Arkansas Department of Environmental Quality

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Arkansas Public Service Commission

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April 8, 2019

Via Electronic Mail Transmission

Mr. Bill Wehrum
Office of Air and Radiation
US Environmental Protection Agency
1200 Pennsylvania Avenue, N. W.
Mail Code: 6101A

RE: Guidance on Regional Haze SIP Development for Second Planning Period SIPs

Mr. Wehrum:

The Arkansas Department of Environmental Quality together with the Arkansas Public Service Commission (collectively, "the Agencies") submit the attached "Accounting for Energy Efficiency Measures in Regional Haze Planning: Concept Paper" for your consideration. The Agencies developed this concept paper in consultation with the Regulatory Assistance Project.

The concept paper provides a potential framework for consideration by the EPA under which the visibility benefits resulting from APSC's EE rules could be quantified and credited under the Regional Haze program. The Agencies' initial analysis projects that the EE programs implemented by Arkansas investor-owned utilities will result in emissions reductions increasing each year between 2021 and 2028 in Arkansas and in states throughout the Southeast and Lower Midwest regions. In addition to providing a pathway for a low-cost method of assessing the amount of avoided emissions from EE using using EPA's AVoided Emissions and geneRation Tool (AVERT), this concept paper addresses how a state might apply each of the four reasonable progress factors to EE, as well as how to address EE in a state's regional haze long-term strategy.

The Agencies request that EPA consider the approach set forth in this document for inclusion in a supplemental memorandum that would expand upon the guidance for the second planning period by setting forth a specific, flexible, and robust approach for the incorporation of energy efficiency standards such as the one expounded upon in the concept paper into the regional haze framework in the second planning period.

Sincerely,

Becky W. Keogh.
ADEQ Director

Ted Thomas
APSC Chairman

Office of Air Quality

ACCOUNTING FOR ENERGY EFFICIENCY MEASURES IN REGIONAL HAZE PLANNING

Concept Paper

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Executive Summary

Under the Regional Haze Program, the states are required to submit a state implementation plan (SIP) for each ten year period to detail a strategy for reducing visibility impairing pollutants—including sulfur dioxide (SO_2), nitrogen oxides (NOx), and fine particulate matter ($PM_{2.5}$)—that impact certain designated national parks and wilderness areas. These areas are referred to as Class I areas. In Arkansas, the largest sources of visibility impairing pollutants are large electric generating units (EGUs).

Traditionally, the Regional Haze program has focused on retrofit technologies to reduce visibility impairing pollutants. Retrofitting existing EGUs with newer pollution control equipment is a substantial investment and may be less economically efficient than considering alternatives that avoid emissions altogether. In addition, utilities make long-term plans regarding their generation assets, which may include retirement of certain EGUs that would occur long before the expiration of a retrofit control's useful life. Therefore, the Arkansas Department of Environmental Quality (ADEQ) seeks to explore additional emission reduction measures for inclusion in the State's Regional Haze SIP revision for the planning period beginning in 2021.

In Arkansas, the Arkansas Public Service Commission (APSC) requires all investor-owned electric utilities to propose, administer, and implement cost-effective energy efficiency (EE) programs within their service territories to meet the Energy Efficiency Resource Standard (EE Resource Standard). These EE programs put downward pressure on electricity load demand resulting in avoided generations and avoided emissions of visibility impairing pollutants. APSC and ADEQ (collectively "the Agencies") have been working with the Regulatory Assistance Project (RAP) to explore the State's long-term strategy for Regional Haze.

In this concept paper, the Agencies provide a potential framework for consideration by the United States Environmental Protection Agency (EPA) under which the visibility benefits resulting from APSC's EE rules could be quantified and credited under the Regional Haze program. The Agencies' initial analysis projects that the EE programs implemented by Arkansas investor-owned utilities will result in emissions reductions increasing each year between 2021 and 2028 in Arkansas and in states throughout the Southeast and Lower Midwest regions. The estimated emissions reductions were determined using EPA's AVoided Emissions and geneRation Tool (AVERT). Modeling the visibility impact on Class I areas in both regions would be the logical next step if EPA finds this framework approvable as part of a Regional Haze SIP.

In addition to providing a pathway for a low-cost method of assessing the amount of avoided emissions from EE using AVERT, this concept paper addresses how a state might apply each of the four reasonable progress factors to EE, as well as how to address EE in a state's regional haze long-term strategy. The Agencies also discuss the factors traditionally used by EPA to ensure that control measures included in a state implementation plan (SIP) meet criteria with regards to approvable emerging and voluntary measures, such as EE. The traditional factors for

EPA assessment of control measures are whether the emission benefits from such measures are real, long-lasting, enforceable, surplus, and quantifiable.

The Agencies request that EPA consider the approach set forth in this document for inclusion in a supplemental memorandum that would expand upon the guidance for the second planning period by setting forth a specific, flexible, and robust approach for the incorporation of energy efficiency standards such as the one expounded upon in the concept paper.

Acknowledgments

The Agencies would like to acknowledge those who contributed to the development and preparation of this report. In particular, the Agencies acknowledge the immensely valuable contributions of Nancy Seidman of the Regulatory Assistance Project, who reached out to ADEQ and APSC regarding opportunities to leverage synergies among existing energy and environmental policies and provided valuable advice in the development of this concept paper. The Agencies also acknowledge the efforts of Wally Nixon of the APSC who was an invaluable resource on Arkansas EE Resource Standard implementation. The Agencies also value the discussions with EPA Region 6 and EPA Headquarters staff that informed the development of this paper. Lastly, the Agencies would like to acknowledge the staff at ADEQ that worked to prepare this report including Erika Droke, Kelly Jobe, Bill Jackson, William Montgomery, and Tricia Treece.

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ACCOUNTING FOR ENERGY EFFICIENCY MEASURES IN REGIONAL HAZE PLANNING

Concept Paper

I. Background

In 1977, Congress added § 169 to the Clean Air Act (CAA), which set forth the following goal for restoring pristine conditions in national parks and wilderness areas:

> Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from man-made air pollution.

In 1999, EPA promulgated the "Regional Haze Regulations: Final Rule" (also referred to as the Regional Haze Rule) to address the combined visibility effects of various pollution sources over a wide geographic region with the goal of achieving natural visibility conditions at designated Class I areas[1] by 2064. The Regional Haze Rule was amended in 2005 and 2017.[2] This program requires all states, including those that do not have Class I areas to participate in planning, analysis, and emission control programs to reduce visibility impairment in Class I areas caused by anthropogenic sources of emissions in compliance with the Regional Haze Rule. States with Class I areas are required to conduct certain analyses to establish goals for each Class I area in the state to improve visibility on the most impaired days and to ensure no degradation occurs on the clearest days. These goals and the long-term strategies to achieve these goals are to be included in SIPs covering each ten-year period leading up to 2064.

ADEQ is the regulatory agency obligated to develop and maintain Arkansas's Regional Haze SIP. Moving forward, the Agencies seek to explore creative avenues in pollution control for state plans and goals, including taking into account in SIPs the emission reductions achieved by EE programs in the state. EPA encourages innovation in the use and inclusion of voluntary measures in SIPs in EPA guidance. [3]

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[1] Class I areas include specifically designated national parks and wilderness areas. A complete list of designated Class I areas can be found at https://www.epa.gov/visibility/list-areas-protected-regional-haze-program.

[2] "Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations" (70 FR 39104, July 6, 2005)
and
"Protection of Visibility: Amendments to Requirements for State Plans" (82 FR 3078, January 10, 2017)

[3] *Incorporating Voluntary Stationary Source Emission Reduction Programs Into State Implementation Plans—Final Policy (Memorandum),* John Seitz, Director U.S. EPA – Office of Air Quality Planning and Standards, no date (est. 1998-2001): https://www.epa.gov/sites/production/files/2016-02/documents/voluntary_stationary_source.pdf
and
Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP), U.S. EPA - Office of Air and Radiation, September 2004:
https://www.epa.gov/sites/production/files/2016-02/documents/emerging_vol_measures.pdf

In Arkansas, electric and natural gas utilities are implementing substantial EE programs. The success of these programs has resulted in increasingly higher savings standards (as measured by reduced electricity sales) for each three-year program period. The avoided generation resulting from these programs has a real and quantifiable impact on emissions from fossil fuel combustion in Arkansas and neighboring states. These emission reductions warrant further exploration by the Agencies to determine the improvements in visibility to Class I areas in Arkansas and other states as a result of these emission reductions.

The APSC has authority granted by the Arkansas General Assembly to regulate the service and rates of those utilities subject to its jurisdiction. The APSC's main purpose is to ensure that utility service in the State is "safe and adequate and that rates are just and reasonable."[4] The Energy Conservation Endorsement Act of 1977 also grants authority for the APSC to "engage in energy conservation programs, projects, and practices which conserve, as well as distribute, electrical energy and supplies of natural gas, oil, and other fuels."[5] Specific to energy conservation, the Act provides the APSC authority to "propose, develop, solicit, approve, require, implement, and monitor" EE programs "by utility companies."[6]

On January 11, 2007, the APSC adopted the Rules for Conservation and Energy Efficiency Programs, which were most recently revised on January 19, 2018 (effective April 20, 2018). These Rules outline requirements for electricity and natural gas providers to include EE measures in future planning and annual reporting. Investor-owned utilities must file an Energy Efficiency Portfolio (EE Portfolio) plan for APSC's approval that addresses programs for all customer classes, and utilities are then required to administer and implement the approved EE Portfolio programs. These proposals must outline "in qualitative and quantitative terms" how the plan will accomplish aspects of the following objectives and benefits:

- Energy savings directly attributable to program activities;
- Long-term and permanent changes in behavior, attitudes, awareness, and knowledge about energy savings and the use of energy efficient technologies in order to achieve energy savings;
- Permanent peak electric demand reduction;
- Energy cost savings and cost-effectiveness;
- Reliability enhancements;
- Energy security benefits;
- Environmental benefits;

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and *Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans*, U.S. EPA – Office of Air Quality Planning and Standards Outreach and Information Division, July 2012: https://www.epa.gov/sites/production/files/2016-05/documents/eeremanual_0.pdf

[4] http://www.apscservices.info/commission-history.asp
[5] *Ark. Code Ann. §§23-3-401 to 405.*
[6] *Ark. Code Ann. § 23-3-405(a)(1)-(2).*

- Economic development/competitiveness benefits;
- Increases in system-wide capacity;
- Accelerating the commercialization of advanced or emerging technologies;
- Improving affordability of energy for all customers; and
- Implementing programs in an efficient manner.[7]

EE Portfolio plans must include quantitative benefits and costs of different aspects of programs, and must provide estimates EE potential and expected demand savings. Proposed plans must include program initiatives for at least one year, up to three years.[8]

To ensure accountability, EE Portfolio plans must include specific Evaluation, Measurement, and Verification (EM&V) procedures used to determine the effectiveness of the program against proposed objectives.[9] The Rules for Conservation and Energy Efficiency Programs require that utilities "use an evaluation period of either ten years (a gas utility may use an evaluation period of fifteen years), or the actual lifetime for each measure in a program to evaluate a program or program portfolio."[10] Utilities must use an independent program evaluator (IE) to generate EM&V for annual reports, using methods in accordance with the APSC's Arkansas Technical Reference Manual.[11] Further, the APSC employs an Independent Evaluation Monitor (IEM) to verify annual reports and plan updates submitted by utilities. The Program Year (PY) for EE Portfolio program annual evaluation and reporting runs from January 1 through December 31.

