Q Since filing its application and direct testimony, has TEP conducted any analyses of Gila River 2 relative to non-fossil fuel resources?

A Yes. In response to a request from Commissioner Sandra Kennedy, TEP belatedly conducted and presented an economic comparison of Gila River 2 to "an equivalent solar-plus-storage

[8] Direct Testimony of Michael Sheehan, pp. 26-27.
[9] *Id*., p. 27.
[10] Ex. AA-2, TEP Response to Data Request No. SC 2.17.

project."[11] TEP claimed that this analysis showed that an "equivalent" solar-plus-storage project consisting of 1,110 MW of solar and 1,140 MW of 4-hour battery storage would cost approximately twice as much as Gila River 2 on an LCOE basis.[12]

Q Does the analysis presented in TEP's letter to Commissioner Kennedy establish the reasonableness of investing in Gila River 2 relative to non-fossil fuel alternatives?

A No. There are at least three reasons why the analysis presented in TEP's letter to Commissioner Kennedy is insufficient and does not establish the reasonableness of investing in Gila River 2 rather than non-fossil fuel alternatives:

1. TEP's analysis inappropriately treats Gila River 2, rather than the need associated with expected load growth and plant retirements, as the baseline for comparison purposes.

2. TEP's analysis incorrectly assumes that all services provided by Gila River 2 would need to be replaced one-to-one by a single alternative resource type.

3. TEP's analysis does not account for the potential for any resources other than solar-plus-storage to provide any of the services offered by Gila River 2.

I discuss each of these flaws further below.

Q Is a ratio of 1,140 MW of battery storage to 1,110 MW of solar typical for a solar-plus-storage project?

A No. As TEP itself acknowledges, most cost-effective solar-plus-storage projects are configured with battery storage capacity equal to approximately one third of the solar

[11] TEP Response to Commissioner Kennedy Letter, Docket No. E-01933A-19-0028, Sept. 9, 2019, p. 3. ["TEP Resp. to Comm'r Kennedy Letter"].
[12] *Id*., p. 5.

capacity.[13] TEP further acknowledges that several recent solar-plus-storage projects of this size have been priced at around $35 per MWh, less than the LCOE of Gila River 2 and less than half the LCOE of the solar-plus-storage project that TEP compared to Gila River 2.[14]

Q Why, then, did TEP compare Gila River 2 to a solar-plus-storage project with more storage capacity than solar capacity?

A TEP performed this comparison because it estimated "that it would require 1,110 MW of solar and 1,140 MW of 4-hour battery storage in order to match the energy and capacity of Gila 2."[15]

Q Does it make sense to evaluate the prudence of investing in Gila River 2 by comparing the unit to a solar-plus-storage project sized to provide the exact energy and capacity services provided by Gila River 2?

A No. The prudence of the Gila River 2 tolling agreement and purchase decisions does not hinge on whether an alternative resource could match Gila River 2's exact generation profile at a lower cost. Instead, it depends on whether an alternative combination of resources could better fulfill TEP's system needs than Gila River 2. As described further below, Gila River 2 was in some respects poorly suited to meet TEP's identified system needs at the time the tolling agreement was signed. It is therefore particularly inappropriate to require that any alternative to Gila River 2 be designed to exactly match the output of that unit. The comparison performed by TEP makes no more sense than it would make to require that Gila River 2 provide the exact same mix of capacity and energy services as a standard solar-plus-storage project.

---

[13] TEP Resp. to Comm'r Kennedy Letter, p. 3.
[14] *Ibid*.
[15] *Ibid*.

Q Is there any reason why the Navajo, San Juan, or Gila River units would need to be replaced in a "one-to-one" fashion by a single resource type?

A No. Even if one were to assume that any alternative to Gila River 2 would need to provide the exact same services as Gila River 2, it would still be unreasonable to assume that a single type of resource, such as solar-plus-storage, would need to provide those services alone. Prudent resource planning practices require the evaluation of whether a portfolio of alternative resources—including both existing resources and/or potential new resources such as solar, storage, wind, demand-side management, and/or peaking gas—could provide the needed services more cost-effectively. TEP's response to Commissioner Kennedy suggests that the Company realizes this. Although the Company's economic analysis comparing Gila River 2 to solar-plus-storage assumed an unreasonably storage-heavy solar-plus-storage project, the Company's emissions analysis assumed a more reasonable project consisting of 550 MW of solar and 165 MW of storage. Under this emissions analysis, TEP filled in the difference between the output of Gila River 2 and the output of the solar-plus-storage project with generation from existing resources.[16]

Q Has TEP conducted economic analyses comparing Gila River 2 to any non-fossil fuel resources other than solar-plus-storage since the Company filed its application in this case?

A Evidently not. Neither the Company's initial response to a request about its economic analyses nor an updated response identifying the solar-plus-storage analysis mention any analyses comparing Gila River 2 to a portfolio including any amount of wind or demand-side resources. [17] In addition, none of the economic analyses provided by the Company include

[16] TEP Resp. to Comm'r Kennedy Letter, pp. 6-7.
[17] Ex. AA-2, TEP Response to Data Request No. SC 2.17; Ex. AA-2, TEP Response to Data Request No. SC 3.11.

any assessment of the potential for peaking gas or market resources to contribute to addressing TEP's system needs in place of Gila River 2.

Q What analyses should TEP have performed prior to entering the Gila River 2 tolling agreement or purchasing Gila River 2?

A Prior to making either of these decisions, TEP should have conducted a rigorous, transparent, and balanced modeling analysis through which it should have identified an optimal, least-cost, least-risk portfolio of resources to fulfill projected needs associated with expected load growth and planned unit retirements. TEP should only have contracted for or purchased Gila River 2 if the unit was found to be part of this optimal portfolio.

ii. TEP has access to cost-competitive non-fossil fuel resource alternatives to Gila River 2.

Q What are the cost characteristics of solar resources that TEP has access to?

A In discovery, TEP would not provide estimated LCOEs associated with its existing or planned renewable projects.[18] However, media reports and the filings of other utilities indicate that TEP has access to solar resources with energy costs far lower than Gila River 2. Media reports indicate that as far back as May 2017, prior to when TEP entered its tolling agreement for Gila River 2, TEP signed a solar-plus-storage power purchase agreement (PPA) where the solar portion cost less than $30 per MWh.[19] This is far lower than the $38-

[18] Ex. AA-2, TEP Response to Data Request No. SC 3.03; Ex. AA-2,TEP Response to Data Request No. SC 3.04. TEP subsequently stated that it does not have levelized cost calculations for its existing renewable projects. Ex. AA-2, TEP Response to Data Request No. SC 5.2.

[19] Gavin Badge, *Tucson Electric signs solar + storage PPA for 'less than 4.5 c/kWh.'*, Utility Dive (May 23, 2017), https://www.utilitydive.com/news/updated-tucson-electric-signs-solar-storage-ppa-for-less-than-45kwh/443293/.

$39 per MWh LCOE of Gila River 2. And solar costs have dropped further since then. In 2018, the Central Arizona Project signed a solar PPA for less than $25 per MWh.[20]

Q What are the cost characteristics of solar-plus-storage resources that TEP has access to?

