SUNFLOWER ELECTRIC POWER CORPORATION

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Memorandum

On

Impacts of EPA-proposed Carbon Pollution Emission Guidelines for Existing Sources Under Section 111(d) of the Clean Air Act

Corey Linville

Vice-President, Power Supply and Delivery

Submitted Electronically to:

The Federal Energy Regulatory

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Docket No. AD 15-4-0000
Sunflower Electric Power Corporation – Corey Linville

My name is Corey Linville and I am the Vice-President for Energy Supply for Sunflower Electric Power Corporation (Sunflower) of Hays, Kansas. Sunflower was formed more than 60 years ago to provide wholesale generation and transmission services to six rural electric cooperatives serving in central and western Kansas. Together our member-owners serve their 200,000 consumers, who rely on affordable and reliable electricity for daily use for their farms, homes, and businesses.

Sunflower is a rural electric generating and transmission cooperative (G&T) that owns and operates facilities to provide essential electricity to its six member-owner distribution cooperatives in central and western Kansas. Sunflower is owned by members Lane-Scott Electric Cooperative, Inc., Dighton, Kansas; Prairie Land Electric Cooperative, Inc., Norton, Kansas; Pioneer Electric Cooperative, Inc., Ulysses, Kansas; The Victory Electric Cooperative Association, Inc., Dodge City, Kansas; Western Cooperative Electric Association, Inc., WaKeeney, Kansas; and Wheatland Electric Cooperative, Inc., Scott City, Kansas. Sunflower owns and operates electricity generating resources, including one affected electricity generating unit (EGU) in this proposed rule, and transmission resources for the express benefit of these members.

Mid-Kansas Electric Company, LLC, (Mid-Kansas) is a coalition of five rural electric cooperatives and one wholly-owned subsidiary company that owns facilities to provide essential electricity to its six member-owners in central and western Kansas. Mid-Kansas is owned by Lane-Scott Electric Cooperative, Inc., Dighton, Kansas; Prairie Land Electric Cooperative, Inc., Norton, Kansas; Southern Pioneer Electric Company, Ulysses, Kansas; The Victory Electric Cooperative Association, Inc., Dodge City, Kansas; Western Cooperative Electric Association, Inc., WaKeeney, Kansas; and

Wheatland Electric Cooperative, Inc., Scott City, Kansas. Sunflower operates the Mid-Kansas facilities, including one affected EGU in this proposed rule, for their benefit.

Sunflower operates the combined Sunflower/Mid-Kansas resources, including 360 MW of coal-based and 710 MW of gas-based EGUs. Further, Sunflower and Mid-Kansas receive energy through power purchase agreements of up to 400 MW/h, of which up to 225 MW/h is wind-based. Further, Sunflower owns or operates and maintains approximately 2,000 miles of transmission lines at operating level voltages up to and including 345 kV, all located in central and western Kansas.

Electric reliability considerations

Sunflower is a member of the Southwest Power Pool, Inc. (SPP) regional reliability and transmission organization (RTO/RE), the oldest such organization in the US. As a member of SPP, Sunflower participates actively in the many committees established by the SPP membership to accomplish its purpose, and as such Sunflower is positioned to understand the relevant complexities associated with the dispatch priorities and decisions made by SPP. SPP has recently (2014) implemented pool-wide economic unit commitment and dispatch (the Integrated Marketplace) while giving proper attention to existing reliability criteria established by the North American Electric Reliability Corporation (NERC); SPP dispatches all Sunflower (and Mid-Kansas) EGUs consistent with its mission. Significantly, Sunflower sells all of the energy it produces from its resources to the SPP consistent with procedures established by SPP; Sunflower further purchases the energy requirements of its cooperative members and other wholesale contracts to which it is bound from the SPP, again consistent with procedures established by SPP. All energy is produced, bought, and sold by way of the SPP, including bilateral transactions.

Sunflower's concerns about the reliability impacts of the proposed EPA are well founded. With large numbers of EGUs retiring in the foreseeable future because of the combined effects of EPA rulemaking it would now be necessary to redispatch future electricity production from coal-based resources to natural-gas combined-cycle resources that economically dispatch within the SPP to only about 30%. SPP has evaluated this, and other building blocks under the proposed rule, and has identified severe low-voltage concerns rising to the level of voltage collapse. It is uncertain how EPA will respond to the queries raised by SPP and other RTOs and we encourage SPP as well as FERC to continue to press the infrastructure and timing issues with EPA that give rise to these extraordinary concerns.

Given that this is EPA's rule, and given that each of the Central region states face a different set of circumstances, including the types and sizes of electric industry entities, their resource mix, applicable state public policy goals or requirements, and state-specific carbon reduction goals we suggest that FERC press EPA for periodic formal joint meetings at which very specific reliability concerns can be raised for resolution. These meetings should and could occur at the RTO and state level expressly to better understand and implement such state-based targets necessary for compliance. Compliance schedules may need to be altered for specific EGUs to provide reliability assurance.

Infrastructure needs

Infrastructure needs addressed here will be primarily related to the insufficiency of transmission lines, the means by which they are currently constructed, and the circular results for purposes of exporting large amounts of wind resources from the high plains areas of several Central states to other states and other RTOs. This is an express objective in EPAs proposed rule. Sunflower's experience in identifying these issues is sufficient to suggest how significant the repurposing of energy infrastructure can alter the balance of current planning activities that govern project approvals within the RTOs. There are about 1400 MW of nameplate wind resources in Sunflower's RA and another 1500 MW are expected by the close of 2016. These resources are being added onto a system that was wholly constructed to adequately and reliably serve the load requirements of the member cooperatives that own Sunflower.