APSC regularly evaluates EE targets. Initially, during the Quick Start phase of implementation (2007–2009), utilities implemented low-cost/high-impact programs, such as residential and commercial energy audits, low- and no-cost weatherization measures for ratepayers, and public education efforts aimed at promoting efficient use of electricity and gas resources.[12] This phase saw the creation of the Arkansas Weatherization Program (AWP) and the Energy Efficiency Arkansas programs, which were paramount in driving public participation in EE programs throughout the state.[13] Utilities funded both programs as part of their EE Portfolios, and these programs were independently operated: AWP was delivered through the Central Arkansas Development Council, and Energy Efficiency Arkansas through the Arkansas Energy Office (AEO), which is now a division within ADEQ. These two program providers supplied annual calculations for energy reductions independent of reported savings by utility EE Portfolios.

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[7] Docket No. 10-101; April 20, 2018, http://www.apscservices.info/Rules/energy_conservation_rules_06-004-R.pdf
[8] *Id.*
[9] Docket 10-100-R; August 31, 2017, http://www.apscservices.info/EEInfo/TRMV8.0.pdf
[10] Docket No. 10-101; April 20, 2018
[11] Docket 10-100-R; August 31, 2017
[12] Utilities' EE Portfolio annual reports and worksheets, 2011-2017: http://www.apscservices.info/eeAnnualReports.aspx
[13] Arkansas Weatherization Program Annual Report, 2015; http://www.apscservices.info/pdf/07/07-079-TF_157_1.pdf

APSC approved continuation of the AWP through 2014, while directing the utilities to participate in a "weatherization collaborative" that would develop "uniform whole house program offerings for all residential customers, including those in severely energy inefficient homes."[14] The uniform weatherization program was approved by APSC on December 9, 2014.[15] This program, directed and implemented by utility providers, became part of the utilities' three-year EE Portfolio beginning in PY 2016, replacing the AWP. The uniform weatherization program serves all residential customers, with the utilities paying up to an average of $3000 per home for weatherization services, which has reduced the cost share from residents, and over time, is expected to result in potentially higher participation rates in EE Portfolio programs.[16] The Energy Efficiency Arkansas program is an ongoing energy education program sponsored and funded jointly by the gas and electric utilities of Arkansas. The purpose of Energy Efficiency Arkansas is to provide fuel neutral information, education, and training that encourages the people and businesses of Arkansas to consume less energy through EE and conservation measures.[17]

In PY 2009, APSC set energy-savings targets for utilities, and established incentives to encourage utilities to surpass baseline goals:

> On December 10, 2010, the [APSC] issued a series of orders governing energy efficiency matters, including requiring utilities beginning in 2012 to move from Quick Start to comprehensive programs and portfolios that meet a "Comprehensiveness Checklist" adopted by Order No. 17 in Docket No. 08-144-U and allowing utilities to earn shareholder performance incentives for meeting or exceeding energy-savings targets (based on reductions in kWh sales against a baseline year), as provided by Order No. 15 in Docket No. 08-137-U. The targets were set (for electric utilities) at 0.25% of 2007 sales for PY 2008, and grew in ensuing years to 0.50%, then 0.75%, 0.90%, 1.0%, and recently were raised to 1.2% of 2018 sales for the next 3-year planning cycle (2020-2022).[18] (*emphasis added*)

In 2013, the 89th General Assembly of Arkansas codified Act 253 at Ark. Code Ann. § 23-3-405 (c)-(e), allowing the APSC to grant exemptions for large industrial sources and public institutions. These sources may opt out of EE Portfolio programs offered through their utility

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[14] Arkansas Weatherization Program Annual Report, 2015; http://www.apscservices.info/pdf/07/07-079-TF_157_1.pdf

[15] APSC Docket 13-002-U, Order No. 22; page 11, December 9, 2014

[16] Arkansas Weatherization Program (AWP) Annual Report, 2015: Highlights section; http://www.apscservices.info/pdf/07/07-079-TF_157_1.pdf

[17] Summarized from Energy Efficiency Arkansas (EEA) 2017 Annual EE Report, http://www.apscservices.info/EEInfo/EEReports/EEA%202017.pdf and from EEA Website: http://energyefficiencyarkansas.org/index.html

[18] *Quoted from "A Brief History of Arkansas's Energy Efficiency Initiatives (2006 to date) and Rules Governing Evaluation, Measurement & Verification of Energy Savings: Wally Nixon, APSC. Emphasis added.*

providers. This statute allows for innovative and independent EE program development by exempted entities, authorizing them to implement programs that are self-directed. Exemptions by APSC are granted only in the instance self-directed program plans produce at least the same EE benefits for the utility system as if the entity was participating in the EE Portfolio programs directed by the service utility.

II. Quantification of Emission Reduction Benefits from the APSC Energy Efficiency Resource Standard (EE Resource Standard)

A. EE Resource Standard Energy Savings

EE measures implemented by electric utilities in Arkansas do and will continue to result in meaningful energy savings and emission reductions in the future. To quantify these savings into the future, the Agencies have projected annual energy sales, incremental energy savings, and cumulative energy savings resulting from EE Portfolio programs.

In this analysis, annual energy sales for 2017 were used to project annual energy sales for each year from 2018 through 2028.[19] Projected sales were based on the annual average growth rate from the U.S. Energy Information Administration's Annual Energy Outlook 2018.[20] The average annual growth rate for both the SERC Reliability Corporation Delta and the Southwest Power Pool South electricity market module regions to which Arkansas belongs is 0.90%.

Projected sales were used to calculate annual incremental and cumulative energy savings for the period of 2018 through 2028. The projected annual incremental savings were calculated based on the EE standard required by the Arkansas Public Service Commission, currently one percent of 2007 sales and 1.2% of 2018 retail sales beginning in 2020. Historic annual incremental savings were based on utility reports to APSC.[21] Cumulative savings are based on incremental savings for each year added to previous years' savings multiplied by the applicable depreciation factor for each year (see Table 1 below).[22] Tables 2 and 3 below show the projected cumulative energy savings for EE programs currently in place in Arkansas.

[19] 2017 energy sales data were obtained from the U.S. Energy Information Administration, form EIA 861, https://www.eia.gov/electricity/data/eia861/

[20] https://www.eia.gov/outlooks/aeo/tables_ref.php

[21] EE Annual Reports filed by the utilities can be accessed here: http://www.apscservices.info/eeAnnualReports.aspx

[22] http://www2.epa.gov/sites/production/files/2014-06/20140602tsd-ghg-abatement-measures-scenario1.xlsx (RefTables worksheet)

Table 1: Depreciation factors used for calculating cumulative EE savings[23]

Year	EE Savings % Not Expiring
0	100.00000000000000%
1	94.73684210526320%
2	89.47368421052630%
3	84.21052631578950%
4	78.94736842105260%
5	73.68421052631580%
6	68.42105263157890%
7	63.15789473684210%
8	57.89473684210530%
9	52.63157894736840%
10	47.36842105263160%
11	42.10526315789470%
12	36.84210526315790%
13	31.57894736842110%
14	26.31578947368420%
15	21.05263157894740%
16	15.78947368421060%
17	10.52631578947370%
18	5.26315789473688%

Table 2: Cumulative Energy Savings for SERC Reliability Corporation, Delta Resulting From EE Programs in Arkansas[24]

Year	Cumulative Savings (GWh)
2018	1,311.39
2019	1,443.56
2020	1,603.69
2021	1,750.52
2022	1,884.02
2023	2,004.23
2024	2,111.12
2025	2,204.69
2026	2,284.96
2027	2,351.92
2028	2,405.56

[23] Cumulative savings are based on incremental savings for each year added to previous years' savings multiplied by the applicable depreciation factor for each year: http://www2.epa.gov/sites/production/files/2014-06/20140602tsd-ghg-abatement-measures-scenario1.xlsx (RefTables worksheet)
[24] *Id.*

Table 3: Cumulative Energy Savings for Southwest Power Pool, South Resulting From EE Programs in Arkansas[25]

Year	Cumulative Savings (GWh)
2018	327.27
2019	379.20
2020	433.76
2021	484.18
2022	530.46
2023	572.60
2024	610.61
2025	644.48
2026	674.21
2027	699.80
2028	721.25

B. Emissions Reductions Resulting from EE Resource Standard Energy Savings

The emissions reductions in the subsequent analyses are limited to those electric-generating utilities voluntarily complying with ASPC's EE standard, specifically, Entergy Arkansas, Inc. ("Entergy"), Southwestern Electric Power Company (SWEPCO), Oklahoma Gas and Electric (OGE), and Empire District Electric ("Empire"). While many utility providers and cooperatives within the state offer EE programs to customers, these entities' programs are not subject to ASPC's verification, monitoring, and reporting requirements. Because the Agencies are interested in only verifiable emissions reductions, those utilities not under jurisdiction of ASPC are excluded from this discussion, though similar regional benefits result from their EE programs, as well. The analysis below is conservative, based on EE data that could be verified.

The Agencies used EPA's AVERT model to estimate the emissions reductions from Arkansas's EE programs. AVERT was chosen due to its ability to quantify emission benefits and reduced generation resulting from EE measures. The tool is able to quantify reductions of $PM_{2.5}$, SO_2, NO_x, and CO_2 from state and multi-state EE measures on the regional, state, and county level within each AVERT region. Additionally the tool allows the user to present information about location-specific emissions benefits in easy-to-interpret tables and maps. The Figure 2 below illustrates how the AVERT model divides the nation into ten distinct regions for which avoided generation and reduced emissions can be estimated. Arkansas is split into two regions in the AVERT Model: the Lower Midwest Region and the Southeast Region. Both of the AVERT regions to which Arkansas belong include portions of multiple electricity market module regions.

AVERT regions do not correspond precisely to specific electricity market module regions, as shown in Figures 1 and 2. Independent System Operators (ISOs) and Regional Transmission

[25] Cumulative savings are based on incremental savings for each year added to previous years' savings multiplied by the applicable depreciation factor for each year: http://www2.epa.gov/sites/production/files/2014-06/20140602tsd-ghg-abatement-measures-scenario1.xlsx (RefTables worksheet)

Organizations (RTOs) are voluntary organizations that plan, operate, dispatch, and provide electricity transmission services within their specific regions. The Federal Energy Regulatory Commission regulates ISO/RTO operations. Entergy participates in the Midcontinent Independent System Operator (MISO). The MISO region extends from the Gulf of Mexico, through portions of the Upper Midwest, and Northern Plains to Canada. MISO territory within Arkansas is assigned to AVERT's Southeast Region. Southwestern Electric Power Company (SWEPCO) participates in the Southwest Power Pool (SPP) RTO. The SPP region extends from northwestern Louisiana, northern Texas, and eastern New Mexico in the south through portions of North Dakota and eastern Montana in the north. SPP territory within Arkansas is assigned to AVERT's Lower Midwest Region.