A TEP has indicated that even standard solar-plus-storage projects have lower LCOE values than Gila River 2. TEP's letter response to Commissioner Kennedy provided a solar-plus-storage PPA price point estimate of $38 per MWh and stated that a number of recent solar-plus-storage projects have yielded PPA prices in the range of $35 per MWh.[21] Both of these values are below TEP's estimate of the LCOE of Gila River 2.

Q What are the cost characteristics of wind resources that TEP has access to?

A According to recent TEP filings, the Company also has access to wind resources that are much lower cost than Gila River 2. TEP's 2018 Action Plan Update contains a figure that identifies an LCOE of less than $22 per MWh for wind resources taking full advantage of the federal production tax credit.[22]

Q What do these cost characteristics indicate regarding the sufficiency of TEP's process for evaluating the Gila River 2 investment decision?

A These cost characteristics reinforce the unreasonableness of TEP's failure to evaluate the potential for non-fossil resources to form part of a least-cost portfolio to replace retiring coal units. Perhaps if TEP had found that renewables cost far more than Gila River 2, the

---

[20] Emma Foehringer Merchant, *Arizona Water Provider Approves Record-Low-Cost Solar PPA to Replace Coal,*. Green Tech Media (June 8, 2018), https://www.greentechmedia.com/articles/read/arizona-water-provider-approves-lower-cost-solar-ppa-to-replace-coal#gs.7i0kp5.

[21] TEP Resp. to Comm'r Kennedy Letter, pp. 2-3.

[22] *2018 Action Plan Update*, Tucson Electric Power (Apr. 30, 2018), p. 11, https://www.tep.com/wp-content/uploads/2018/06/TEP-Action-Plan.pdf ["TEP 2018 Action Plan Update"].

Company may have been justified in screening such resources out of an assessment of alternatives to retiring coal units. But that is clearly not the case here. TEP's service territory lies in a region that has some of the strongest renewable resource potential in the country.[23] And under one of the most common resource cost metrics, LCOE, renewables are cheaper than Gila River 2.

Q Would solar, wind, and solar-plus-storage resources offer additional benefits relative to Gila River 2 besides lower energy costs?

A Yes. Among other benefits, each of these resources would result in emissions reductions relative to Gila River 2. TEP's testimony highlights the emission benefits of Gila River 2 relative to continuing to operate existing coal units.[24] But zero-emitting resources such as solar and wind provide far greater emission benefits relative to retiring coal units than Gila River 2 can. Even in TEP's emissions analysis assuming that solar-plus-storage would need to be supplemented by coal generation to replace the services provided by Gila River 2, the Company still found that the combination of solar-plus-storage and coal would reduce carbon dioxide emissions and water usage relative to Gila River 2.[25] If solar-plus-storage were instead supplemented with a mix of wind, demand-side management, and/or peaking gas resources, the emissions benefits relative to Gila River 2 would be even greater.

[23] *See* U.S. State Solar Resource Maps, National Renewable Energy Laboratory, https://www.nrel.gov/gis/solar.html.

[24] Direct Testimony of Michael Sheehan, p. 24.

[25] TEP Resp. to Comm'r Kennedy Letter, pp. 6-7.

iii. TEP has never established a need for Gila River 2.

Q When did TEP file its most recent IRP prior to deciding to first enter a tolling agreement for and then purchase Gila River 2?

A TEP's most recent resource plan prior to its Gila River 2 decisions was its 2017 IRP, filed in April 2017.[26]

Q Did TEP's 2017 IRP Reference Case Plan identify a need for a new NGCC resource in 2017?

A No.

Q When was the earliest year in which a new NGCC resource was called for under TEP's 2017 IRP Reference Case Plan?

A The earliest year in which TEP's 2017 IRP Reference Case Plan included a new NGCC resource was 2022.[27]

Q What was the magnitude of new NGCC resources included in TEP's 2017 IRP Reference Case Plan?

A TEP's 2017 IRP Reference Case Plan called for 412 MW of new NGCC resources starting in 2022.[28] That 412 MW resource was the only new NGCC resource included over the entire planning period from 2017 through 2032.

---

[26] *2017 Integrated Resource Plan*, Tucson Electric Power (Apr. 3 2017), https://www.tep.com/wp-content/uploads/2016/04/TEP-2017-Integrated-Resource-FINAL-Low-Resolution.pdf ["TEP 2017 IRP"].
[27] *Id.*, p. 52.
[28] *Ibid*.

Q How does the Gila River 2 investment compare to the timing and magnitude of new NGCC resources included in TEP's 2017 IRP Reference Case Plan?

A As summarized above, Gila River 2 is 550 MW and TEP first signed a tolling agreement for Gila River 2 in 2017. Thus, Gila River 2 is 138 MW, or 33 percent, larger than the entire 2017-2032 NGCC resource need identified in TEP's 2017 IRP Reference Case Plan. In addition, TEP contracted for Gila River 2 five years prior to the first identified need for an NGCC resource under the Company's 2017 IRP Reference Case Plan. It is also worth noting that TEP contracted for Gila River 2 only five months after submitting an IRP that included a plan to hold off on investing in new NGCC resources until 2022.

Q What was the impact of TEP's decision to contract for Gila River 2 on the Company's capacity position?

A Predictably, contracting for Gila River 2 put the Company in the position of having more capacity than it needed to meet its own load. To address this situation, TEP entered a tolling agreement through which the Company is providing a third party with 475 MW of capacity, most of which comes from Gila River 2.[29]

Q TEP has repeatedly described the 550 MW of capacity provided by Gila River 2 as needed to replace 508 MW of retiring TEP coal capacity.[30] Is that an accurate characterization of the source of a need for capacity from Gila River 2?

A No, it is not. The referenced 508 MW of retiring TEP coal capacity includes 170 MW at San Juan Unit 2, 170 MW at San Juan Unit 1, and 168 MW at Navajo Generating Station.[31] San

[29] TEP 2018 Action Plan Update, p. 26.
[30] Exhibit MES-5, pp. 1-2; Direct Testimony of Michael Sheehan, p. 22; Direct Testimony of David Hutchens, pp. 10-11.
[31] Exhibit MES-5, p. 1.

Juan Unit 2 closed in 2017 and Navajo is slated to close at the end of 2019.[32] Yet TEP's 2017 IRP Reference Case Plan, which incorporated these planned retirements, did not identify a need for any new NGCC resources until 2022, following the retirement of San Juan Unit 1 and a projected rapid increase in mining-related load.[33] Thus the NGCC capacity provided by Gila River 2 can at most be said to be associated with replacing the 170 MW of San Juan Unit 1 coal capacity, not the 508 MW of retiring coal capacity across all San Juan and Navajo units. This is further shown by the presence of the above-referenced 475 MW tolling agreement, through which TEP is selling off the equivalent of more than 85 percent of Gila River's capacity as excess capacity.

Q What was the source of the projected rapid increase in mining-related growth between 2019 and 2022 under TEP's 2017 IRP load forecast?

A The rapid increase in TEP's projected mining load was largely a result of the expected development of the Rosemont mine project.[34]

Q What is the current status of the Rosemont mine project?

A In July 2019, a federal judge barred construction of the Rosemont mine.[35] This suggests that a substantial portion of the load growth upon which the 2017 TEP IRP's identified 2022 need for 412 MW of NGCC capacity was based may not materialize. This would mean that Gila River 2 is even more oversized relative to TEP's resource need than it appeared at the time TEP entered into the Gila River 2 tolling agreement.