Once connected to SPP the traditional planning function is put into motion, and new transmission projects are determined necessary to assure the reliability of the newly connected wind resources as well. The existing load-serving entities pony-up to pay for these new transmission projects that are not to be constructed for their benefit at all. New transmission projects, new wind projects, new reliability studies, new transmission projects… the circle continues. The Clean Power plan will only make worse this problem of reliability issues related to designing behind the curve.

Price contour maps from the SPP integrated market clearly show the impacts that adding wind generation to areas with little load can have on transmission congestion. Areas in western Nebraska, western Kansas, and the Oklahoma and Texas panhandles have significant wind production and relatively small demand. The excess generation must be exported to the east across transmission lines that weren't designed to handle this amount of export. New transmission projects ease the congestion until additional wind is built.

This is not the first time the challenge of designing and building systems to meet future needs has occurred. There are examples of this for large high-voltage electric transmission systems by major energy companies in other parts of the US in the last half of the 20th century. There is also the example of the interstate highway construction program, also in the last half of the 20th century. But, repeating this effort now, especially when driven by environmental and not energy policy, must be engaged if we are to replace the current slow-go behind the curve means now available.

Implications for wholesale markets

Sunflower expects that the most significant impact to a well-functioning wholesale market will arise because of the redispatch of NGCC EGUs from 30% to 70% by the mere promulgation of the EPA rule. This is entirely counter to security-constrained economic dispatch that now governs the entire integrated marketplace. The goal of reducing wholesale power costs was the driving force behind the substantial investment of time and money made by members of SPP to implement the integrated marketplace. Will states in which SPP members are located now have to establish some offer curve “adder” or “carbon tax” to the cost structure of lower-cost resources in order to accomplish the EPA re-dispatch of energy production, thus defeating the very premise upon which the market was built?

In such case the dispatch of coal-based and other gas-based Kansas EGUs will be reduced substantially, and the price of energy purchased from SPP will increase substantially for Sunflower’s members and their consumer-owners. This is discussed in detail in the attached report performed for Sunflower.

Sunflower has modeled the net effect of this re-dispatch to identify an approximately 25% reduction in the utilization of Holcomb 1 (Sunflower's 360 MW coal-based EGU) compared to the base case. Indeed, the ultimate utilization of Holcomb 1 may approach a 35% capacity factor – minimum load for the technology, and not coincidentally the least efficient load point. Further, the economic model results indicate the effects of this NGCC re-dispatch will result in an approximate 65% increase in the wholesale cost of all energy purchased from the pool. Recall that these effects on Sunflower member-owners and their consumer-owners occur even though there are no NGCC facilities even located in Kansas. EPA's analysis of each of its building blocks in each individual state effectively ignores these kinds of real integrated market impacts on Kansas ratepayers.

Conclusion

Rural agricultural economies are historically fragile, and ill-conceived regulation such as this will harm our members; they will suffer lost production and lost business opportunity that cannot be remedied when, or if, you change your mind later. We have grave concerns about the future price of electricity under the President's announced GHG-reduction strategy for existing electricity producing plants.

Not all utilities are the same – some, like Sunflower, are small and have limited resources with which to meet new regulatory requirements while continuing to satisfy its member and power pool obligations. The only coal-fired generation asset owned and operated by Sunflower is Holcomb 1, a nominal 360 MW unit. Holcomb 1 is well-controlled for criteria and hazardous air pollutants, and because it has always been well-maintained it is among the most efficient facilities in Kansas. Because there is little or no opportunity to further improve efficiency and thus reduce greenhouse gas emissions, we are concerned that the effect of EPA CO_2 regulations, especially if they are not based upon sound inside-the-fence rulemaking, may have the effect of imposing arbitrary limits on CO_2 emissions. In such a case then, higher cost gas-fired resources will necessarily be used to meet our obligations, resulting in higher rates for consumers.

We appreciate the opportunity to provide these limited comments to FERC on the FERC-jurisdictional issues associated with EPA's proposed GHG rulemaking. Please contact the writer at (620) 277-4517 for specific questions or information related to these comments.

Attachments:

Sunflower Electric Power Corporation Carbon Study Report

Sunflower Electric Power Corporation Clean Power Plan Study

Price Contour Maps from the SPP State of the Market Report Fall 2014

Sunflower Electric Power Corporation
Carbon Study Report

This report summarizes the findings of ACES' study to determine the impacts of the Environmental Protection Agency's (EPA) Clean Power Plan. Specific details and assumptions included in the set up of ACES' Security Constrained Economic Dispatch (SCED) model can be provided at SEPC's request. The findings are based on a 2020 Base Case (2020-BC) simulation and a 2020 simulation (2020-NGCC) where Natural Gas Combined Cycle (NGCC) generation reaches 70% capacity factor (CF) due to an increase in the offer curve of coal-fired resources. The most alarming findings of the study for SEPC are the drop in generator production and increase in LMPs from the 2020-BC to the 2020-NGCC scenario. The sections that follow provide more detail on these findings.

Section 1: Drop in Generator Production

The largest sources of energy for SEPC are Jeffery Energy Center (JEC) and Holcomb. In the 2020-BC, these resources are economically dispatched near a 71% and 47% CF, respectively. In the 2020-NGCC scenario, these same resources' CFs drop to 61% and 32%, respectively. SEPC's Rubart Station is the only resource among SEPC's portfolio that experiences a noticeable increase in output from the 2020-BC to 2020-NGCC. Rubarts' CF grows from 7% to 19%. The production deficit caused by the decreased output of SEPC's coal-fired resources; however, is only minimally dampened by Rubart. SEPC's wind resource production was unaffected and therefore omitted from discussion in this section. In total SEPC's generation fleet production drops nearly 810,000 MWh in the 2020-NCGG scenario. Figure 1 details SEPC's resource LMPs, CFs and production output.