Figure 1: United States Electricity Market Module Regions

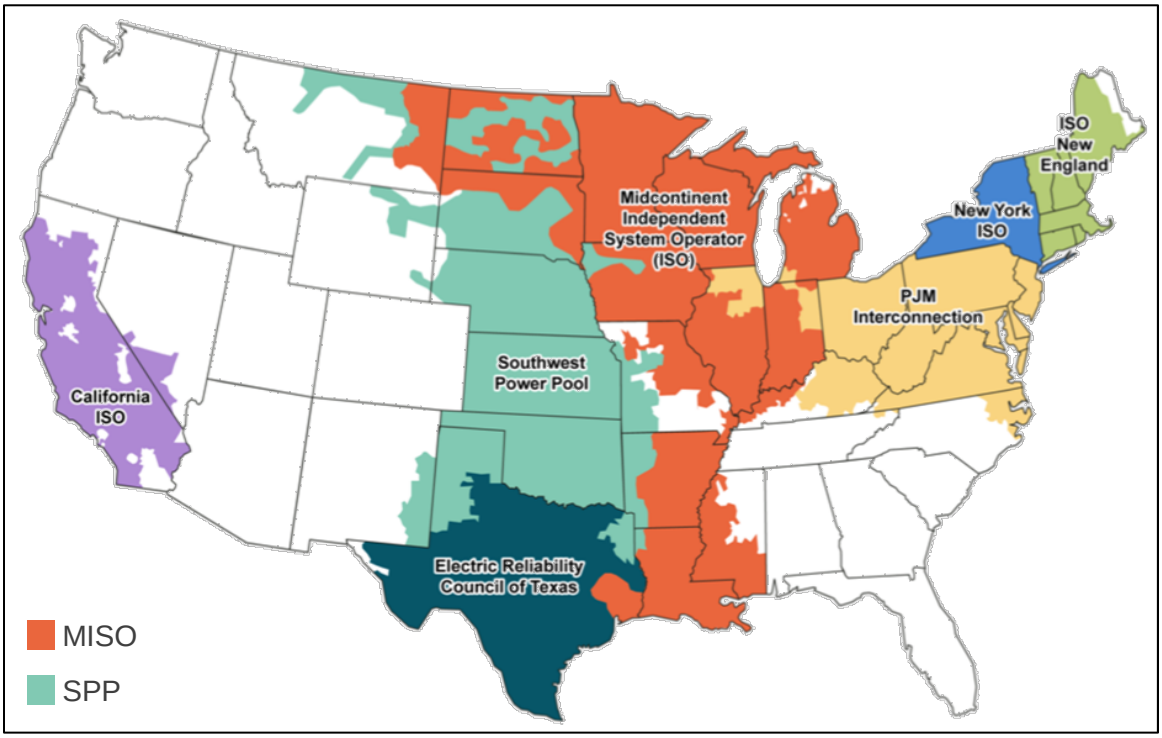
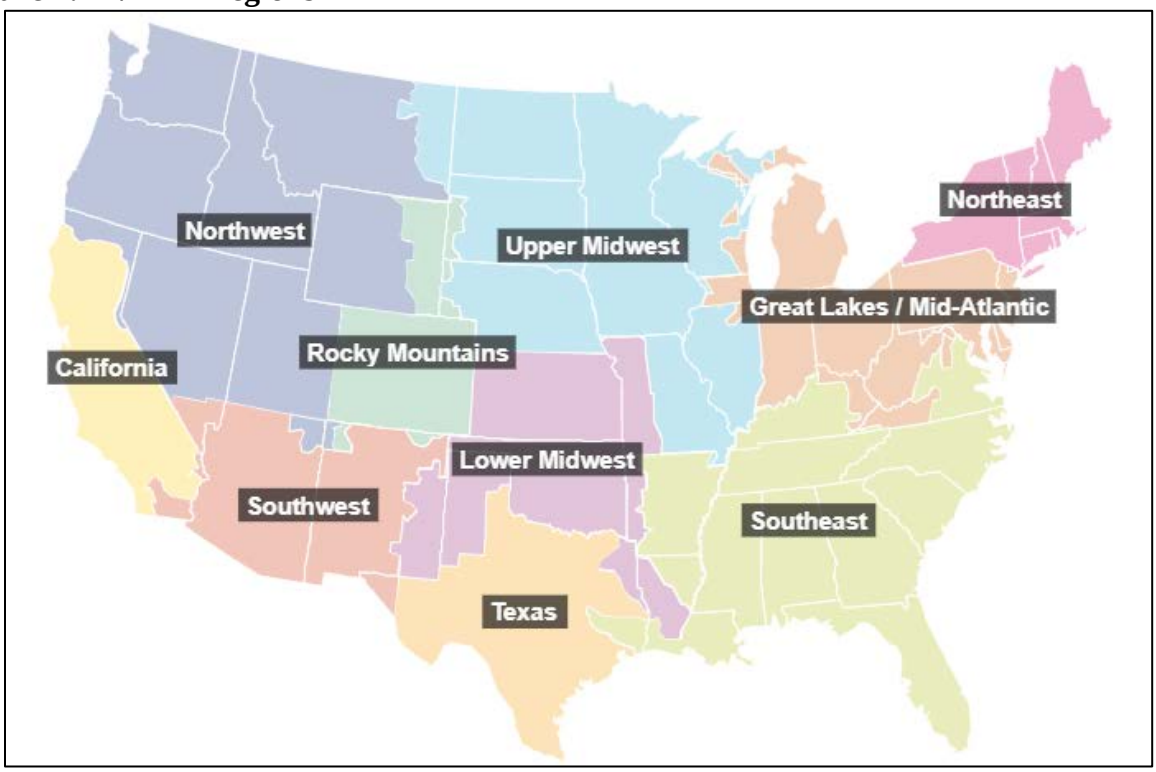


Figure 2: AVERT Regions



Projected cumulative EE energy savings were used in AVERT to estimate annual regional emission reductions for SO_2, NOx, and $PM_{2.5}$ for 2021–2028 in each region. Tables 4 and 5 below show estimated annual regional emission reductions resulting from Arkansas EE projects in years 2021 through 2028, which represents the second planning period for the Regional Haze Program.

Table 4: Estimated Annual Emission Reductions for the AVERT Southeast Region Resulting From Arkansas EE Measures During the Second Planning Period of the Regional Haze Program

Year	SO_2 (tons)	NOx (tons)	$PM_{2.5}$ (tons)
2018	505.43	594.33	66.76
2019	556.17	653.88	73.47
2020	617.71	726.07	81.61
2021	674.45	792.60	89.12
2022	725.76	852.66	95.90
2023	771.95	906.74	102.01
2024	813.09	954.84	107.45
2025	849.18	997.03	112.22
2026	880.15	1,033.28	116.31
2027	906.01	1,063.55	119.72
2028	926.76	1,087.81	122.45

Table 5: Estimated Annual Emission Reductions for the AVERT Lower Midwest Region Resulting From Arkansas EE Measures During the Second Planning Period of the Regional Haze Program

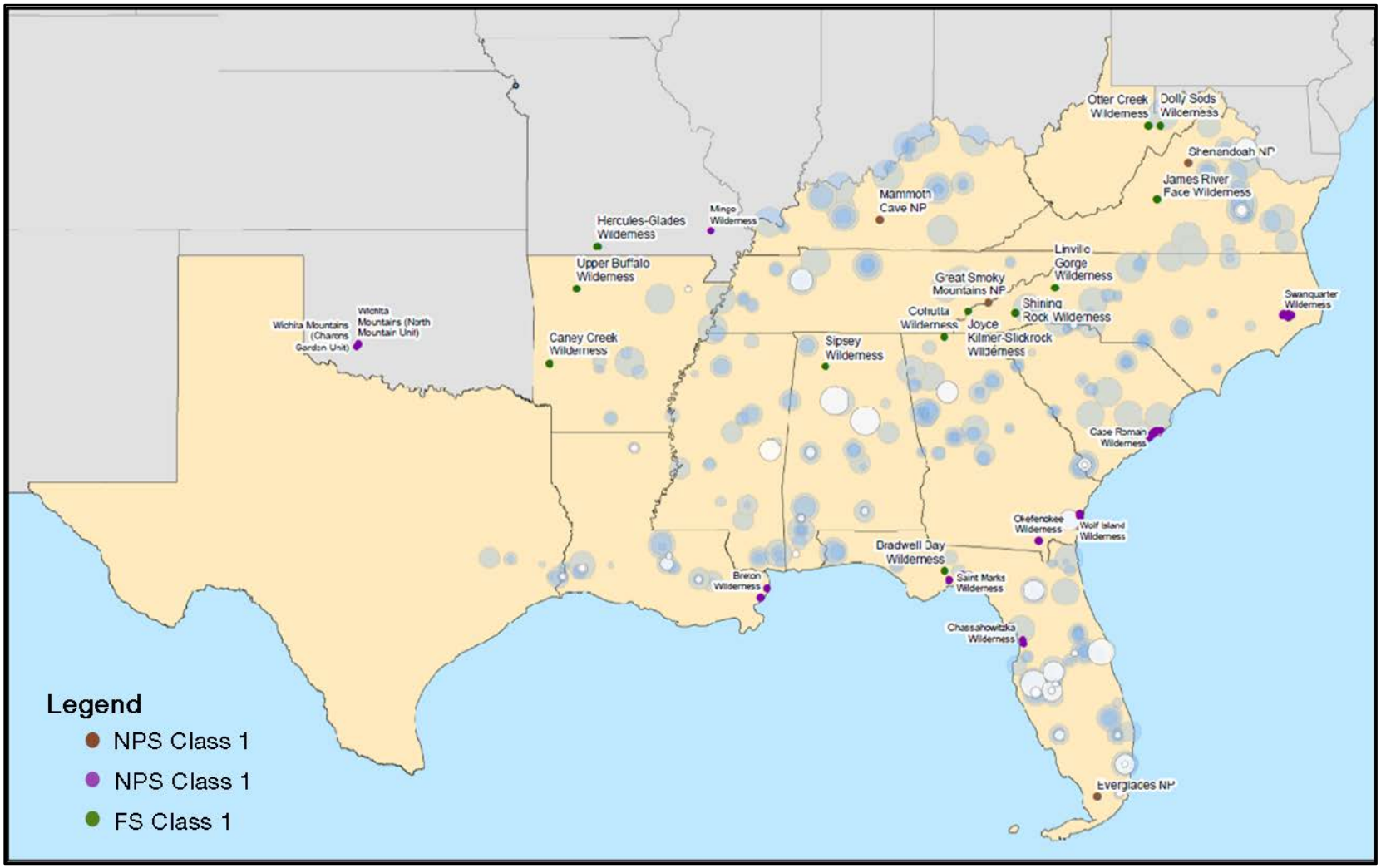
Year	SO_2 (tons)	NOx (tons)	$PM_{2.5}$ (tons)
2018	300.70	192.35	15.84
2019	348.45	222.89	18.36
2020	398.07	254.63	20.97
2021	445.130	284.715	23.455
2022	487.730	311.740	25.690
2023	526.560	336.645	27.730
2024	561.615	358.930	29.570
2025	592.835	378.785	31.210
2026	620.230	396.225	32.650
2027	643.815	411.235	33.885
2028	663.610	423.825	34.925

EE measures in place in Arkansas will have impacts throughout each respective region in terms of both avoided generation and reduced emissions of visibility impairing pollutants. These reductions have the potential to be beneficial in reducing haze at Class I areas in Arkansas as well as Class I areas in other states. The benefits of the EE programs increase over time as more incremental savings are added and EE measures from previous years continue to produce savings.

The Regional Haze program is intended to address the combined visibility effects of various pollution sources over a wide geographic region with the goal of achieving natural visibility conditions at designated Class I areas across the country by 2064. The emissions reductions achieved by EE programs occur over a wide geographic region due to the nature of the electrical grid and how electric generating units (EGUs) are dispatched. EE programs reduce demand for electricity. EGUs are dispatched based in a least-cost manner; therefore, less economical units (marginal units) may be called upon less as a result of EE. Due to the diffuse nature of the emission reductions, which occur due to decreased generation across a region, the visibility benefits of reduced pollution are also spread to a wide geographic region including many Class I areas.