---

[32] Direct Testimony of David Hutchens, p. 7.

[33] TEP 2017 IRP, pp. 51-52.

[34] *Id*., pp. 36-37.

[35] Tony Davis, *Federal judge bars Rosemont Mine construction,* Arizona Daily Star (Aug. 1, 2019), https://tucson.com/news/local/federal-judge-bars-rosemont-mine-construction/article_53b3d5bc-b403-11e9-a413-e78b06cf0a82 html.

Q Would non-fossil fuel resource options provide value relative to Gila River 2 in the presence of uncertain future load such as that associated with the Rosemont mine?

A Yes. Non-fossil fuel resources such as solar and storage provide two important benefits in the context of uncertain load growth. First, they can be developed relatively quickly in response to changing load expectations. Second, they are modular and scalable, such that they can be sized to meet evolving load needs. In contrast, at the time of TEP's decision to contract for Gila River 2 in 2017, Gila River 2 was not needed in the near term and was oversized relative to a speculative capacity need five years in the future.

iv. TEP's Gila River 2 analyses and decisions run counter to previous Commission guidance against overly focusing on natural gas resources.

Q Has the Commission previously expressed concerns regarding the tendency of TEP and other Arizona utilities to overly focus on natural gas resources in their resource planning processes and decisions?

A Yes. In December 2016, Commissioner Tobin submitted comments in TEP's 2017 IRP docket stating that the preliminary IRPs submitted by TEP and the other Arizona utilities were "heavily weighted toward the selection of a single resource option – natural gas."[36] Subsequently, the Commission declined to acknowledge TEP's 2017 IRP and set strict limitations on the procurement of natural gas resources, including a requirement that TEP conduct an independent analysis comparing the costs of a proposed gas resource to alternative energy storage options before acquiring any new gas resources.[37]

[36] Decision No. 76632, Docket No. E-00000V-15-0094, Mar.13, 2018, p. 22 ["Decision No. 76632"].
[37] *Id*., pp. 51-53.

Q How do TEP's Gila River 2 analyses and decisions align with the concerns expressed by the Commission regarding an excessive focus on natural gas resources?

A It appears that TEP's Gila River 2 analyses and decisions contain the same flaws that caused the Commission's concerns with TEP's 2017 IRP process. Despite the Commission's comments and guidance, TEP first entered a tolling agreement for Gila River 2 and then decided to purchase Gila River 2 without having conducted any economic analyses comparing Gila River 2 to non-fossil fuel resource alternatives, including energy storage.

4. ECONOMIC STATUS OF SPRINGERVILLE AND FOUR CORNERS

Q Please summarize this section.

A In this section, I discuss the economic status of TEP's Springerville and Four Corners coal units. I present evidence indicating that each of the Springerville and Four Corners units has been uneconomic relative to the market in recent years. I then show that TEP has not presented any analyses to justify its ongoing investments in these units. Finally, I discuss the importance of rigorous economic assessments of existing coal units under the current electricity market environment.

Q Please describe TEP's coal fleet.

A TEP is the part or full owner of three coal-fired power stations with planned operations beyond 2019:[38]

- Springerville Generating Station. TEP owns 100 percent of Springerville Units 1 and 2. These units provide 387 and 406 MW of TEP capacity, respectively.

[38] *2019 Preliminary Integrated Resource Plan*, Tucson Electric Power (Jul. 1, 2019), Appendix A, https://www.tep.com/wp-content/uploads/2019/07/TEP-Preliminary-Integrated-Resource-Plan-070119-FINAL-Version-2.pdf ["TEP 2019 PIRP"].

- San Juan Generating Station. TEP owns 50 percent of San Juan Unit 1, which provides TEP with 170 MW of capacity.
- Four Corners Power Plant. TEP owns 7 percent of Four Corners Units 4 and 5. Each of these units provides 55 MW of TEP capacity.

TEP also owns 168 MW of capacity at the Navajo Generating Station. Navajo is scheduled to retire by the end of 2019.[39]

Q Which TEP coal units do you focus on in this section of your testimony?

A This section of my testimony focuses on TEP's Springerville and Four Corners units.

Q What are TEP's current plans for the Springerville units?

A Mr. Sheehan's testimony indicates that the Company is currently planning to continue operating Springerville 1 and 2 until 2040 and 2045, respectively.[40] The testimony of David Hutchens asserts that the Springerville units "will remain a valuable part of [TEP's] energy portfolio for the foreseeable future."[41]

Q What are TEP's current plans for the Four Corners units?

A Mr. Sheehan's testimony states that TEP plans to continue operating its Four Corners units until the expiration of their current coal supply agreement in July 2031.[42]

[39] Direct Testimony of Michael Sheehan, p. 8; Ex. MES-5, p.2
[40] Direct Testimony of Michael Sheehan, p. 7.
[41] Direct Testimony of David Hutchens, p. 8.
[42] Direct Testimony of Michael Sheehan, p. 14.

Q Please describe TEP's rate case requests with respect to the Springerville and Four Corners plants.

A TEP is requesting the recovery of capital and operations and maintenance (O&M) costs associated with the continued operation of the Springerville and Four Corners plants.[43] These costs are set based on a 2018 test year.

i. Recent historical evidence indicates that the Springerville and Four Corners units are uneconomic.

Q Have you assessed the recent economic performance of the Springerville and Four Corners units?

A Yes. Using a combination of data provided directly by TEP and government data reported by TEP, as well as Arizona-specific capacity price estimates from Arizona Public Service Company's (APS) 2017 IRP, I evaluated the net value provided by the Springerville and Four Corners units in 2017 and 2018.[44]

Q Please summarize your findings regarding the recent economic performance of the Springerville and Four Corners units.

A I estimate that each of the four Springerville and Four Corners units incurred net losses [redacted] from 2017 through 2018.

[43] Ex. AA-2, Attachment "Rate Base - Post Test Year Plant 07-2019 Update" to TEP Response to Uniform Data Request No. 1.001; Ex. AA-2, Attachment "SC 1.03.xlsx" to TEP Response to Data Request No. SC 1.03.

[44] My analysis was limited to two years of historical performance because TEP objected to requests for more years of data. *See* Ex. AA-2, TEP Response to Data Request Nos. SC 1.09 and SC 1.10.

Table 1. Historical Net Value of the Springerville and Four Corners Units, 2017-2018 (2018 $Million)

Plant	Unit	2017	2018	*2017–2018 Total*
Springerville	1	[redacted]	[redacted]	[redacted]
Springerville	2	[redacted]	[redacted]	[redacted]
Four Corners	4	[redacted]	[redacted]	[redacted]
Four Corners	5	[redacted]	[redacted]	[redacted]

Sources: Attachment "SC 1.06 CONFIDENTIAL.xlsm" to TEP Response to Sierra Club Data Request No. SC 1.06; Attachment "SC 2.01.xlsx" to TEP Response to Sierra Club Data Request No. SC 2.01; FERC Form 714; APS 2017 IRP; Synapse tabulation.

Q Describe how you arrived at the values in Table 1.