Section 2: Increase in LMPs

The increase in LMPs at SEPC's resources above paired with the net reduction in production results in an overall increase in generation production revenues of nearly $43 million. This increase does include the additional revenues from SEPC's wind resources. SEPC's load zone increases from $17.62/MWh in 2020-BC to $29.43/MWh in 2020-NGCC. This increase in LMP at the load causes a $70 million increase to SEPC's load cost from 2020-BC. As SEPC is generally short energy and thus buying from the market, the increased LMPs across the board negatively impact SEPC.

In conclusion, ACES' study reveals the potential impact of the EPA's Clean Power Plan on SEPC is increased costs to SEPC. SEPC's main sources of generation production are reduced. While the generation LMPs do increase, the bolstered generation revenues do not cover the losses resulting from increased load LMPs. Additional detail is included within the accompanying Excel workbook. Figure 1 provides support to the commentary above.

Figure 1.

SECI Nodes	Annual Average LMPs 2020-BC	Annual Average LMPs 2020-NGCC	Annual Capacity Factors 2020-BC	Annual Capacity Factors 2020-NGCC	Annual Production 2020-BC	Annual Production 2020-NGCC
WR.JEC.1	$24.85	$36.26	71%	59%	978,530	818,375
WR.JEC.2	$24.86	$36.30	69%	59%	956,388	813,278
WR.JEC.3	$24.85	$36.28	75%	66%	1,021,918	899,620
SECIHOLCOM1UN1	$17.28	$29.16	47%	32%	1,458,762	979,248
MKECCIM_UN1	$20.70	$32.38	3%	1%	14,863	6,371
MKECCIM_UN2	$20.70	$32.38	3%	1%	14,863	6,371
MKECCLIFTON_UN1	$24.56	$37.15	0%	0%	1,973	1,535
MKECJUDLR_UN4	$17.22	$28.68	0%	0%	1,732	1,567
MKECMULGRN_UN3	$19.16	$31.02	0%	0%	2,312	2,684
SECIGRDNCT1UN2	$17.42	$29.37	0%	0%	3,491	3,516
SECIGRDNCT1UN3	$17.42	$29.37	0%	0%	0	0
SECIGRDNCT1UN4	$17.42	$29.37	0%	0%	0	0
SECIGRDNCT1UN5	$17.42	$29.37	0%	0%	0	0
SECIRUBART	$17.42	$29.37	7%	19%	67,650	183,480
MKECGRAYWIND	$16.59	$27.47	33%	33%	328,572	328,572
MKECSHOOTSTAR	$13.84	$24.35	38%	38%	347,781	347,781
SECI_SMOKY	$27.35	$39.03	38%	38%	330,701	330,701
SECI_SMOKY2	$27.35	$39.03	39%	39%	510,488	510,488
			Total Production (MW):		6,040,025	5,233,586
			Total Production Revenue ($):		$133,938,882	$176,805,030

Sunflower Electric Power Corporation

Clean Power Plan Study

November 7, 2014

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1. Executive Summary

ACES performed a Locational Marginal Price (LMP) and economic dispatch analysis on behalf of Sunflower Electric Power Corporation (SEPC) to assist in determining the impacts of the Environmental Protection Agency's (EPA) Clean Power Plan. In the Clean Power Plan, the EPA states several methods to lower carbon emission rates. This analysis looks at the price implications and the utilization of alternate generation under several scenarios designed around the EPA's methods. This analysis should help SEPC understand the potential range of outcomes that the plan may have on their portfolio. While the focus of the study is Kansas, the majority of the Eastern Interconnect was included in the model run to develop an understanding of the potential interactions in SPP and surrounding areas.

ACES completed model runs of several scenarios to understand the impacts to both the price and capacity factors throughout SPP. First, a Base Case (2020-BC) was completed to use as a reference case for scenario comparison. ACES' Base Case includes continued renewable growth, respecting state Renewable Portfolio Standards (RPS), including imports and exports. One of the four measures the EPA highlighted is an increase in renewable generation. Since a renewable build is already assumed in the Base Case, it was not studied individually. Next, ACES completed individual studies to understand the impacts of each of the EPA's carbon reduction methods individually. These scenarios include:

- Natural gas combined cycle generators (NGCC) run at a 70% capacity factor (2020-NGCC)
- Energy efficiency reduces load (2020-EE) with a 1.5% efficiency rate
- Coal efficiency increases by 3% and 6% (2020-CE3 and 2020-CE6)

The final scenarios were designed to combine the individual runs detailed above to reveal the overall impact of the Clean Power Plan. The study referred to as 2020-ALL3 combines the setup of 2020-NGCC, 2020-EE, and 2020-CE3, while 2020-ALL6 combines 2020-NGCC, 2020-EE, and 2020-CE6. Although SEPC recognized that the CE6 scenario is unrealistic, ACES included it in this report for proper due diligence and consistency of modeling all of the EPA's suggested scenarios. ACES study pertaining to the Clean Power Plan utilized EPA's assumptions, therefore understanding the full impacts of the EPA assumptions while also understanding realistic assumptions provides proper due diligence for any decisions or rebuttals SEPC would make going forward.

The study results reveal that the 2020-NGCC, 2020-ALL3, and 2020-ALL6 scenarios have the greatest impact on SEPC, as prices in its area significantly increase. Since the 2020-ALL3 and 2020-ALL6 scenarios include the 2020-NGCC, it can be inferred that increasing the NGCC capacity factor to 70% by increasing the cost of coal-fired generation is the most impactful of the EPA's suggested carbon reduction techniques. While prices increased between 40% and 70% from the Base Case, the bulk of SEPC's generation output decreased due to the cost adders placed on the offer curves of coal-fired resources. While generation revenue increases with increased prices, the lower capacity factors lead to greater increases in load costs compared to increases in generation revenue. The energy and carbon efficiency studies (2020-EE, 2020-CE3, and 2020-CE6) had very little impact on SEPC, as generation production levels and prices remained relatively flat.