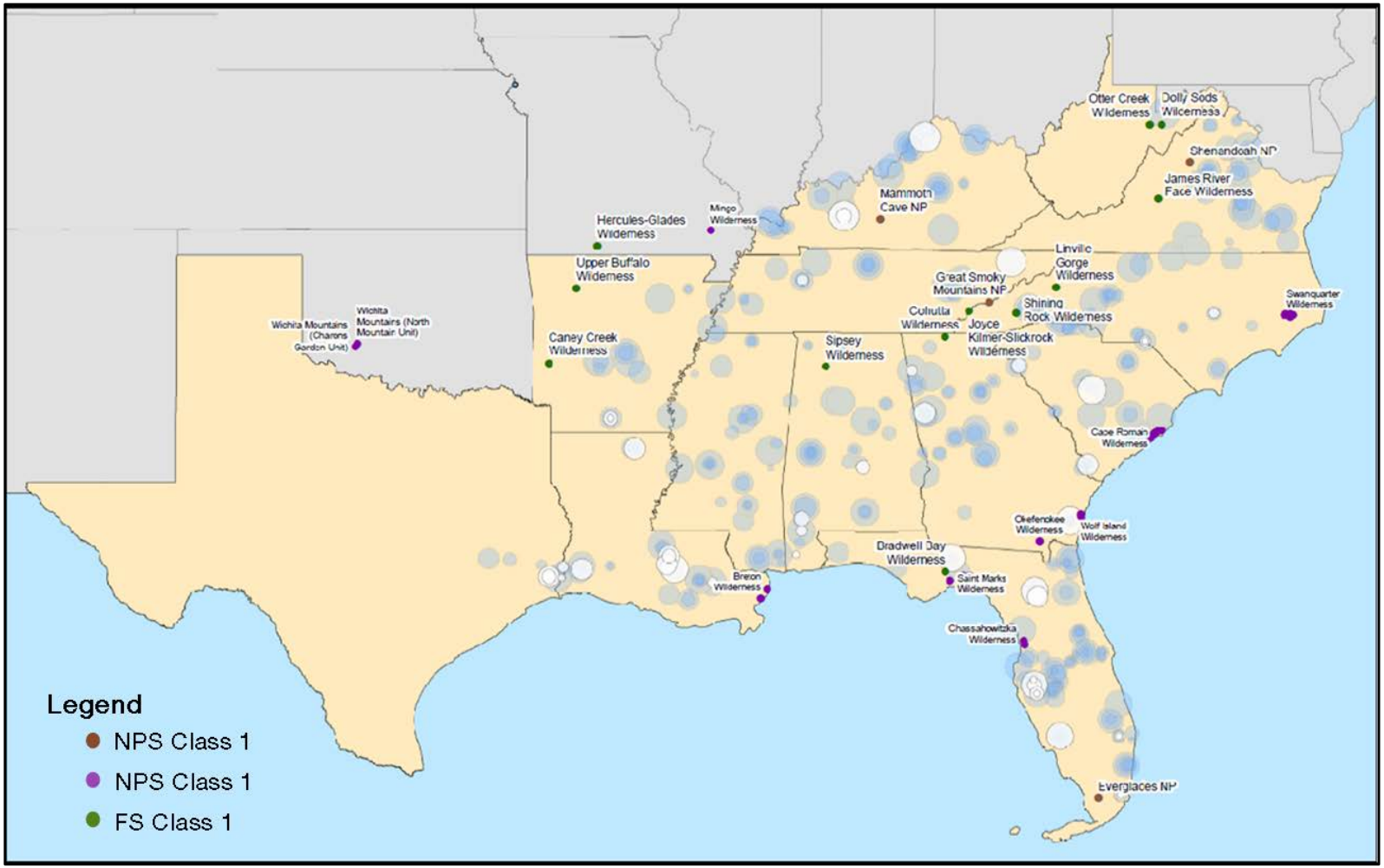
The maps in Figures 3, 4, and 5 below show the magnitude of avoided generation and reduced emissions of SO_2, NO_x, and $PM_{2.5}$ from specific units as predicted by AVERT in the AVERT Southeast Region in 2028, the final year of the second planning period for Regional Haze. These savings are based on the reduced load in Arkansas resulting from EE savings in the Entergy market.

Figure 3: Projected 2028 SO_2 Reductions for the AVERT Southeast Region from Specific Units as Predicted by AVERT[26]



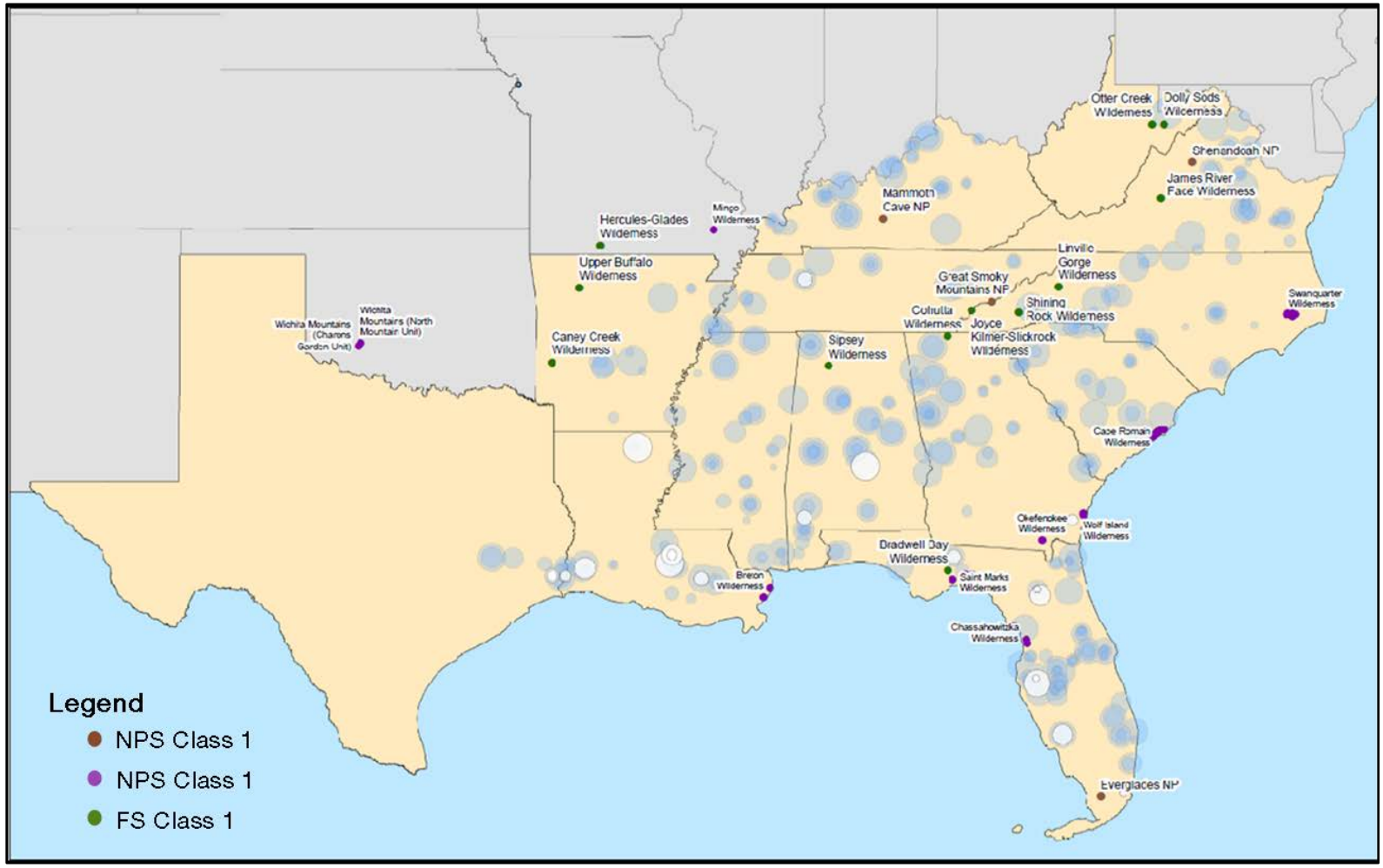
[26] The diameter of each circle indicates the magnitude of a unit's change in generation/emissions. Circles are semi-transparent: darker areas occur in regions with overlapping units. Negative changes (emissions decreases) are indicated with blue circles; positive changes (emissions increases) are indicated with black-bordered white circles.

Figure 4: Projected 2028 NOx Reductions from Arkansas EE Programs for the AVERT Southeast Region from Specific Units as predicted by AVERT[27]



[27] The diameter of each circle indicates the magnitude of a unit's change in generation/emissions. Circles are semi-transparent: darker areas occur in regions with overlapping units. Negative changes (emissions decreases) are indicated with blue circles; positive changes (emissions increases) are indicated with black-bordered white circles.

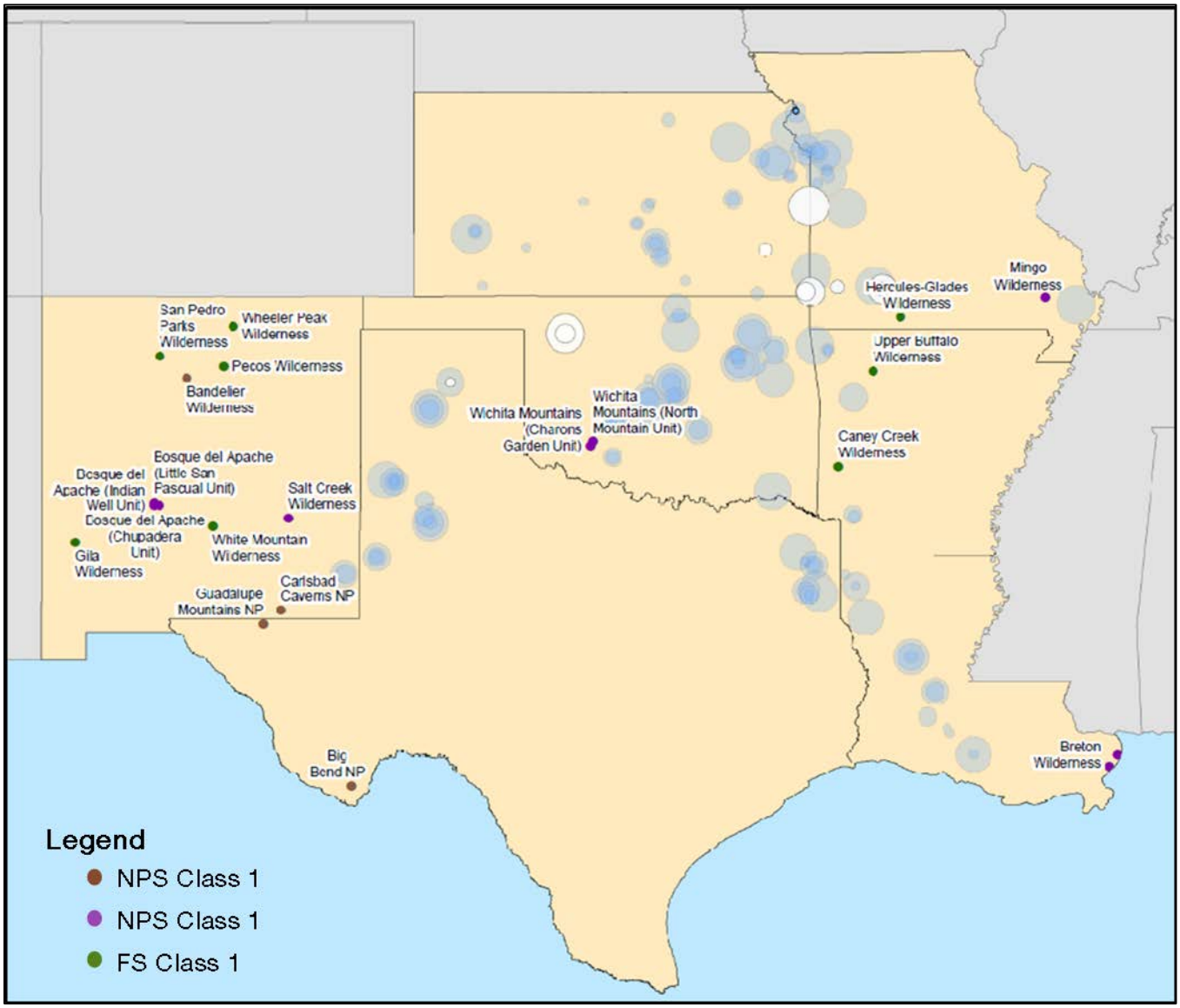
Figure 5: 2028 $PM_{2.5}$ Reductions from Arkansas EE Programs for the AVERT Southeast Region from Specific Units as predicted by AVERT[28]



[28] The diameter of each circle indicates the magnitude of a unit's change in generation/emissions. Circles are semi-transparent: darker areas occur in regions with overlapping units. Negative changes (emissions decreases) are indicated with blue circles; positive changes (emissions increases) are indicated with black-bordered white circles.