A The values in Table 1 are based on data related to each unit's energy value, capacity value, other revenue sources, fuel costs, non-fuel variable O&M costs, fixed O&M costs, property taxes, property insurance, and capital costs.

TEP provided historical hourly net generation for each of the units.[45] To calculate each unit's energy value, I multiplied each unit's historical hourly net generation by the relevant hourly TEP system lambda as reported to the Federal Energy Regulatory Commission (FERC).[46]

To calculate capacity value, I relied on Arizona-specific 2018 capacity price assumptions provided in APS's 2017 IRP.[47] I multiplied the 2018 capacity price by each unit's capacity to derive the annual capacity value.

---

[45] Attachment "SC 1.06 CONFIDENTIAL.xlsm," tabs "SCDR 1.10a. 2017" and "SCDR 1.10a. 2018" (referred to in TEP Response to Data Request No. SC 1.10). For Four Corners, TEP provided historical hourly net generation at the plant level. I multiplied the Four Corners aggregate hourly net generation values by the share of each unit's annual net generation (provided in Attachment "SC 2.01.xlsx" to TEP Response to Data Request No. SC 2.01) to arrive at unit-level hourly net generation. Attached as Ex. AA-3.

[46] *Form No. 714 – Annual Electric Balancing Authority Area and Planning Area Report*, The Federal Energy Regulatory Commission (Last updated Jul. 8, 2019), https://www.ferc.gov/docs-filing/forms/form-714/data.asp. ["FERC Form 714"] (The system lambda dataset identifies the marginal cost of energy in each hour.).

TEP provided unit-level, annual values for other revenues, non-fuel variable O&M costs, fixed O&M costs, property taxes, property insurance, environmental capital costs, and non-environmental capital costs.[48] I used these data as they were provided.

TEP provided unit-specific delivered fuel prices in terms of dollars per million British thermal units (MMBtu)[49] and unit-level fuel consumption in terms of MMBtu.[50] To calculate each unit's annual fuel costs, I multiplied the unit-specific fuel price by the relevant fuel consumption.

I subtracted fuel, O&M, property tax, insurance, and capital costs from each unit's energy value, capacity value, and other revenues to arrive at annual net value.

Q Please present the results from your analysis for the Springerville units, showing each revenue and cost component.

A **Figure** 1 and **Figure** 2 present the results of my analysis for Springerville Units 1 and 2. In each year, the costs of operating the units exceeded the value provided by the units.

---

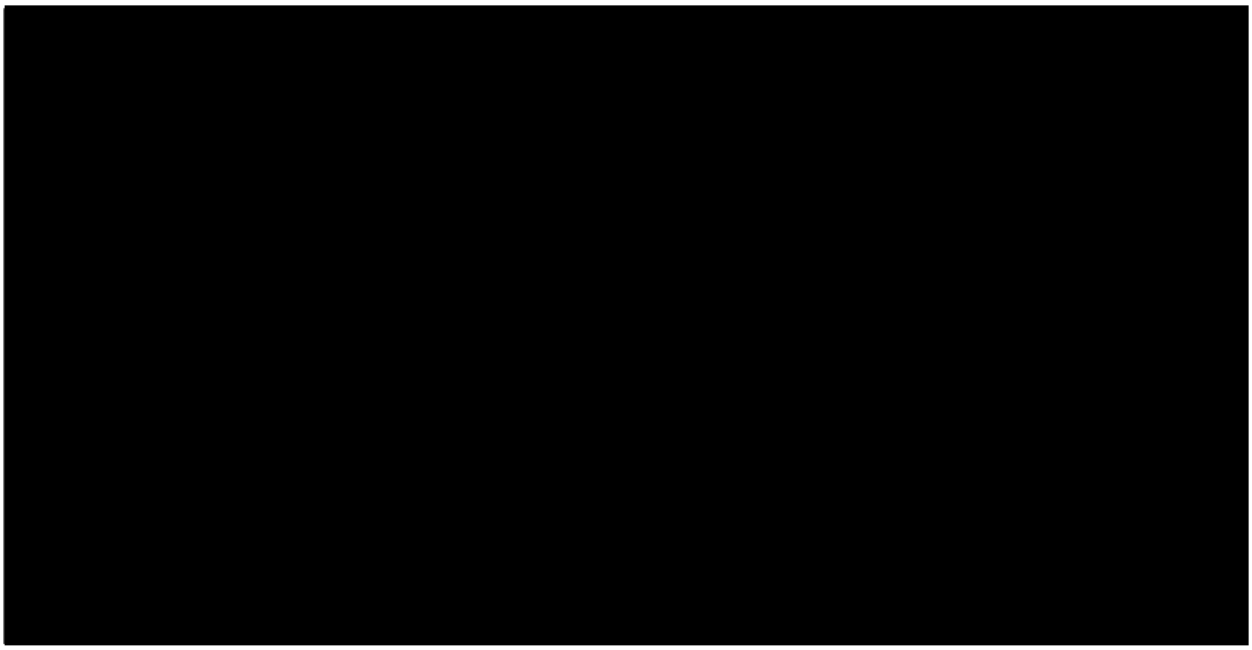
[47] *2017 Integrated Resource Plan*, Arizona Public Service Company (Apr. 2017), Table D-5, p. 159, https://www.aps.com/en/About/Our-Company/Doing-Business-with-Us/Resource-Planning.

[48] Ex. AA-3, Attachment "SC 1.06 CONFIDENTIAL.xlsm," tab "SCDR 1.09 Revised" (referred to in TEP Response to Sierra Club Data Request No. SC 1.09).

[49] *Ibid*.

[50] Ex. AA-2, Attachment "SC 2.01.xlsx" to TEP Response to Sierra Club Data Request No. SC 2.01.

Figure 1. Springerville Unit 1 Net Value Components, 2017-2018 (2018 $Million)



Sources: Attachment "SC 1.06 CONFIDENTIAL.xlsm" to TEP Response to Sierra Club Data Request No. SC 1.06; Attachment "SC 2.01.xlsx" to TEP Response to Sierra Club Data Request No. SC 2.01; FERC Form 714; APS 2017 IRP; Synapse tabulation.

Figure 2. Springerville Unit 2 Net Value Components, 2017-2018 (2018 $Million)

Sources: Attachment "SC 1.06 CONFIDENTIAL.xlsm" to TEP Response to Sierra Club Data Request No. SC 1.06; Attachment "SC 2.01.xlsx" to TEP Response to Sierra Club Data Request No. SC 2.01; FERC Form 714; APS 2017 IRP; Synapse tabulation.

Q Please present the results from your analysis for the Four Corners units, showing each revenue and cost component.

A **Figure** 3 and **Figure** 4 present the results of my analysis for Four Corners Units 4 and 5. I find that the costs of operating these units exceeded the value provided by the units in each historical year analyzed. In fact, I estimate that each Four Corners unit incurred more fuel costs alone than it provided in total value in 2017 and 2018.

Figure 3. Four Corners Unit 4 Net Value Components, 2017-2018 (2018 $Million)

Sources: Attachment "SC 1.06 CONFIDENTIAL.xlsm" to TEP Response to Sierra Club Data Request No. SC 1.06; Attachment "SC 2.01.xlsx" to TEP Response to Sierra Club Data Request No. SC 2.01; FERC Form 714; APS 2017 IRP; Synapse tabulation.