2. Background

On June 2, 2014, the EPA proposed a plan to reduce carbon emissions from existing power plants in the United States. The plan states the goal of reducing carbon emissions from the power sector by 30% in 2030 relative to 2005 emissions levels. To accomplish this, the EPA set a carbon emission target rate, by state, which is ultimately designed to lead to reduced carbon emissions nationally. States have the flexibility to collaborate with other states or to choose different methods to meet the reduction, but the ultimate goal remains the same. The EPA highlights four potential methods to accomplish the target carbon emissions reduction: 1) increase efficiency of coal-fired generation by 6%, 2) substitute carbon-intensive generation with less carbon-intensive generation (i.e., utilize NGCC instead of coal), 3) substitute carbon-based generation with zero-carbon generation (i.e., install renewable generation), and 4) use demand-side energy efficiency to reduce the amount of generation required.

This report focuses on methods 1, 2, and 4, as method 3 is already included in ACES' Base Case. ACES increases the installation of renewable generation (method 3) when modeling in the future to meet state RPS standards. Additional information on the installation of renewables can be found in Section 3 of this report and the previously delivered assumptions document.

To analyze the impacts of these methods, ACES completed several scenarios utilizing a security constrained economic dispatch (SCED) model, modeling 2020 (the first milestone year in the Clean Power Plan and a year for which ACES has sufficient transmission build to complete a SCED simulation). First, a Base Case was completed to understand the economics and impacts of the plan. Second, a scenario was completed that increased all coal resource offers to achieve NGCC Capacity Factor (CF) of 70% (2020-NGCC). Third, a scenario was completed that increased demand-side energy efficiency by 1.5% (2020-EE). Forth, scenarios increasing coal-fired efficiency by 3% and 6% were studied (2020-CE3 and 2020-CE6). Finally, these methods were combined into two single studies (2020-ALL3 and 2020-ALL6). The following sections identify the impacts of these scenarios on SEPC.

3. General Model Assumptions

The model assumptions included in the study are detailed in this section. The following list summarizes the general model assumptions:

- All hours of the year in each month were modeled for 2020, consistent with the extent of available transmission and generation data. This enabled proper front-end model reconciliation with current price levels, and also enabled appropriate trend analysis throughout the study period.

- Load growth was assumed “normal” based on regional (ISO/RTO, local Balancing Authority) planning forecasts.
- No transmission outages were modeled.
- Generation outages were modeled statistically, with random outages respecting historical forced outage rates and more frequent outages in the shoulder seasons during the typical maintenance period.
- In general, future generation projects were included in base data if they are under construction or have an air permit. These resources are placed in service based on estimated completion dates, which were determined using estimates of the projects’ status and completion timeline.
- New transmission is entirely dependent on what is included and approved in the STEP/ITP process.
- Wind units were modeled as receiving the Production Tax Credit (PTC) if installed in or prior to 2014. Anything installed in 2015 or after did not have the PTC.

3.1. Market Structure

ACES’ price forecasting model segments the country into various regions to mimic market boundaries. The purpose of this segmenting is to properly reflect the actual nature of transactions between utilities and markets, while accurately modeling prices within each market as they are expected to operate in the future. As such, several assumptions vary depending on the market area being considered. The following is a list of some of the notable structural differences:

- SPP:
  - Dispatched as a single, coordinated Nodal market mimicking the future market design with consolidated capacity and reserves
  - Power moves within the market to minimize costs
  - Marginal losses included in the dispatch decision
  - Coordinated with SPP and NERC flowgates
- MISO:
  - Dispatched in a single, coordinated Nodal market mimicking the current market design
  - Power moves within the market to minimize costs
  - Marginal losses included in the dispatch decision
  - Coordinated with MISO flowgates
  - Reserve sharing
  - MISO South will be included as a full participant

3.2. Security Constrained Commitment and Dispatch Logic

The model mimics the Day-Ahead decision making process for the SPP market. Resources are assigned production costs and parameters based on fuel, technology, maintenance, and many other factors. Each resource is represented at a bus, as is each load on the system. The lines and transformers connecting the buses are given limits from the planning models, and they are monitored based on the NERC flowgate list. All of these parameters are constraints within the optimization problem.

3.3. Future Generation Project Assumptions

Based on the current dataset from the vendor, along with market knowledge and intelligence, new thermal generators that are expected to be on-line in the Eastern Interconnect over the study period totaled approximately 12,700 MW, primarily consisting of combined cycle and nuclear generation. In SPP, the totals are much lower with no scheduled thermal units for the next six years. Other facilities may be planned during the study period, but these are indefinite projects or are smaller facilities. The major projects were wind farms throughout the Great Plains. Wind facilities not specifically planned are added, as detailed in Section 3.5.

3.4. Future Generation Retirement Assumptions

Generation retirements are expected to significantly outpace new thermal generation additions in the next three to five years in SPP and across the Eastern Interconnect. The majority of the expected retirements should occur in 2015 with the implementation of the new Mercury and Air Toxics Standards (MATS) rules. Surrounding areas are also expecting several coal retirements beginning in 2015 as the utilities gradually shift their generation fleet from coal to natural gas and renewables. Other generation retirements are possible in addition to the announced retirements as utilities attempt to comply with the more stringent environmental standards. Overall, over 9 GW of generation retirements have been announced in SPP and surrounding areas for the period of the study.

3.5. Generic Wind Build

ACES assesses all potential new generation and transmission projects for inclusion in the model, as is discussed in the previous sections. However, projects that are not currently announced may be built to meet Renewable Portfolio Standards (RPS), especially wind projects. Thermal units generally have much longer lead times from announcement to completion, so it is unlikely that any significant thermal projects that are not currently being planned will be built by 2020.