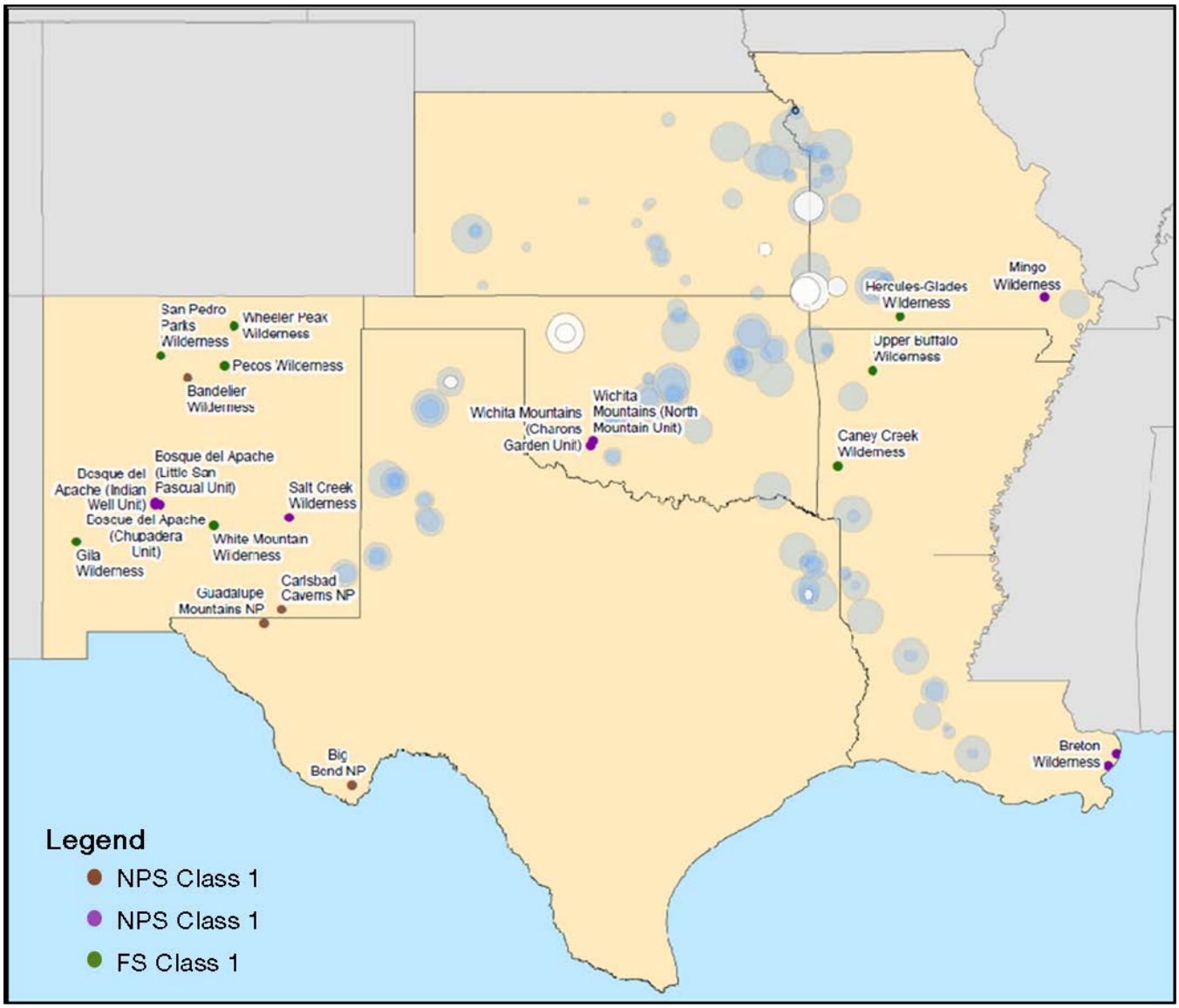
The maps in Figures 6, 7, and 8 below show the magnitude of avoided generation and reduced emissions of SO_2, NO_X, and $PM_{2.5}$ in the AVERT Lower Midwest Region in 2028, which is the final year of the second planning period for Regional Haze. These savings are based on the reduced load in Arkansas resulting from EE savings from programs implemented by SWEPCO, Empire, and OGE.

Figure 6: Projected 2028 SO_2 Reductions from Arkansas EE Programs for the AVERT Lower Midwest Region from Specific Units as predicted by AVERT[29]



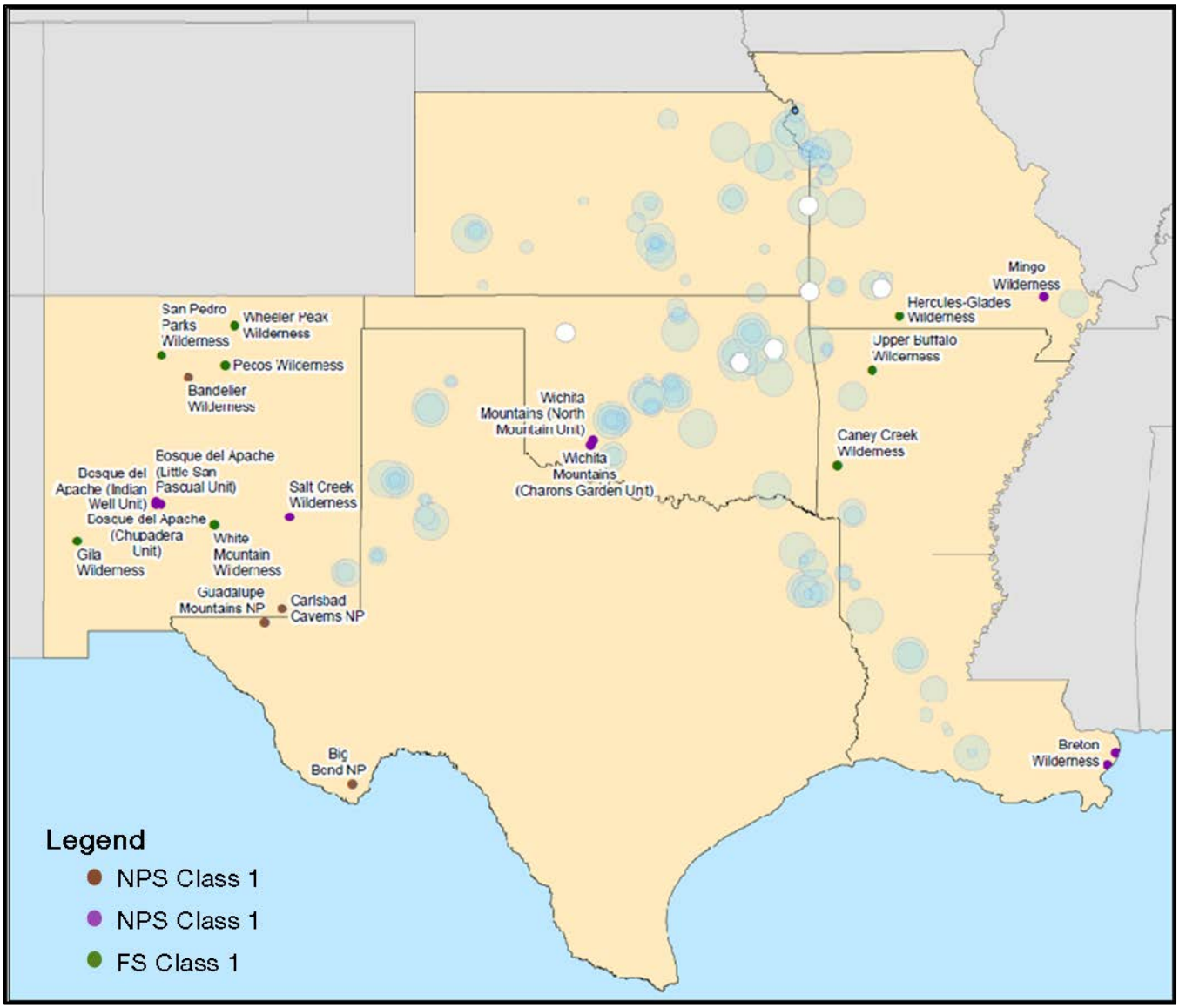
[29] The diameter of each circle indicates the magnitude of a unit's change in generation/emissions. Circles are semi-transparent: darker areas occur in regions with overlapping units. Negative changes (emissions decreases) are indicated with blue circles; positive changes (emissions increases) are indicated with black-bordered white circles.

Figure 7: Projected 2028 NO_X Reductions from Arkansas EE Programs for the AVERT Lower Midwest Region from Specific Units as predicted by AVERT[30]



[30] The diameter of each circle indicates the magnitude of a unit's change in generation/emissions. Circles are semi-transparent: darker areas occur in regions with overlapping units. Negative changes (emissions decreases) are indicated with blue circles; positive changes (emissions increases) are indicated with black-bordered white circles.

Figure 8: Projected 2028 $PM_{2.5}$ Reductions from Arkansas EE Programs for the AVERT Lower Midwest Region from Specific Units as predicted by AVERT[31]



[31] The diameter of each circle indicates the magnitude of a unit's change in generation/emissions. Circles are semi-transparent: darker areas occur in regions with overlapping units. Negative changes (emissions decreases) are indicated with blue circles; positive changes (emissions increases) are indicated with black-bordered white circles.

III. Establishing a Regional Haze Framework Consistent with EE

The current regional haze framework can legally accommodate energy efficiency measures without revision. Under 40 C.F.R. § 51.308(d)(3), the long-term strategy "must include enforceable emissions limitations, compliance schedules, and *other measures* as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal Areas." (emphasis added). The Agencies urge EPA to explicitly allow states to include energy efficiency measures under the authority provided by the "other measures" category. This could be accomplished in several ways that are discussed below.