Figure 4. Four Corners Unit 5 Net Value Components, 2017-2018 (2018 $Million)

Sources: Attachment "SC 1.06 CONFIDENTIAL.xlsm" to TEP Response to Sierra Club Data Request No. SC 1.06; Attachment "SC 2.01.xlsx" to TEP Response to Sierra Club Data Request No. SC 2.01; FERC Form 714; APS 2017 IRP; Synapse tabulation.

Q What are the implications of your assessment of the recent economic performance of TEP's Springerville and Four Corners units?

A My assessment indicates that each of the Springerville and Four Corners units is uneconomic relative to a market proxy. These historical data points do not mean that TEP should immediately retire these units. However, they do highlight the importance of conducting rigorous retirement assessments of these units.

Q Are you aware of any other recent unit-specific assessments of the Springerville and Four Corners units?

A Yes. I am aware that Strategen Consulting recently published a report that evaluated the economics of Arizona coal units, including the Springerville and Four Corners units.[51] That study concluded that all of the Springerville and Four Corners units are uneconomic relative to both market energy and solar-plus-storage alternatives, even when accounting for early retirement costs associated with exiting the Four Corners must-take coal contract.[52]

ii. TEP has not established the prudence of continuing to invest in the Springerville and Four Corners units.

Q Has TEP provided evidence or analysis supporting its proposed recovery of costs associated with the continued operation of Springerville and Four Corners?

A No, TEP has not provided any evidence supporting its proposed continued capital and O&M expenditures at Springerville or Four Corners in this case. Specifically, TEP has not presented any evaluations of the value in continuing to operate any of the Springerville or Four Corners units.

Q Has TEP conducted any unit replacement studies of the Springerville or Four Corners units?

A No.[53]

---

[51] Maria Roumpani et al., *Arizona Coal Plant Valuation Study*, Strategen Consulting (Sept. 16, 2019), https://www.strategen.com/reports-1/2019/9/17/arizona-coal-plant-valuation-study. Attached as Ex. AA-4.
[52] *Id.*, p. 12.
[53] Ex. AA-2, TEP Response to Data Request No. SC 2.07a-b.

Q How has the Company sought to justify its decision to not assess the value of continuing to operate the Springerville and Four Corners plants?

A The Company has offered three justifications for not evaluating the reasonableness of its plan to continue operating all Springerville and Four Corners units beyond 2030. First, TEP states that evaluations of the need for the continued operation of its existing resources, including Springerville and Four Corners, are handled in the Company's IRP process.[54] TEP specifically notes that its 2017 and 2014 IRPs both included evaluations of alternative portfolios, including a portfolio with no coal-fired generation.[55] Second, TEP states that the Company did not evaluate the retirement of the Springerville or Four Corners units because it already has plans to retire its San Juan and Navajo units by 2022.[56] Finally, TEP argues that its existing plant participation agreement at the Four Corners Plant justifies its lack of retirement assessments of that plant.[57]

Q Do any of these explanations justify the Company's lack of evaluations of the reasonableness of continuing to invest in the Springerville and Four Corners plants?

A No. As I discuss further below, none of these explanations adequately justify the Company's lack of evaluations of the Springerville and Four Corners plants.

Q Did TEP's 2017 IRP present a sufficient evaluation of its existing coal fleet?

A No. The full coal retirement portfolio evaluated in TEP's 2017 IRP required that retiring coal units be replaced with small nuclear reactors.[58] To have accurately evaluated a full coal retirement scenario, TEP would have needed to assess replacement with a least-cost resource

[54] Ex. AA-2, TEP Response to Data Request No. SC 1.06c; Ex. AA-2, TEP Response to Data Request No. SC 1.07.
[55] Ex. AA-2, TEP Response to Data Request No. SC 1.07b.
[56] Ex. AA-2, TEP Response to Data Request No. SC 2.07a-b.
[57] Ex. AA-2, TEP Response to Data Request No. SC 2.07b.
[58] Ex. AA-2, TEP Response to Data Request No. SC 2.10b.

portfolio. Mandating that coal units be replaced exclusively with costly nuclear reactors prevented TEP from identifying potential cost-effective replacement of the coal units with other resource types.

Q Did TEP's 2017 IRP include unit-specific analyses of alternative retirement dates for any of the Springerville or Four Corners units?

A No.[59] Even if TEP had conducted an adequate full coal retirement scenario analysis, such an assessment would not have established the value (or lack thereof) in continuing to operate specific units. In the case of TEP's 2017 IRP, the Company neither conducted a sufficient full coal retirement evaluation nor conducted unit-specific assessments of any of the Springerville or Four Corners units.

Q Did TEP's 2017 IRP contain other deficiencies?

A Yes. The Commission declined to acknowledge TEP's 2017 IRP due to a range of concerns, including the over-projection of future energy demand and an over-reliance on natural gas resources.[60] Thus, even if the 2017 IRP had included unit-specific retirement analyses that had enabled least-cost replacement of the Springerville and Four Corners, other flaws in the IRP may have invalidated those analyses.

Q Can TEP's 2014 IRP analyses be relied upon to support continued expenditures on the Springerville and Four Corners units?

A No. TEP's 2014 IRP also did not include unit-specific retirement analyses of any of the Springerville or Four Corners units. In fact, at the time of filing of TEP's 2014 IRP, TEP had

[59] Ex. AA-2, TEP Response to Data Request No. SC 2.10d.
[60] Decision No. 76632.

not yet even acquired Springerville Unit 1.[61] Furthermore, 2014 was long enough ago that the broader market context surrounding potential coal retirements has changed substantially. In particular, renewable costs and gas prices are much lower today than they were in 2014.

Q Could TEP's plans to retire the San Juan and Navajo plants limit TEP's ability to evaluate retirement of the Springerville or Four Corners plants?

A No. There is no reason why near-term retirement plans for one set of plants should preclude evaluating alternative retirement dates for a different set of plants. On the contrary, a rational response to TEP's finding that it will save customers more than $500 million by retiring San Juan and Navajo would be to assess whether the Company could achieve additional savings by retiring additional coal units in the near- to mid-term.[62]

Q Have other utilities conducted simultaneous analyses evaluating near-term retirement of each of their coal units within a single resource planning cycle?

A Yes. The 2018 IRP of Northern Indiana Public Service Company (NIPSCO) evaluated alternative retirement dates for each of its remaining five coal units.[63] NIPSCO concluded that it could save its customers more than $4 billion dollars by retiring all of its coal units in 2023 rather than continuing to operate them beyond 2030.[64] In addition, PacifiCorp's ongoing 2019 IRP process for its six-state service territory has included unit-by-unit

[61] Ex. AA-2, TEP Response to Data Request No. SC 2.10a.
[62] Direct Testimony of Michael Sheehan, page 25.
[63] *2018 Integrated Resource Plan*, Northern Indiana Public Service Company LLC. (Oct. 31, 2018), https://www.nipsco.com/docs/librariesprovider11/rates-and-tariffs/irp/2018-nipsco-irp.pdf?sfvrsn=15.
[64] *Id.*, p. 151.

assessments of alternative retirement dates for each of the 22 coal units that it was previously planning to operate through at least the mid-2020s.[65]

Q Does TEP's existing plant participation agreement at Four Corners eliminate the usefulness of evaluating the economics of that plant?