To properly reflect the amount of wind resources that will be needed to meet the RPS requirements, ACES reviewed each state's requirements, including the nature of eligible projects and importing of renewable energy from other areas. Based on this review, a forecast was developed for each state for wind facility installation by 2020. This forecast was then compared to the known facilities expected to be built over the same period. Any deficiency is made up through the addition of "generic" wind facilities to areas that represent the better geographic wind resources for each state.

3.6. Future Transmission Project Assumptions

There are many transmission upgrades planned throughout SPP. Figure 1 highlights the high voltage upgrades, including the in-service dates. The in-service dates of these projects reflect the most recent expansion plan timelines. The actual timing of these facilities being placed in service will have significant impacts on actual locational prices.

Figure 1.

Future Transmission Build - SPP			
Project Name	States	Voltage	Expected ISD
Shipe Road – Kings River	AK	345 kV	6/1/2016
Spearville – Clark County	KS	345 kV	12/31/2014
Clark County – Flat Ridge	KS	345 kV	12/31/2014
Flat Ridge – Wichita	KS	345 kV	12/31/2014
Flat Ridge – Woodward	KS/OK	345 kV	12/31/2014
Iatan – Nashua	MO	345 kV	6/1/2015
Woodward – Tuco	OK/TX	345 kV	8/1/2014
Woodward – Hitchland	OK/TX	345 kV	6/30/2014
Valliant – NW Texarkana	OK/TX	345 kV	5/1/2015
Nebraska City – Maryville – Sibley	NE/MO	345 kV	6/1/2017
Hoskins – Neligh	NE	345 kV	6/1/2019
Elk City – Gracemont	OK	345 kV	3/1/2018
Elm Creek – Summit	KS	345 kV	3/1/2018
Cherry Creek – Gerald	NE	345 kV	1/1/2018
Holt – Cherry Creek	NE	345 kV	1/1/2018
Tuco – New Deal	TX	345 kV	6/1/2018
Arcadia – Redbud	OK	345 kV	6/1/2019
Tuco – Amoco – Hobbs	TX	345 kV	1/1/2020

3.7. Fuel Inputs

Coal, natural gas, fuel oil, and emissions forward curves used in the study are available via spreadsheet upon request. NYMEX gas and oil quotes, along with ACES' coal forecasts[1], form the majority of the data, supplemented by broker data and historical relationships.

4. Analysis

Overall, the LMP results are intuitive given the current generation landscape and market structure. The Base Case shows stable results similar to those currently being observed after factoring load growth, renewable growth, and the upward sloping fuels curves. Running the NGCC units at a 70% CF causes annual 7x24 prices to increase by approximately 67% throughout Kansas. The energy efficiency scenario decreased prices by approximately 2% from the Base Case, while the carbon efficiency scenarios had negligible price impacts. The combined scenarios reveal a 65% increase in pricing from the Base Case, as the load and coal efficiency marginally offset the impacts of the 2020-NGCC scenario.

Similar to the LMP analysis, the NGCC CF analysis results are intuitive. The Base Case results show NGCC

[1] ACES coal curves are based, in part, on data obtained from the Wood Mackenzie Coal Market Service.

at an approximate 30% CF, coal-fired generation closer to a 70% CF, and peaking gas near a 2% CF. By increasing the offer price of coal-fired generation to obtain a 70% CF at the NGCC plants, coal capacity factors drop to approximately 50% and the competitiveness of less efficient gas units increase as well. As was the case with the LMP results, the energy and carbon efficiency scenarios only have a minimal impact on production. The impacts of the combined scenarios are as one would expect: the NGCC CF increases from the 2020-BC but drops from the 2020-NGCC. Generation from coal resources decreases from the 2020-BC, but not as sharply as in the 2020-NGCC scenario.

The sections that follow detail the impacts of the scenarios in respect to SEPC. Figure 2 displays the annual average LMPs, per SEPC resource, while Figure 3 reveals the annual capacity factor of these resources. SEPC's renewable resource set is omitted, as these resources experienced no change in CF through the scenarios.

Figure 2.

Annual Average LMPs ($/MWh)							
SECI Nodes	**2020-BC**	**2020-NGCC**	**2020-EE**	**2020-CE3**	**2020-CE6**	**2020-ALL3**	**2020-ALL6**
WR.JEC.1	$24.85	$36.26	$24.51	$24.81	$24.78	$35.80	$35.82
WR.JEC.2	$24.86	$36.30	$24.52	$24.82	$24.79	$35.84	$35.86
WR.JEC.3	$24.85	$36.28	$24.51	$24.81	$24.78	$35.82	$35.84
SECIHOLCOM1UN1	$17.28	$29.16	$16.83	$17.24	$17.23	$28.77	$28.78
MKECCIM_UN1	$20.70	$32.38	$20.25	$20.66	$20.66	$32.05	$32.10
MKECCIM_UN2	$20.70	$32.38	$20.25	$20.66	$20.66	$32.05	$32.10
MKECCLIFTON_UN1	$24.56	$37.15	$24.07	$24.51	$24.48	$36.64	$36.65
MKECJUDLR_UN4	$17.22	$28.68	$16.80	$17.18	$17.18	$28.36	$28.37
MKECMULGRN_UN3	$19.16	$31.02	$18.77	$19.14	$19.11	$30.67	$30.70
SECIGRDNCT1UN2	$17.42	$29.37	$16.97	$17.38	$17.37	$28.98	$28.99
SECIGRDNCT1UN3	$17.42	$29.37	$16.97	$17.38	$17.37	$28.98	$28.99
SECIGRDNCT1UN4	$17.42	$29.37	$16.97	$17.38	$17.37	$28.98	$28.99
SECIGRDNCT1UN5	$17.42	$29.37	$16.97	$17.38	$17.37	$28.98	$28.99
SECIRUBART	$17.42	$29.37	$16.97	$17.38	$17.37	$28.98	$28.99
MKECGRAYWIND	$16.59	$27.47	$16.18	$16.56	$16.55	$27.15	$27.16
MKECSHOOTSTAR	$13.84	$24.35	$13.50	$13.81	$13.81	$24.12	$24.12
SECI_SMOKY	$27.35	$39.03	$26.82	$27.27	$27.28	$38.33	$38.26
SECI_SMOKY2	$27.35	$39.03	$26.82	$27.27	$27.28	$38.33	$38.26
SECI_SECI	$17.62	$29.43	$17.20	$17.57	$17.57	$29.08	$29.08

Figure 3.