First, EPA could modify the analytical framework for the second planning period to allow states the flexibility to include whatever measures are needed to achieve the required amount of progress for the second planning period and beyond. The guidance that was proposed in 2016 created a framework with a number of potential barriers to the inclusion of energy efficiency in a state implementation plan revision.[32] The proposed guidance set forth a series of analytical steps intended to apply to source-specific controls. If finalized, these steps would preclude the use of energy efficiency as a measure to ensure reasonable progress because both the energy efficiency measures and avoided emissions are diffused across sources and incompatible with the traditional analysis, despite evidence indicating that the EE measures reduce EGU emissions that affect Class 1 areas.

The Agencies request that EPA either (a) create an alternative analytical framework for energy efficiency under the previously-discussed, "other measures" category, or (b) revise and broaden the proposed steps to allow the flexibility to include energy efficiency as a measure in a similar manner as other measures. Table 6 below includes the Proposed Guidance's analytical steps as compared to an alternative that would allow energy efficiency measures to become viable:

[32] Draft Guidance on Progress Tracking metrics, Long-term Strategies, Reasonable Progress Goals and Other Requirements for Regional Haze State Implementation Plans for the Second Implementation Period, 2016

Table 6: Proposed Guidance vs. Alternative Framework

Proposed Guidance[33]	Alternative Analytical Framework
Ambient data analysis (Step 1)	Ambient data analysis (Step 1)
Screening of sources (Step 2)	Determine Reasonable Progress Goals (Step 2)
Source emissions control measure characterization (Step 3)	Decision on the content of the long term strategy based on (1) controls that are on the books and upcoming; (2) controls selected as applied to a source or group of sources; and (3) other measures including energy efficiency (Step 3)
Decision on the content of the long term strategy (Step 4)	Regional Scale Modeling (Step 4)
Regional scale modeling of the LTS to set the RPGs for 2028 (Step 5)	
Progress, degradation and glidepath checks (Step 6)	

The above-described process is intended to convey a series of steps under which the degree of improvement needed to achieve reasonable progress goals are set first and states permitted broad discretion, whether source-specific or an alternative such as EE, to reduce visibility impairment, so long as those measures achieve the reasonable progress goals for affected Class I areas. EE could be appropriately analyzed and included as one of the measures chosen to achieve the progress needed to reach background visibility conditions.

If EPA chooses to retain the series of analytical steps in the Proposed Guidance, then the Agencies propose that a wholly separate set of analyses be designed for EE under a new category based on the explicit existing statutory authority for "other measures." Analysis of EE as applied to potentially affected EGUs or other affected facilities could be performed separately from the traditional analysis similar to that performed in this concept paper. After performing the ambient data analysis in step 1, the state could analyze the EE standard and measures by applying the four factors to EE and ultimately including the EE measures in the long term strategy. In this way, EE could be treated as its own reasonable progress measure, albeit with unique attributes requiring more flexibility in how the analysis is performed.

IV. Four-Factor Analysis Demonstration for EE measures

Clean Air Act 169(a) requires states to consider four factors—cost of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, the remaining useful life of any existing source subject to requirements—in determining what

[33] Draft Guidance on Progress Tracking metrics, Long-term Strategies, Reasonable Progress Goals and Other Requirements for Regional Haze State Implementation Plans for the Second Implementation Period, 2016

measures are necessary to make reasonable progress toward the national goal of natural visibility conditions in each designated Class I area by 2064. Cost of compliance is traditionally assessed by comparing the cost of implementing retrofit technology, including capital investments and ongoing operation and maintenance, to the tons of emissions reduced. Costs include both capital investments and ongoing operation and maintenance costs.

When considering the impact of EE programs, as with retrofit projects, costs are unique depending on the EE program being analyzed, and vary from source to source and customer to customer. In the following sections, the Agencies compare source-specific data to determine retrofit compliance costs versus EE program costs, and analyze costs and benefits of EE programs for ratepayers. The Agencies discuss the time expected for compliance, which in the case of EE programs, is more immediate and produces cumulative energy and emissions benefits, unlike retrofit projects. The Agencies also consider remaining useful life of typical EE measures implemented through EE programs, and discuss environmental and societal benefits realized over time. Finally, the discussion demonstrates how EPA and states could use existing infrastructure, assessments, and emissions calculation tools of the Regional Haze Program to include consideration of emissions benefits gained through EE programs implemented by EGUs.

A. Cost of Compliance

1. EE vs Retrofit Technology Cost Curves and Cost-Effectiveness

As part of the discussion of employing EE as an option for reducing emissions in Class I areas, the Agencies assessed the cost-effectiveness in terms of dollars per ton of visibility impairing pollutant reduced for Arkansas EE programs as compared to retrofit controls. In the following discussion, the Agencies compare cost of compliance for EE programs to average source-specific emissions controls for the utilities, and consider the pollution benefits from each.

The Agencies conducted generalized cost analyses of common retrofit controls for the top two potential NOx and SO_2 influencers of visibility on the most impaired days at Arkansas Class I sites at Upper Buffalo and Caney Creek (projected to 2028).[34] Facility types in this category include coal-fired EGUs, large paper and pulp mills, and cement and chemical plants. Common retrofit technologies for these source types (e.g., the installation of flue gas desulfurization scrubbers, wet gas scrubbers, and selective catalytic reduction systems and controls) were evaluated to estimate cost per ton of pollutant reduced. Based on expected avoided emissions of these controls, the estimates for cost-effectiveness for each facility ranged from $738 per ton of pollutant reduced to $8900 per ton (an average of $4934 per ton). These estimates are based on

[34] The top two potential influencers were determined based on Ramboll's 2018 "Determining Areas of Influence – CenSARA Round Two Regional Haze: Final Report" prepared for the Central States Air Resource Agencies Association https://www.adeq.state.ar.us/air/planning/sip/pdfs/regional-haze/f.9-alpine-geophysics-technical-support-document-for-cenrap.pdf

typical costs and screening tools developed by EPA.[35] For any given facility, a source-specific engineering analysis would be required to determine actual costs for retrofits.

By comparison, projected cost-effectiveness in dollars per ton of emissions reduced for Arkansas EE utilities are higher than for retrofits; however, these programs have other meaningful benefits beyond emissions reductions. Indeed, emission reductions are an ancillary benefit to the EE programs. Under APSC rules, a program is considered cost-effective if it has a high probability of providing aggregate ratepayer benefits to the majority of utility customers. Whether or not these EE programs will be implemented is wholly independent of the cost-per-ton of visibility impairing pollutants reduced, and the resulting emissions benefits are therefore realized without additional compliance costs. Essentially, emissions reductions from EE programs are gratis improvements in air quality resulting from existing programs.

For EE programs, the Agencies estimated the projected cost-effectiveness for each region in years 2018–2028 using a baseline average cost per GWh incremental annual savings,[36] the projected incremental savings for each year, and the AVERT emission reduction results. Tables 7 and 8 illustrate cost-effectiveness in terms of dollars per ton reduced for the Southeast and the Lower Midwest Region. Another benefit of EE is that the programs provide non-air quality benefits—such as water and wastewater reductions, natural resource conservation, and lower energy costs for customers—that are not included in base cost-effectiveness projections below. The benefits of energy savings (and related air emissions reductions) are accumulated over time.

[35] http://vista.cira.colostate.edu/Improve/rhr-summary-data/; Menu of Control Measures for NAAQS Implementation, available at: https://www.epa.gov/air-quality-implementation-plans/menu-control-measures-naaqs-implementation; EPA Air Pollution Control Cost Manual, available at: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution

[36] The baseline average cost per GWh incremental savings was calculated for each region based on the most recent three years of program cost and annual savings achieved data submitted to APSC in utility annual energy efficiency reports.

Table 7: Southeast Region Estimated Cost-Effectiveness in Dollars per Ton of Visibility Impairing Pollutants Reduced, Projected for Arkansas EE Programs

Year	Change in Emissions (Tons)				Cumulative Energy Savings (GWh)	Estimated Annual Cost of Program	Cost-Effectiveness
	SO2	NOx	PM2.5	Cumulative (SO2, NOx, PM2.5)			
2018	-505	-594	-67	-1167	1311	$51,177,674	$43,872
2019	-556	-654	-73	-1284	1444	$51,177,674	$39,873
2020	-618	-726	-82	-1425	1604	$60,567,392	$42,492
2021	-674	-793	-89	-1556	1751	$60,567,392	$38,921
2022	-726	-853	-96	-1674	1884	$60,567,392	$36,174
2023	-772	-907	-102	-1781	2004	$60,567,392	$34,013
2024	-813	-955	-107	-1875	2111	$60,567,392	$32,296
2025	-849	-997	-112	-1958	2205	$60,567,392	$30,927
2026	-880	-1033	-116	-2030	2285	$60,567,392	$29,840
2027	-906	-1064	-120	-2089	2352	$60,567,392	$28,990
2028	-927	-1088	-122	-2137	2406	$60,567,392	$28,342

Table 8: Lower Midwest Region Estimated Cost-Effectiveness in Dollars Per Ton of Visibility Impairing Pollutants Reduced, Projected for Arkansas EE Programs

Year	Change in Emissions (Tons)				Cumulative Energy Savings (GWh)	Estimated Annual Cost of Program	Cost-Effectiveness
	SO2	NOx	PM2.5	Cumulative (SO2, NOx, PM2.5)			
2018	-301	-192	-16	-509	327	$17,686,611	$34,756
2019	-348	-223	-18	-590	379	$17,686,611	$29,993
2020	-398	-255	-21	-674	434	$19,260,978	$28,591
2021	-445	-312	-23	-780	484	$19,260,978	$24,683
2022	-488	-312	-26	-825	530	$19,260,978	$23,342
2023	-527	-337	-28	-891	573	$19,260,978	$21,619
2024	-562	-359	-30	-950	611	$19,260,978	$20,272
2025	-593	-379	-31	-1003	644	$19,260,978	$19,207
2026	-620	-396	-33	-1049	674	$19,260,978	$18,359
2027	-644	-411	-34	-1089	700	$19,260,978	$17,688
2028	-664	-424	-35	-1122	721	$19,260,978	$17,161

2. Utilities' and EE customer costs, and the payback period on EE

In PY 2017, Entergy (Southeast Region) invested a total $57,141,646 in administration of its EE Portfolio programs; OGE invested $6,404,252, and SWEPCO invested $9,920,316 (Lower Midwest Region). Because of its limited customer base, Empire (Lower Midwest Region) has

Commission approval to file a cumulative EE Portfolio report at the end of a 3-year cycle. So Empire will file a report in 2020 for the 2017–2019 program period.[37] Therefore, PY 2017 EE investment numbers are not available for Empire.

Most EE Portfolio resources are concentrated on putting energy savings measures into the hands of customers in order to deliver the greatest impact on energy savings. For each EEP, the average categorical expenditure for incentives and direct install costs was sixty-four percent of the total annual amount spent on EE Portfolio facilitation and implementation. On average, another thirty percent was allocated to marketing and delivery.

Commercial and residential customers of utilities are offered zero- and low-cost options through the EE Portfolios and through programs offered through Energy Efficiency Arkansas. These include free weatherization and energy consumption audits, rebates for qualifying energy efficient equipment and appliances, and supplemental federal funding through the U.S. Department of Energy for low-income or severely energy-inefficient buildings. Unlike traditional source-specific controls, many EE measures ultimately reduce utility costs to the consumer. Payback periods on EE measures are specific to equipment being modified or replaced. Some programs, such as those replacing older bulbs with CFL or LED, are fully funded by the EE Portfolio, and the customer will see immediate benefits in terms of monthly energy costs. For EE Portfolio programs offered through Arkansas's utilities, customers can expect reasonable payback periods for their investments. For instance, to retrofit lighting project for commercial and industrial customers with a peak demand of more than 50 kW, the average payback period is two and one-half years for an investment of $23,000.00.[38] Table 9 below shows equipment for a commercial lighting retrofit; after the initial investment by the customer, the utility EE Portfolio program incentive would pay back approximately $9500. The annual energy savings of 68,039 kWh would reduce customer energy costs by $5400 in the first year, and thereafter.[39] The benefits of the technology implemented in this example would continue to benefit the customer in terms of savings, for approximately twelve and one-half years past the date of payback (see Appendix A for retrofit lighting and other EE measures' useful life estimates).