A No. While TEP may not have control over an ultimate retirement decision at Four Corners, it should at least assess whether it makes sense for the Company to seek to exit its ownership agreement prior to 2031. It is possible that the terms of that agreement would make exiting Four Corners early too onerous even if the plant is uneconomic. But TEP cannot determine whether the costs associated with exiting Four Corners justify the continued operation of Four Corners without conducting an economic evaluation. In such an evaluation, any costs of exiting the participation agreement should be accounted for in the same manner as all other costs.

iii. Recent market trends highlight the importance of rigorous economic evaluations of existing coal units.

Q How have recent electricity market trends affected the economics of coal units across the country?

A In general, recent market trends have negatively impacted the economics of coal units and have led to a substantial number of coal unit retirements. According to the U.S. Energy Information Administration (EIA), more than 65,000 MW of U.S. coal capacity retired between 2007 and 2018.[66] In 2018 alone, 12,900 MW of U.S. coal capacity retired.[67] EIA has

[65] *2019 Integrated Resource Plan (IRP) Public Input Meeting*, PacifiCorp (Dec. 3-4, 2018), pp. 8-9, https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2019-irp/2019-irp-presentations-and-schedule/2018-12-03-04%20-%20General%20Public%20Meeting.pdf.

[66] *Today in energy: U.S. coal consumption in 2018 expected to be the lowest in 39 years*, U.S. EIA, (Dec. 28, 2018), https://www.eia.gov/todayinenergy/detail.php?id=37817.

identified a range of economic factors contributing to these retirements, including low natural gas prices, increased competition from renewables, and limited growth in electricity demand.

Q Have other utilities responded to the evolving market landscape by conducting retirement assessments of their coal fleets?

A Yes. Assessments of existing coal units have become an increasingly prevalent component of utility resource planning exercise. As discussed previously, NIPSCO and PacifiCorp both evaluated all of their remaining coal units in their most recent IRPs. Georgia Power's most recent IRP similarly included retirement assessments for each of its existing coal units.[68]

Q What are some of the key characteristics of a rigorous coal unit retirement assessment?

A A proper unit economic retirement assessment should examine all costs and benefits associated with alternative near-term and mid-term retirement dates. Crucially, such an assessment should compare the continued operation of each unit to an optimized, least-cost replacement portfolio that can provide all services that would otherwise be provided by the retiring unit. Finally, unit retirement assessments, like all IRP assessments, should rely on up-to-date resource cost assumptions informed by recent requests for proposals (RFPs) where possible.

---

[67] *Today in energy: More than 60% of electric generating capacity installed in 2018 was fueled by natural gas*, U.S. EIA (Mar. 11, 2019), https://www.eia.gov/todayinenergy/detail.php?id=38632.

[68] *Technical Appendix Volume 2: Unit Retirement Study to 2019 Integrated Resource Plan*, Georgia Power, (Jan. 31, 2019). Georgia Public Service Commission Docket No. 42310. Attached as Ex. AA-5.

Q What assessments of Springerville and Four Corners has TEP committed to conducting as part of its 2020 IRP process?

A TEP has stated that it plans to evaluate the long-term viability of both Springerville and Four Corners as part of its 2020 IRP process.[69] However, the Company has not provided much detail regarding the nature of these analyses.

Q What are your conclusions and recommendations with respect to the economic status of the Springerville and Four Corners units?

A TEP has not conducted any assessments of the economic viability of the Springerville and Four Corners units. Given my findings regarding the recent uneconomic performance of these plants relative to a market proxy, this lack of analysis is particularly troubling. I therefore recommend that the Commission require TEP to conduct and present rigorous economic assessments of alternative retirement dates for each of the Springerville and Four Corners units in its 2020 IRP. These assessments should use the best practices identified above. Until TEP has conducted these analyses, the Commission should not permit the Company to recover incremental capital expenses at these units.

5. SUNDT RICE PROJECT

Q Please summarize this section.

A In this section, I evaluate TEP's proposal to place into rate base its planned $172 million capital investment in 182 MW of RICE units. I show that TEP has not provided sufficient evidence of the ramping capacity needs that the RICE units are ostensibly designed to fill. I also show that the Company has failed to appropriately evaluate generation and transmission system alternatives to the RICE units that may, individually or in combination, be able to

[69] Ex. AA-2, TEP Response to Data Request No. SC 1.17b.

provide TEP's stated ramping and voltage-support service requirements at a lower cost. Specifically, TEP has not sufficiently considered: (1) the impact of TEP's impending Western Energy Imbalance Market (EIM) participation; (2) alternative voltage support technologies such as Static VAR Compensators and synchronous condensers; (3) delayed retirement of either or both of the existing Sundt Units 1 and 2 in combination with replacement using emerging technologies such as battery storage; or (4) installation of a smaller number of RICE units.

Q Please provide a brief overview of TEP's proposed RICE Project.

A TEP's proposed RICE project consists of ten 18.2 MW natural gas-fired units located at the H. Wilson Sundt Generating Station (Sundt).[70] The RICE units are currently under construction and are expected to be placed in service on or before April 1, 2020.[71] Under TEP's plan, the RICE units will replace the existing Sundt Units 1 and 2.[72]

Q What is TEP's request regarding the RICE units in this case?

A In this case, TEP is seeking approval to place its $172 million capital investment in the RICE units into rate base.[73]

Q Please summarize TEP's justifications for its RICE unit investments.

A TEP claims that it needs to install a fast-ramping generation resource at Sundt that can (1) support the rapid expansion of renewables on its system and (2) ensure sufficient voltage

[70] Direct Testimony of Michael Sheehan, p. 9.
[71] *Id*., p. 19.
[72] *Id*., p. 9.
[73] Direct Testimony of David Hutchens, pp. 10-11.

support in the Tucson metropolitan area.[74] TEP argues that the RICE technology provides "the best combination of operating flexibility and cost-effectiveness" to meet these needs.[75]

i. TEP has not provided sufficient evidence that the Sundt RICE project is needed to meet ramping needs.

Q Has TEP adequately justified the Company's need for new RICE units to provide ramping support?

A No. While it is true that TEP has seen an increase in renewables since its last rate case, with even more renewable capacity projected to come online in the next few years, the Company's analysis does not definitively establish a need for incremental ramping capacity. TEP's planned increase in renewable penetration may *eventually* support a need for *some* additional grid balancing services to compensate for the net increase in system variability (due to both load and renewable resource output patterns). However, TEP has not demonstrated that it requires 182 MW of RICE units coming online in 2020 to meet ramping needs.

Q Please summarize your concerns with the Company's analysis of ramping needs.

A TEP does not adequately justify why 182 MW of RICE capacity is needed to address the specific concerns it has around ramping. When TEP modeled its future ramping needs, the Company found that it could meet projected ramping needs with already-planned resources provided that future renewable projects are not highly geographically concentrated.[76] Despite

---

[74] Appendix A to TEP 2018 Action Plan Update, *H. Wilson Sundt Generating Station Reciprocating Engine Use Case: Final Report* (Dec. 2017), pp. 11-19 ["RICE Use Case Final Report"].

[75] *Id*., p. 19.