Annual Capacity Factors (%)							
SECI Nodes	2020-BC	2020-NGCC	2020-EE	2020-CE3	2020-CE6	2020-ALL3	2020-ALL6
WR.JEC.1	71%	59%	70%	71%	71%	58%	58%
WR.JEC.2	69%	59%	68%	69%	69%	57%	57%
WR.JEC.3	75%	66%	73%	75%	75%	64%	65%
SECIHOLCOM1UN1	47%	32%	49%	47%	47%	34%	34%
MKECCIM_UN1	3%	1%	2%	3%	3%	1%	1%
MKECCIM_UN2	3%	1%	2%	3%	3%	1%	1%
MKECCLIFTON_UN1	0%	0%	0%	0%	0%	0%	0%
MKECJUDLR_UN4	0%	0%	0%	0%	0%	0%	0%
MKECMULGRN_UN3	0%	0%	0%	0%	0%	0%	0%
SECIGRDNCT1UN2	0%	0%	0%	0%	0%	0%	0%
SECIGRDNCT1UN3	0%	0%	0%	0%	0%	0%	0%
SECIGRDNCT1UN4	0%	0%	0%	0%	0%	0%	0%
SECIGRDNCT1UN5	0%	0%	0%	0%	0%	0%	0%
SECIRUBART	7%	19%	6%	7%	7%	18%	18%

4.1. Base Case

The LMP results from the 2020-BC reveal that the congestion environment is expected to be very similar to today's market. In general, LMPs increased from western Kansas to eastern Kansas. The bulk of SEPC's thermal generation is expected to be sourced from Jeffrey Energy Center (JEC) and Holcomb, with smaller contributions from Cimarron and Rubart. Comparing the other scenarios to the 2020-BC provide insight to the impacts of the EPA's proposed Clean Power Plan.

SPP generally does not dispatch a high enough level of SEPC's generation to cover its load obligation. SEPC tends to benefit from this "short" position, as it can purchase energy from the market at a lower price than its resources can produce given the large amount of renewable generation installed near or in SEPC's load zone. This situation is expected to be maintained in the 2020-BC to SEPC's benefit. SEPC is expected to collect $126 million for its generation, while the cost of its load obligation is only $107 million, resulting in revenue of nearly $19 million for SEPC during the year.

4.2. NGCC, Energy Efficiency, and Coal Efficiency Scenarios

These scenarios were previously studied during Phases 1 and 2 of this overall process. The Phase 1 and Phase 2 reports, which are included in Section 6, have been previously provided and discussed. In summary, the stand-alone efficiency scenarios had minimal impact to SEPC in terms of pricing and production. The 2020-NGCC scenario had the greatest impact on SEPC, as load costs increased by $70 million and generation revenues only increased by approximately $41 million. SEPC's generation LMPs did increase in the 2020-BC; however, there was a drop in production at the JEC and Holcomb resources.

4.3. Combined Scenarios

The combined scenarios are the culmination of the previous studies and provide insight into the impact of the EPA's Clean Power Plan in its entirety. The 2020-ALL3 and 2020-ALL6 scenario results are extremely close in terms of LMPs and generation production. As such, the 2020-ALL3 scenario will be discussed in detail; however, the same conclusions can be drawn for the 2020-ALL6 scenario. The results are intuitive when the standalone scenarios are referenced.

LMPs in the 2020-ALL3 scenario increased from the 2020-BC, but not as significantly as they did in the 2020-NGCC scenario. This reveals that energy and coal efficiency have the ability to help mitigate a small amount of the price impacts to SEPC. Similarly, SEPC's generation drops from the 2020-BC, but not as significantly as it did in the 2020-NGCC scenario.

Under the 2020-ALL3 scenario, SEPC's generation revenues ($166 million) are not expected to cover its cost to serve load ($177 million). In the 2020-BC, SEPC's generation revenue exceeded its cost to serve load, so the 2020-ALL3 scenario represents a fundamental change in SEPC's cost structure. The model results reveal that the EPA rule will increase SEPC's load costs and, while generation revenues will also increase, they will be outpaced by the load due to the decrease in generation production.

5. Conclusion

Each of the EPA's methods for achieving the emission rates in the Clean Power Plan are expected to have varying levels of impact on SEPC in 2020. The energy and coal efficiency scenarios did not have a noticeable effect on SEPC's CFs or LMPs. The scenario that achieves a CF of 70% for NGCC has the most significant impact on SEPC, as it led to a 67% increase in load cost from the Base Case. In this scenario, the generator prices also increased; however, their production, for the most part, decreased due to the offer curve adder. When these factors were combined into the 2020-ALL3 scenario, load prices increased by 65% from the Base Case. Overall, SEPC's generation decreases from the Base Case, but not as significantly as it did in the 2020-NGCC scenario. Based on the expected market activity, SEPC would net an $11.6 million charge to the market in the 2020-ALL3 scenario versus an $18.9 million credit from the market in the Base Case.

6. Appendix

ACES previously reported on the 2020-NGCC scenario in the Phase 1 report and 2020-EE, 2020-CE3 and 2020-CE6 scenarios in its Phase 2 report. These brief reports have been included below.