Table 9: Commercial Retrofit Lighting Scenario

Existing Lighting	Retrofit Lighting
(60) highbays 400W MH	(60) 180W LEDs
(10) wall packs 250W MH	(10) 75W LEDs
(10) troffers 4 Lamp 32W T8	(10) 50W LEDs

[37] APSC Order, May 3, 2016: http://www.apscservices.info/pdf/07/07-076-TF_267_1.pdf
[38] SWEPCO Annual EE Portfolio Report, 2016: page 700.
http://www.apscservices.info/EEInfo/EEReports/SWEPCO%202016.pdf
[39] *Id.*

Rather than costing ratepayers to comply, as is the case when costs are passed on to utility ratepayers to recover the capital expenditure needed to fund environmental controls, customers of utilities experience direct individual and ongoing savings from participation in EE programs. EE program investments are recoverable through rate adjustments just as retrofit projects, but ratepayers themselves receive real-world benefits from the EE programs that their utility payments subsidize.

Because of the cumulative energy savings gained per dollar invested in EE programs, these programs are cost-effective in the long-term for utilities and for customers. Additional air quality benefits from these programs are surplus and occur without further costs.

B. Time Necessary for Compliance

The EE Portfolio measures developed by utilities to meet standards set by ASPC are being continuously implemented and will be implemented regardless of the Regional Haze Program and its timing requirements. The sections below discuss the timing for EE Portfolio program planning, implementation and reporting.

1. Requirements of APSC EE Resource Standard for timing

APSC rules require that each investor-owned utility file its Annual Report and Excel Workbook in May of each year, which provides information on the energy program savings planned, budgeted, and achieved [for the prior PY], and then evaluated and verified by independent program evaluator. These reports, including the evaluators' reports, are available in each utility's EE docket […].[40] The timing for implementation of individual EE Portfolio measures is largely determined by the success (or low performance) of specific EE Portfolio programs and the associated goals for each program. For instance, a program within an EE Portfolio that does not have expected participation rates will be evaluated in the Annual Report for the past PY; if a feasible means of increasing participation within that program cannot be projected forward, the program will be retired, replaced with a new program, or its budget transferred to a more successful program in the EE Portfolio (with approval from ASPC). Programs and associated EE measures identified for the upcoming PY will begin (at the earliest) in January, and to be included in the EM&V for that PY, must be completed by December of the same year; successful programs often are continued through several PYs, but reporting for each PY is bound to January through December. Updated comprehensive EE Portfolio plans must be filed April 1 for the following PY.[41]

EE programs are prescriptive and are evaluated annually for achievement and ongoing performance.

[40] *Quoted from "A Brief History of Arkansas's Energy Efficiency Initiatives (2006 to date) and Rules Governing Evaluation, Measurement & Verification of Energy Savings: Wally Nixon, Arkansas Public Service Commission*
[41] Docket No. 10-101; April 20, 2018

2. Timing of cumulative benefits of EE policy

EE benefits from EE Portfolios increase annually as new measures are implemented and measures from previous years continue to produce savings. As the energy savings realized through EE Portfolios increase over time, so do avoided generation and emissions reductions. Therefore, these are programs that will continue to contribute to RH improvement at low cost for more than ten years per measure, and additional measures are being included each year to replace those that "expire" in that program year. For example, if an LED lightbulb burns out, that will be replaced by another LED bulb, frequently at a lower cost to install than the first bulb, and the associated benefits will carry on for another ten years.

C. Remaining Useful Life

1. Lifetime assumptions for various measures

For each program in an EE Portfolio, data is included to show annual and lifetime savings associated with specific measures implemented for each program. For instance, in Entergy's 2017 EE Portfolio, the Home Energy Solutions program evaluated 25,757 megawatt hours (MWh) of energy savings and a ten megawatt (MW) reduction in energy demand for PY 2017.[42] The lifetime savings, calculated based on useful life of measures installed under the program in PY 2017, will produce 421,459 MWh of energy savings. The majority of implemented measures under EE Portfolios have long-term benefits, which cumulatively reduce load resulting in less combustion of fossil fuels from EGUs and consequently reduced air emissions.

The Technical Reference Manual outlines technical methods for calculating savings for the following EE measures as part of utilities' EE Portfolios:

a. Residential Deemed Savings, Installation and Efficiency Standards, including:
   i. HVAC measures,
   ii. Building envelope measures,
   iii. Domestic hot water measures,
   iv. Appliance replacements, and
   v. Lighting upgrades;
b. Commercial, Industrial, and Small Commercial Deemed Savings, Installation and Efficiency Standards, including:
   i. HVAC measures,
   ii. Building envelope measures,
   iii. Domestic hot water measures,
   iv. Motors,
   v. Appliances replacements,
   vi. Lighting upgrades,
   vii. Other methods, and

[42] Entergy Arkansas, Inc., Arkansas Energy Efficiency Program Portfolio Annual Report: Docket No. 07-085-TF 2017 Program Year: http://www.apscservices.info/EEInfo/EEReports/Entergy%202017.pdf

viii. Food service equipment.

For each of these categories, the Technical Reference Manual provides calculations to account for remaining useful life (RUL) of equipment replaced and the estimated useful life (EUL) of newly implemented EE measures to account for annual and lifetime energy use reductions. Appendix A includes a list of measures regularly implemented through EE Portfolio programs in Arkansas, and the estimated useful life for each, according to the Technical Reference Manual document. The combined average useful life for these measures is thirteen and one-half years, meaning the system-wide benefits of energy savings and the reduction of energy costs for the customer continue long after initial investment and installation.

Because the remaining useful life of various measures varies, the Agencies utilized a depreciation schedule (see Table 1) for EE measures developed by EPA in calculating emissions reductions using AVERT.

2. Planned retirements for EGUs and potential effects on emissions reductions

Between 2027 and 2030, two coal-combustion electric generating units (EGU) in the Southeast Region are slated for retirement or will cease burning coal, and utilities are committing to invest in renewable energy options, as solar power emerges as a growing industry in Arkansas.[43] Fuel switching at EGUs to reduce coal and petroleum consumption (and related emissions) is also common practice, as options for renewable and cleaner energy (from natural gas, for example) become less costly. For this paper, emissions savings estimates are based on the fleet of EGUs as of 2017.

D. Energy and Non-Air Quality Impacts

1. Grid resiliency and avoided additional generation/transmission

Energy demand is a key factor affecting grid resiliency, particularly during peak load times. EE measures help to insulate the reliability of the system by providing meaningful demand reductions. Measures implemented in one year provide demand reductions for that PY and continue to provide demand reductions in subsequent years, in addition to new demand-reducing measures implemented with each following PY. Table 10 below illustrates the total MW of energy demand avoided through implementation of EE Portfolio programs in PYs 2015–2017; as with other benefits realized through EE measures, demand avoided increases incrementally over time.

[43] Entergy settlement agreement with Sierra Club, November 2018; Plant Specific Conditions section https://media.arkansasonline.com/news/documents/2018/11/16/Notice_of_Lodging_of_Settlement_Agreement.filed.PDF and Arkansas News article, August 7, 2015: *Entergy proposes closing White Bluff coal plant in 13 years.* http://www.arkansasnews.com/news/arkansas/entergy-proposes-closing-white-bluff-coal-plant-13-years

Table 10: Energy Demand Avoided (MW) Through Utility EE Portfolio Programs, 2015–2017

Program Year	Southeast Region	Lower Midwest Region	Statewide Total
2015	75.0	19.05	**94.05**
2016	92.5	17.44	**109.94**
2017	104.4	16.25	**120.65**

2. Payback in electricity savings for EE customers

This factor was explored earlier in this paper under cost of compliance; however, the Agencies note that after the payback period for a measure, the EE project continues to provide cost-savings to the customer. Using the commercial lighting scenario from earlier as an example, after the payback period of two and one-half years, the customer would save approximately $67,500 over the remaining lifetime of the new lights. For residential customers, the savings for EE measures is on a smaller scale, but is proportional to the initial investment, and has comparable EUL. Long-term savings encourages customers to engage in EE Portfolio program offerings, and to continue employing EE measures in daily operations.

3. Non-Energy benefits of EE measures

While the primary measure of success for EE Portfolios is the direct savings achieved in energy use and demand, other benefits result from the implementation of these measures. Non-energy benefits include reductions in maintenance, water usage, wastewater needs, and fossil fuel consumption. These benefits can account for increases in health, safety, comfort, property values, and even productivity. Entergy's EE Portfolio measures that were implemented in PY 2017 will yield a lifetime savings of 291,110,605 gallons of water with an avoided cost of $1,598,936.[44] For the same year, SWEPCO's implemented measures will result in a lifetime savings of 32,993,571 gallons of water, saving consumers $112,282.[45] OG&E provided PY 2017 calculations showing first-year water savings of 9,710,220 gallons of water and $48,217 from its EE Portfolio program measures.[46] These are substantial reductions in water use and result in considerable savings for customers that are in addition to primary energy savings benefits.

[44] Entergy Arkansas, Inc. Arkansas Energy Efficiency Program Portfolio Annual Report, 2017 Program Year http://www.apscservices.info/EEInfo/EEReports/Entergy%202017.pdf

[45] Southwestern Electric Power Company Arkansas Energy Efficiency Program Portfolio Annual Report, 2017 Program Year http://www.apscservices.info/EEInfo/EEReports/SWEPCO%202017.pdf

[46] Oklahoma Gas and Electric Company Arkansas Energy Efficiency Program Portfolio Annual Report, 2017 Program Year http://www.apscservices.info/EEInfo/EEReports/OG&E%202017.pdf

V. EE in Long-Term Strategy

As a requirement of the Regional Haze Program, each state must submit a long-term strategy that addresses regional haze and visibility impairment for each Class I Area within its borders, and for each Class I Area located outside the state that may be affected by its emissions. The long-term strategy must include enforceable emissions limitations, compliance schedules, and other measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Areas. In the following sections, the Agencies discuss how EE programs could be a component of long-term strategies for states, falling under the category of "other measures," as long as these benefits are documented on a technical basis, and can be reasonably calculated using EPA-approved tools and evaluations. Similar tools and strategies used to address Regional Haze contained in previous iterations of guidance can be adapted to demonstrate the technical basis for crediting EE programs in the long-term strategy.

A. Translation of EE emissions benefits to visibility benefits

EPA's AVERT tool was used to estimate avoided generation and emissions reductions resulting from EE measures in place in Arkansas. The regional emissions changes could be used as inputs for an acceptable photochemical model such as the Comprehensive Air Quality Model with Extensions (CAMx) in order to determine potential visibility impacts.

Potential visibility impacts to Class I areas in Arkansas and surrounding states resulting from avoided generation at specific EGUs within the region, could be estimated using photochemical modeling. The modeling could be performed by the Central States Air Resources Agencies (CenSARA) as part of the overall regional haze modeling that will be conducted for the Central States Region, or by ADEQ if resources to support in-house modeling become available. The Agencies propose that visibility improvements resulting from EE measures in Arkansas could reduce the need for other control measures that might otherwise be necessary to achieve visibility improvement goals while saving money for Arkansas consumers and providing many ancillary benefits.