[76] TEP modeled ramping requirements under three alternative siting scenarios for future renewable energy: (1) Geographically Dispersed; (2) Base Case; and (3) Geographically Concentrated. Ramping needs vary significantly based on the geographic distribution of renewables. TEP found that the Company's 10-minute renewable ramping requirements could range from 224 MW to 328 MW, with between three and 118 days with

this, TEP still claimed that it needed more fast-ramping resources to meet resource availability constraints, accommodate uncertainty in renewables siting, and balance additional renewables beyond what it projected to come online by 2024.[77]

Q Is uncertainty in the 2024 availability of TEP's ramping resources a valid reason to build 182 MW of RICE capacity in 2019?

A No. Under its Base Case ramping capacity assessment, TEP found that its planned ramping capacity—which includes neither the RICE units nor Sundt Units 1 or 2—would be about 50 MW greater than its ramping requirements.[78] Only two of the Company's planned ramping capacity resources are listed as providing more than 50 MW of ramping capacity, and the largest of those resources is expected to provide 78 MW of ramping capacity.[79] Thus, under TEP's base assumptions, 28 MW of additional ramping capacity would be enough to ensure sufficient 2024 ramping capacity even if the largest of the Company's ramping resources was unavailable during the time of greatest ramping need.[80] Even in the unlikely event that the Company's two largest planned ramping capacity resources were both unavailable during the time of greatest ramping need, the Company's analysis suggests it would only need an incremental 83 MW of ramping capacity.[81] These values are far lower than the 182 MW of planned RICE capacity, they do not account for the ramping capacity provided by Sundt Units 1 and 2, and they are only expected to arise in 2024 under TEP's analysis.

---

ramps exceeding 200 MW depending on whether future renewables are geographically dispersed (low end) or concentrated (high end). RICE Use Case Final Report, p. 14.

[77] RICE Use Case Final Report, p. 15.

[78] *Id*., p. 14.

[79] *Id*., p. 14. Note that even this 78 MW resource appears to be a combination of two separate generating units.

[80] *Id.*, p. 14. (78 MW of DMP/NL4 resource minus 50 MW excess capacity equals 28 MW.)

[81] *Id.*, p. 14. (78 MW of DMP/NL4 resource plus 55 MW of Luna resource minus 50 MW excess capacity equals 83 MW.)

Q Is the geographical dispersion of new renewable resources outside of TEP's control?

A No. TEP has at least some control over where its future renewable resources are sited. If siting future wind and solar resources in a geographically dispersed manner would reduce the need to build costly new capacity for the specific purpose of meeting ramping needs, then TEP should take that into account in its renewable procurement decisions. If TEP successfully achieves a "geographically dispersed" renewable scenario, its planned ramping capacity would exceed its expected 2024 ramping needs by about 80 MW.[82] Under this scenario, TEP would have sufficient ramping capacity even if its largest ramping resource was entirely unavailable during the hour of greatest ramping need.

Q Is it reasonable for TEP to build RICE capacity in 2019 to meet potential ramping requirements in 2024 and beyond?

A No. One of the benefits of simple, fast-ramping resources such as RICE and battery storage is that they can be developed relatively quickly. Mr. Sheehan's testimony indicates that the Company's planned RICE units will enter operation less than three years after the Company commenced an RFP process for the units and only 16 months after the start of construction.[83] TEP could therefore have waited at least two to three more years before developing any new resources needed to fill ramping capacity needs in 2024, and could have waited even longer to develop ramping capacity needed beyond 2024. By delaying a decision, TEP would have developed a more accurate understanding of what its ramping capacity needs will actually be in 2024 and beyond. Waiting could also have allowed the Company to take advantage of cost declines in alternative fast-ramping technologies, such as battery storage.

---

[82] RICE Use Case Final Report, p. 14.

[83] Direct Testimony of Michael Sheehan, pp. 16-19. The RFP process took place starting in June 2017. Construction commenced in January 2019. The RICE units are expected to enter service no later than April 1, 2020.

Q Please summarize your concerns with the Company's failure to consider the impact of joining the Western EIM.

A Until 2022, TEP will generally have to meet its system ramping needs with its own resources. However, in 2022 TEP will join the Western EIM.[84] At that point, the pool of resources available to address TEP system variability will expand considerably, since the EIM is structured for the exact purpose of more efficiently balancing variations in load and renewable generation using region-wide resources. TEP evidently ignored this critical EIM functionality when assessing its needs for future ramping resource capacity. Participation in the EIM will fundamentally help address TEP's resource variability and ramping needs, as the Company discusses in its 2019 Preliminary IRP:

> Energy Imbalance Markets (EIMs) are specialized wholesale power markets designed to help Control Areas, such as TEP's, to balance the sub-hourly intermittent characteristics of wind and solar power. An EIM aggregates the variability of loads and resources across the footprints of its participating balancing areas and dispatches resources to achieve the least-cost balance of electric demand and supply in real-time (e.g., 5-to 15-minute intervals).[85]

Given the Company's own discussion of the value provided by an EIM market, TEP should have modeled future ramping needs in the context of EIM market participation to understand how this would affect the need for incremental ramping capacity.

[84] TEP Preliminary 2019 IRP, p. 44.
[85] TEP Preliminary 2019 IRP, p. 44.

ii. TEP has not established that investing in the Sundt RICE project was a prudent choice relative to non-fossil fuel alternatives.

Q How did TEP select the RICE units?

A TEP hired Burns and McDonnell Engineering to evaluate technologies that could meet both system ramping needs and minimum must-run generation requirements associated with local voltage support.[86] The resulting study identified RICE and Simple Cycle Gas Turbines (SCGT) as the most suitable technologies for addressing the specified requirements. TEP then completed a use-case study that compared the alternatives of (1) investing in new RICE units in 2019, (2) building four new SCGTs in 2019, or (3) maintaining Sundt Units 1 and 2 until 2030 and 2028, respectively, and then replacing those units with RICE units. After deciding that near-term development of RICE units was the best of these three options, TEP issued an RFP for the RICE units in 2017.[87]

Q Did TEP's selection process adequately consider alternatives to the RICE units?

A No. There are at least four ways in which TEP's process was biased in favor of selection of the RICE units (or other, similar gas resources) as opposed to alternative resources. First, TEP unreasonably assumed that a single resource must serve both the ramping and local voltage support requirements it identified. Second, TEP did not adequately evaluate the option of continuing to operate Sundt Units 1 and 2 in the near term in order to enable alternative resource costs to continue to decline. Third, TEP's analyses did not properly

[86] The minimum operational requirements were as follows: (1) continuous availability in order to support TEP's local area minimum must- run generation requirements, (2) a minimum turndown or capacity of 10 MW, (3) an initial start time of 0 to 20 MW within five minutes, (4) an initial ramp time of 10 to 20 MW in 30 seconds, (5) a full ramp of 10 to 200 MW in five minutes, (6) the ability to have multiple starts and ramping periods each day without a maintenance penalty, (7) for natural gas resources, a maximum heat rate of 9,000 Btu per kWh, and (8) no operating time or capacity limits across all existing Sundt generating units due to air permitting requirements. TEP 2018 Action Plan Update, p. 18.