6.1. Phase 1 Report

Sunflower Electric Power Corporation - Carbon Study Report

This report summarizes the findings of ACES' study to determine the impacts of the Environmental Protection Agency's (EPA) Clean Power Plan. Specific details and assumptions included in the setup of ACES' Security Constrained Economic Dispatch (SCED) model can be provided at SEPC's request. The findings are based on a 2020 Base Case (2020-BC) simulation and a 2020 simulation (2020-NGCC) where Natural Gas Combined Cycle (NGCC) generation reaches 70% capacity factor (CF) due to an increase in the offer curve of coal-fired resources. The most alarming findings of the study for SEPC are the drop in generator production and increase in LMPs from the 2020-BC to the 2020-NGCC scenario. The sections that follow provide more detail on these findings.

Section 1: Drop in Generator Production

The largest sources of energy for SEPC are Jeffery Energy Center (JEC) and Holcomb. In the 2020-BC, these resources are economically dispatched near a 71% and 47% CF, respectively. In the 2020-NGCC scenario, these same resources' CFs drop to 61% and 32%, respectively. SEPC's Rubart Station is the only resource among SEPC's portfolio that experiences a noticeable increase in output from the 2020-BC to 2020-NGCC. Rubarts' CF grows from 7% to 19%. The production deficit caused by the decreased output of SEPC's coal-fired resources; however, is only minimally dampened by Rubart. SEPC's wind resource production was unaffected and therefore omitted from discussion in this section. In total SEPC's generation fleet production drops nearly 810,000 MWh in the 2020-NCGG scenario. Figure 1 details SEPC's resource LMPs, CFs and production output.

Section 2: Increase in LMPs

The increase in LMPs at SEPC's resources above paired with the net reduction in production results in an overall increase in generation production revenues of nearly $41 million. This increase does include the additional revenues from SEPC's wind resources. SEPC's load zone increases from $17.62/MWh in 2020-BC to $29.43/MWh in 2020-NGCC. This increase in LMP at the load causes a $70 million increase to SEPC's load cost from 2020-BC. As SEPC is generally short energy and thus buying from the market, the increased LMPs across the board negatively impact SEPC.

In conclusion, ACES' study reveals the potential impact of the EPA's Clean Power Plan on SEPC is increased costs to SEPC. SEPC's main sources of generation production are reduced. While the generation LMPs do increase, the bolstered generation revenues do not cover the losses resulting from increased load LMPs. Additional detail is included within the accompanying Excel workbook. Figure 1 provides support to the commentary above.

Figure 1.

SECI Nodes	Annual Average LMPs		Annual Capacity Factors		Annual Production	
	2020-BC	2020-NGCC	2020-BC	2020-NGCC	2020-BC	2020-NGCC
WR.JEC.1	$24.85	$36.26	71%	59%	978,530	818,375
WR.JEC.2	$24.86	$36.30	69%	59%	956,388	813,278
WR.JEC.3	$24.85	$36.28	75%	66%	1,021,918	899,620
SECIHOLCOM1UN1	$17.28	$29.16	47%	32%	1,458,762	979,248
MKECCIM_UN1	$20.70	$32.38	3%	1%	14,863	6,371
MKECCIM_UN2	$20.70	$32.38	3%	1%	14,863	6,371
MKECCLIFTON_UN1	$24.56	$37.15	0%	0%	1,973	1,535
MKECJUDLR_UN4	$17.22	$28.68	0%	0%	1,732	1,567
MKECMULGRN_UN3	$19.16	$31.02	0%	0%	2,312	2,684
SECIGRDNCT1UN2	$17.42	$29.37	0%	0%	3,491	3,516
SECIGRDNCT1UN3	$17.42	$29.37	0%	0%	0	0
SECIGRDNCT1UN4	$17.42	$29.37	0%	0%	0	0
SECIGRDNCT1UN5	$17.42	$29.37	0%	0%	0	0
SECIRUBART	$17.42	$29.37	7%	19%	67,650	183,480
MKECGRAYWIND	$16.59	$27.47	33%	33%	328,572	328,572
MKECSHOOTSTAR	$13.84	$24.35	38%	38%	347,781	347,781
SECI_SMOKY	$27.35	$39.03	38%	38%	330,701	330,701
SECI_SMOKY2	$27.35	$39.03	39%	39%	510,488	510,488
			Total Production (MW):		6,040,025	5,233,586
			Total Production Revenue ($):		$133,938,882	$176,805,030

6.2. Phase 2 Report

Sunflower Electric Power Corporation - Carbon Study Report (Energy and Carbon Efficiency)

This report summarizes the findings of ACES' study to determine the impacts of the Environmental Protection Agency's (EPA) Clean Power Plan. Specific details and assumptions included in the setup of ACES' Security Constrained Economic Dispatch (SCED) model can be provided at SEPC's request. The findings are based on the following scenarios:

- 2020 Base Case (2020-BC) simulation
- 2020 Energy Efficiency simulation (2020-EE) with load modifying resources to simulate the 1.5% proposed load efficiency rate
- 2020 Coal Efficiency simulation (2020-CE3) with coal's efficiency increased by 3% and
- 2020 Coal Efficiency simulation (2020-CE6) with coal's efficiency increased by 6%.

While SEPC duly recognized CE6 as unrealistic, ACES is including it in this report for proper due diligence and consistency. The previous ACES study pertaining to the Clean Power Plan utilized EPA's assumptions, therefore understanding the full impacts of the EPA assumptions while also understanding realistic assumptions provides proper due diligence for any decisions or rebuttals SEPC would make going forward.

From an LMP and production perspective, the results did not significantly vary from the 2020-BC. This result is expected as an increase in energy efficiency by itself equates to a minor drop in load. Similarly an increase in coal efficiency by itself only shaves a marginal amount of higher priced generation, but has a minimal impact on the marginal unit committed to set price. The 2020-EE scenario produced the largest drop (while still minimal) in LMP for SEPC's generation fleet from the 2020-BC. This drop was limited to between 1% and 3% as the highest priced hours in the 2020-BC were moderately priced hours in 2020-EE with the drop in load. The annual LMPs for the same resource set in the 2020-CE3 and 2020-CE6 were basically flat to the 2020-BC. The increase in efficiency for the coal resources did not have much impact as the transmission limitations of the grid still required dispatch similarly to the 2020-BC. This limited these coal resources from increasing production significantly. Capacity factors remained flat form the 2020-BC. Figure 1 and Figure 2 detail the annual average LMPs and annual capacity factors, respectively, across the each scenario.

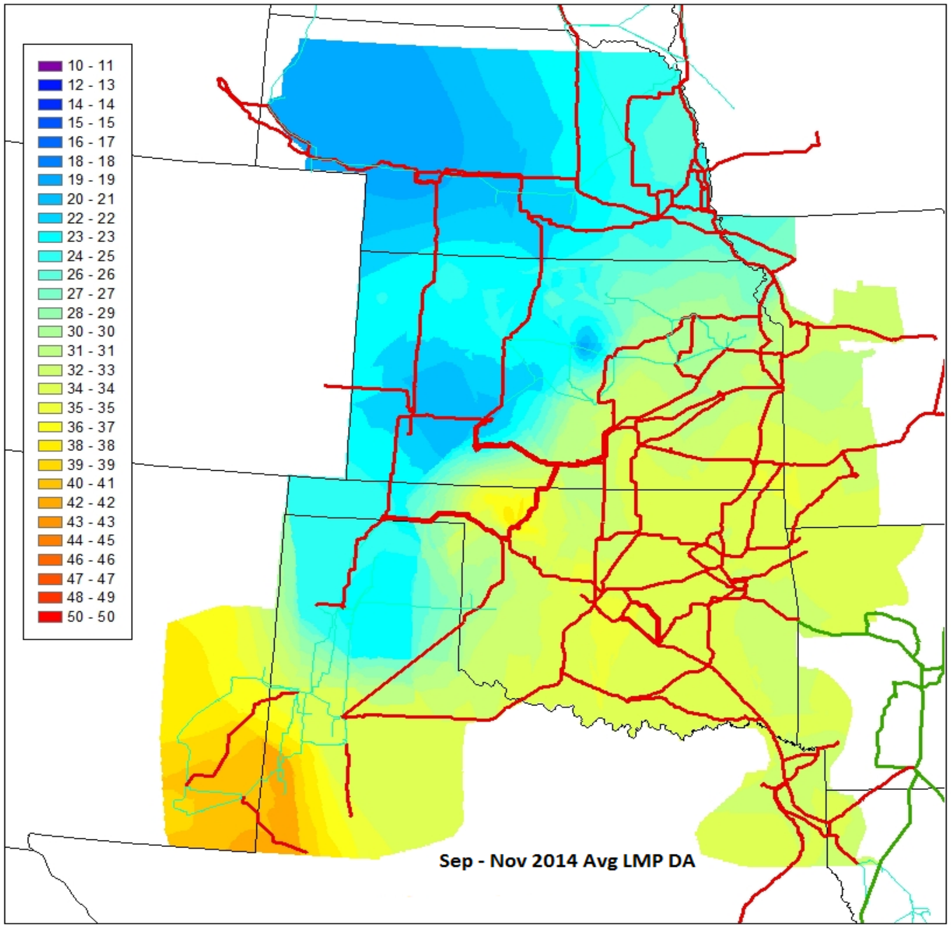
Figure 1.

Annual Average LMPs				
SECI Nodes	**2020-BC**	**2020-EE**	**2020-CE3**	**2020-CE6**
WR.JEC.1	$24.85	$24.51	$24.81	$24.78
WR.JEC.2	$24.86	$24.52	$24.82	$24.79
WR.JEC.3	$24.85	$24.51	$24.81	$24.78
SECIHOLCOM1UN1	$17.28	$16.83	$17.24	$17.23
MKECCIM_UN1	$20.70	$20.25	$20.66	$20.66
MKECCIM_UN2	$20.70	$20.25	$20.66	$20.66
MKECCLIFTON_UN1	$24.56	$24.07	$24.51	$24.48
MKECJUDLR_UN4	$17.22	$16.80	$17.18	$17.18
MKECMULGRN_UN3	$19.16	$18.77	$19.14	$19.11
SECIGRDNCT1UN2	$17.42	$16.97	$17.38	$17.37
SECIGRDNCT1UN3	$17.42	$16.97	$17.38	$17.37
SECIGRDNCT1UN4	$17.42	$16.97	$17.38	$17.37
SECIGRDNCT1UN5	$17.42	$16.97	$17.38	$17.37
SECIRUBART	$17.42	$16.97	$17.38	$17.37

Figure 2.

	Annual Capacity Factors			
SECI Nodes	**2020-BC**	**2020-EE**	**2020-CE3**	**2020-CE6**
WR.JEC.1	71%	70%	71%	71%
WR.JEC.2	69%	68%	69%	69%
WR.JEC.3	75%	73%	75%	75%
SECIHOLCOM1UN1	47%	49%	47%	47%
MKECCIM_UN1	3%	2%	3%	3%
MKECCIM_UN2	3%	2%	3%	3%
MKECCLIFTON_UN1	0%	0%	0%	0%
MKECJUDLR_UN4	0%	0%	0%	0%
MKECMULGRN_UN3	0%	0%	0%	0%
SECIGRDNCT1UN2	0%	0%	0%	0%
SECIGRDNCT1UN3	0%	0%	0%	0%
SECIGRDNCT1UN4	0%	0%	0%	0%
SECIGRDNCT1UN5	0%	0%	0%	0%
SECIRUBART	7%	6%	7%	7%

Day-Ahead (average September - November)



Real-Time (September - November)