[87] TEP 2018 Action Plan Update, p. 18.

account for battery storage resource cost declines. Finally, TEP wrote its RFP specifically for RICE units rather than designing the RFP to be technology-neutral.

Q Has TEP reasonably justified the selection of a single resource to provide both voltage support and grid-balancing needs?

A No. Operational requirements to meet load and resource output variation are system-wide requirements and are not specific to the Tucson region. It is valid for TEP to consider resources that can simultaneously address system-wide ramping needs and voltage constraints in the Tucson area—as one option. However, the existence of the local-area voltage constraints should not limit the Company to considering only local solutions that can address all voltage and ramping needs simultaneously. The Company's focus on a single solution limits its ability to consider solutions comprised of multiple components that could be lower cost.

Q Can you give a simple example of a solution with multiple components that TEP did not analyze?

A Yes. Installation of local Tucson-area voltage support equipment such as Static VAR Compensators or synchronous condensers would allow for greater reliance on capacity and energy resources outside the immediate Tucson area. The Tucson area's local capacity needs would then be lower, and TEP could meet incremental system ramping capacity requirements with technologies that are less well-suited to meet local minimum must-run generation requirements, such as battery storage.

Q Even assuming that TEP can only address its identified Tucson voltage support issues with minimum generation requirements, would that justify the construction of 182 MW of RICE units?

A No. With respect to voltage support issues, TEP appears to be primarily concerned with how to efficiently and cost-effectively meet minimum generation requirements during the approximately 90 percent of hours when those requirements are lower than 25 MW.[88] But meeting a 25 MW minimum generation requirement would require no more than two 18.2 MW RICE units, not the ten units that TEP is proposing to include in rate base in this case.

Q How is TEP's "delayed investment" portfolio different from the delayed retirement portfolio for Sundt Units 1 and 2 that you believe the Company should have evaluated?

A Under TEP's only "delayed investment" portfolio, Sundt Unit 2 retires in 2028, Sundt Unit 1 retires in 2030, and each unit is replaced with RICE units at the time it is retired.[89] TEP should have evaluated a range of possible alternative retirement dates, including retirement in 2022 when the Company joins the EIM. TEP also should have evaluated a range of alternative replacement options beyond RICE units under a delayed investment scenario.

Q Is there reason to believe that alternative resources would be more competitive replacement options in the future than they are today?

A Yes. TEP's 2018 Action Plan Update indicates that energy storage projects were approximately twice as costly as RICE units in 2017 but "will start to become cost competitive to traditional natural gas peakers within the next five to seven years."[90] A

[88] RICE Use Case Final Report, pp. 17-18.
[89] *Id*., p. 27.
[90] TEP 2018 Action Plan Update, p. 18.

graphical comparison presented in TEP's Action Plan Update indicates that 4-hour battery storage resources will reach installed cost parity with RICE units by 2025.[91]

Q Did TEP's assessment indicate that near-term investment in the RICE units was economically preferable to delayed investment?

A No. TEP's assessment indicated that investing in the RICE units in 2019 would result in a higher net present value revenue requirement than delaying investment under two of three scenarios evaluated, including TEP's Base Case.[92] This further indicates that TEP should have devoted additional attention to alternative versions of a "delayed investment" portfolio, including replacement with battery storage.

Q Do you have additional concerns with the way that TEP's evaluation process treated battery storage resources?

A Yes. The original Burns and McDonnell technology assessment that TEP relied on presents a static assessment of the cost of installing different technologies at the time the analysis was conducted (March 2017).[93] TEP's reliance on an assessment that excludes cost decline assumptions is problematic for several reasons: (1) TEP relied on this assessment to inform a future resource decision, yet the assessment contains no information on how future costs of different resources are projected to change; (2) the assessment provides no information that would allow TEP to evaluate the value of delaying a project; and (3) the assessment disadvantages battery storage resources, which have been experiencing rapidly declining costs, relative to traditional thermal resources.

---

[91] *Ibid*.

[92] RICE Use Case Final Report, p. 30.

[93] Confidential Attachment "SC 5.5 BurnsMac App B-COMPETITIVELY-SENSITIVE CONDIDENTIAL" to TEP Response to Data Request No. SC 5.5. Attached as Ex. AA-6.

TEP used the results of the limited Burns and McDonnell assessment to narrow down its selection of future resource options to exclude battery storage. However, the Burns and McDonnell study indicated an expected project timeline for battery storage [redacted].[94] A difference of one year has a nominal impact on the cost of thermal technologies, but it has a significant impact on the cost of battery storage. In November 2016, Lazard reported battery storage capital costs of $417 to $949 per kilowatt-hour (kWh) for a lithium-ion battery in a peaker use case.[95] By the end of 2017, Lazard was reporting capital costs of $335 to $425 per kWh for lithium-ion peaking resources, with an estimated 2018 cost of only $291 per kWh.[96]

Q Did the RFP that led to the RICE investment allow for responses associated with non-RICE technologies?

A Yes. However, the RFP was written specifically to solicit bids to construct RICE units. The email sent out to potential RFP respondents described the RFP as soliciting the "design and construction of Reciprocating Internal Combustion Engine" generators and indicated that TEP already had plans to separately procure the RICE generators themselves directly from manufacturers.[97] Although TEP allowed bidders to propose an "alternative technology," it made clear that the Company was focused on building RICE units to meet its identified system needs.[98]

---

[94] Ex. AA-6, Confidential Attachment "SC 5.5 BurnsMac App B-COMPETITIVELY-SENSITIVE CONDIDENTIAL" to TEP Response to Data Request No. SC 5.5, [redacted]

[95] *Lazard's Levelized Cost of Storage – Version 2.0*, Lazard (Dec. 2016), p. 17. Attached as Ex. AA-7.

[96] *Lazard's Levelized Cost of Storage Analysis – Version 3.0.,* Lazard (Nov. 2017), p. 14. Attached as Ex. AA-7.

[97] Ex. AA-2, Attachment "SC 3.01 Sundt RICE IM Report.pdf" to TEP Response to Data Request No. SC 3.01. p. 4.

[98] Ibid.

Q Was it reasonable for TEP to develop an RFP specifically targeted at RICE units?

A No. TEP should have issued a technology-neutral RFP that identified necessary operational requirements and encouraged all bidders who felt they could meet those requirements cost-effectively to respond. Since the decision to focus on RICE units was in part based on cost considerations, a surprisingly low-cost RFP response associated with an alternative technology could have allowed TEP to meet its system needs more cost-effectively than with RICE resources. In addition, as discussed above, TEP should have split apart its mandated operational requirements where possible, such that bidders could have proposed technologies specifically addressing the voltage support or ramping requirements without having to address both types of needs.

Q What are your conclusions and recommendations with respect to TEP's proposal to include $172 million in RICE unit capital expenses in rate base?

A I conclude that TEP has not adequately justified the need for, timing of, or magnitude of its RICE unit investments. TEP's analyses did not compare the planned RICE unit investments to a sufficient range of alternatives and did not establish a near-term need for 182 MW of RICE units for either ramping capacity or voltage support purposes. I therefore recommend that the Commission not allow TEP to include the RICE investments in rate base. In the alternative, the Commission should not permit TEP to earn a return on its poorly justified investments in the RICE units.

Q Does this conclude your direct testimony?

A Yes, it does.