B. Ensuring State Implementation Plan Robustness

EPA policy has traditionally provided for flexibility with regard to the use of EE in SIPs, but EPA has nevertheless considered whether the particular measures meet the following requirements in determining how the avoided emissions can be accounted for in a SIP: real, quantifiable, surplus, enforceable, and permanent.[47]

[47] See generally, *Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans*, U.S. EPA Office of Air Quality Planning and Standards, p. 14-15 (providing for three different "pathways" based on whether the measures are quantifiable, surplus, enforceable, and permanent); .

1. Real

EE measures reduce fossil fuel electric generation, which in turn reduces emissions of all pollutants emitted from affected facilities. EE measures also reduce fuel use and lower emission rates in boilers and furnaces by improving the fuel efficiency of the boiler or furnace, which also reduces emissions of all pollutants from that fuel. The largest energy providers in the state view EE as a viable option for future planning and investment, as evidenced in annual EE Portfolio reports, and by trends in EE Portfolio and EE opportunity spending that regularly results in annual EE savings that exceed APSC goals, and demonstrate that the programs' results are real.

2. Quantifiable

The calculations within the Technical Reference Manual provide a reliable estimation of avoided energy consumption. When paired with tools that reliably quantify pollutant emissions generated per GWh including AVERT, the energy savings in GWh produced by EE Portfolios is sufficiently quantifiable to meet standard SIP requirements for emissions reduction quantification. Because APSC sets annual energy savings goals for utilities' EE Portfolios and the structure for EE Portfolios to meet and exceed the goals is incentive-based, accurate and quantified data to evaluate program effectiveness is necessary and provided. The utilities rely on the Technical Reference Manual to show that their programs are on-track to receive incentive payouts, and the APSC relies on the Technical Reference Manual to effectively assess programs to show real and quantified energy savings before rewarding providers.

Reduced energy demand from programs administered under APSC's Rules are calculated using protocols recognized by the American National Standards Institute ("ANSI"), the American Society of Heating, Refrigerating and Air-Conditioning Engineers ("ASHRAE"), and the Illuminating Engineering Society of North America (IESNA). Technical resources referenced in the Technical Reference Manual also include equations and protocols published by the U.S. Department of Energy's Energy Efficiency and Renewable Energy Office, and EPA's EnergyStar® strategies for buildings and industrial plants. These protocols are detailed in the Technical Reference Manual, which is reviewed annually by APSC and their appointed IEM, and by utilities and their IEs. The Technical Reference Manual is updated regularly to account for new technologies and best practices in EE, and is referenced from initial development of EE programs through EM&V processes by APSC's IEM. The Arkansas Technical Reference Manual, Version 7.0, was most recently updated in August 2017.

Trends in energy and demand savings show the benefits of implementing an incentive-based structure for utilities' EE Portfolios (see Tables 11–14 below). Before the incentive was introduced, utility EE Portfolios came close to or reached the goal set by PSC; for the largest utilities, every year after shows an increased average exceedance of the goal, as utilities adjust their EE Portfolio programs to be more effective. In PY 2017, SWEPCO exceeded the goal by forty-one percent, Entergy exceeded the goal by sixty-five percent, and OGE, a smaller electric

provider in the state, exceeded the goal by seventeen percent. Utilities and their investors see real benefits in EE, and in Arkansas, have committed to continued improvement of system-wide efficiency. These efforts amounted to an energy savings of 319,790 MWh and a demand reduction of 124.6 MW in 2017. Higher levels of energy savings are expected due to the increased EE target starting in 2020 and as the utilities implementation experience with these programs increases.

All of these efforts demonstrate how the programs' achievements are quantified in ways that meet EPA's criteria.

Table 11: Net Evaluated Annual Energy & Demand Savings, Entergy (Southeast Region), 2011–2017 [48]

Program Year	Energy Savings Goal %	Net Energy Savings Goal (MWh)	Net Energy Saved (MWh)	Percent of Goal	Energy Demand Avoided Achieved (MW)
2011	.25	40,227	39,967	**99%**	
2012	.50	96,694	107,627	**111%**	
2013	.75	139,622	188,468	**135%**	
2014	.75	135,738	205,507	**151%**	
2015	.90	162,886	230,341	**141%**	75.0
2016	.90	161,478	253,290	**157%**	92.5
2017	.90	160,484	264,992	**165%**	104.4

Table 12: Net Evaluated Annual Energy & Demand Savings, SWEPCO (Lower Midwest Region), 2011–2017 [49]

Program Year	Energy Savings Goal %	Net Energy Savings Goal (MWh)	Net Energy Saved (MWh)	Percent of Goal	Energy Demand Avoided Achieved (MW)
2011	.25	10,426	11,855	**113%**	
2012	.50	15,714	15,714	**100%**	
2013	.75	23,093	25,388	**110%**	
2014	.75	21,339	30,055	**141%**	
2015	.90	24,273	31,356	**129%**	15.9
2016	.90	23,958	34,356	**143%**	14.0
2017	.90	23,872	33,667	**141%**	12.7

[48] Utilities' EE Portfolio annual report workbooks, 2011-2017: http://www.apscservices.info/eeAnnualReports.aspx
[49] *Id.*

Table 13: Net Evaluated Annual Energy & Demand Savings, OGE (Lower Midwest Region), 2011-2017[50]

Program Year	Energy Savings Goal %	Net Energy Savings Goal (MWh)	Net Energy Saved (MWh)	Percent of Goal	Energy Demand Avoided Achieved (MW)
2011	.25	6,753	4,985	**74%**	
2012	.50	11,364	7,596	**66%**	
2013	.75	16,844	13,411	**80%**	
2014	.75	16,288	13,794	**85%**	
2015	.90	18,904	20,543	**117%**	3.1
2016	.90	18,623	23,257	**125%**	3.4
2017	.90	18,058	21,131	**117%**	3.5

Table 14: Net Evaluated Annual Energy & Demand Savings, Empire (Lower Midwest Region), 2011-2015 [51]

Program Year	Energy Savings Goal %	Net Energy Savings Goal (MWh)	Net Energy Saved (MWh)	Percent of Goal	Energy Demand Avoided Achieved (MW)
2011	.25	387	3	**1%**	
2012	.50	777	151	**19%**	
2013	.75	1,077	177	**16%**	0.05
2014	.75	1,170	147	**13%**	0.04
2015	.90	1170	212	**18%**	0.05

3. Enforceable

If the state chooses to adopt a permanent and enforceable "backstop" to be implemented in the event that expected visibility improvements fail to materialize then EPA should approve a Regional Haze SIP that takes credit for EE programs. Such a "backstop" approach ensures that the State would be responsible for assuring that the emission reductions credited in the SIP occur. The five-year progress report provides an existing mechanism that will afford the State with the opportunity to reassess progress and determine whether the "backstop" is necessary. The State would make an enforceable commitment to EPA to monitor, assess, and report to EPA on the emission reductions resulting from the voluntary measures and to remedy any shortfalls from

[50] Utilities' EE Portfolio annual report workbooks, 2011-2017: http://www.apscservices.info/eeAnnualReports.aspx
[51] *Id.*

forecasted emission reductions in a timely manner; it would be the State's responsibility to correct the shortfall within two calendar years of when the shortfall is determined to exist.

These programmatic instruments make EE programs enforceable.

4. Surplus

The energy savings from APSC approved EE Portfolios is not required under federal air pollution control rules or federal EE rules. Resulting emissions reductions have not been traditionally considered as part of Arkansas's progress toward long-term visibility goals. Because the emissions reductions from EE programs are uncounted under pollution management plans, these are wholly surplus benefits, and could allow for state regulatory flexibility to meet federal requirements for visibility.

5. Long-lasting

Many of the measures implemented under utility EE Portfolios, such as commercial upgrades to LED-compatible ballasts and building envelope/insulation installation, ensure longevity of the public benefits from reduced energy use and the related emissions reductions. Because the benefits transfer to the customer in terms of profit margin and cost savings, there is no incentive to return to less efficient measures. Upgrades made in each program year will continue to offer benefits to the system and the individual customer for many forward-looking years.

VI. Conclusion

Because of reduced energy use and generation, EE programs administered through utilities regulated by the APSC deliver real and quantifiable reductions in SOx, NOx, and $PM_{2.5}$. These programs are long-lasting and the measures implemented provide compounding benefits for grid resiliency, customer savings, quality of life, and reduced air pollution. Using the AVERT model and detailed data required in EE Portfolio annual reports, the Agencies are confident these avoided emissions are quantified in a way that is approvable as part of a Regional Haze SIP. The Agencies request EPA's feedback on this framework and initial analysis and look forward to future collaboration and synergy in environmental and energy planning.

Appendix A

Table A-1 Estimated Useful Life of Common Arkansas EE Portfolio Measures [52]

Measure	Estimated Useful Life (EUL)
Direct-vent heaters	20 years
Duct insulation	20 years
Gas furnaces	20 years
Gas furnace tune-up	3 years
Central air conditioner and heat pump tune-up	10 years
Central air conditioner replacement	19 years
Ground source heat pumps	25 years
Heat pump replacement	16 years
Hydronic heating	20 years
Window air conditioner replacement	10.5 years
Duct sealing	18 years
Smart thermostat	11 years
EnergyStar ventilation fans	19 years
Attic knee wall insulation	20 years
Ceiling insulation	20 years
Wall insulation	20 years
Floor insulation	20 years
Roof deck insulation	20 years
Radiant barriers	25 years
EnergyStar windows	20 years
Window solar film	10 years
Air infiltration	11 years
Electric storage tank water heaters	13 years
Tankless gas/electric water heaters	20 years
Heat pump water heaters	10 years
Gas storage tank water heaters	11 years
Solar water heaters	15 years
Water heater jackets	13 years
Electric storage water heater–Pipe Insulation	13 years
Gas storage water heater-Pipe Insulation	11 years
Heat pump water heater-Pipe Insulation	10 years
Faucet Aerators	10 years
Low-flow showerheads	10 years
Showerhead thermostatic restrictor valve	10 years
Tub spout + showerhead thermostatic restrictor valve	10 years
EnergyStar clothes washers	14 years

[52] Arkansas Technical Reference Manual, Version 7.0, August 31, 2017: http://www.apscservices.info/EEInfo/TRMv7.0.pdf

EnergyStar dishwashers	15 years
EnergyStar refrigerators	17 years
Advanced power strips	10 years
EnergyStar pool pumps	10 years
EnergyStar dehumidifiers	12 years
EnergyStar Compact Fluorescent Lamps (CFLs)	5 years (avg)
EnergyStar Specialty CFLs	9.75 years (avg)
EnergyStar Specialty LEDs	19-20 years
EnergyStar omni-directional LED	19 years
Indoor/outdoor linear fluorescents	15 years
Boiler cutout controls	20 years
Boiler or furnace vent dampers	12 years
Boiler reset controls	20 years
Boiler tune-up	2 years
Boiler replacement – commercial boilers	12 years
Central air conditioner and heat pump tune-up	10 years
Commercial and industrial boilers	20 years
Commercial furnaces	20 years
Direct vent heaters (small commercial and converted residences)	20 years
Duct efficiency improvements	18 years
Duct insulation (converted residences)	20 years
Duct insulation (small commercial)	20 years
Occupancy-based packaged terminal air conditioners (PTAC) and packaged terminal heat pumps (PTHP)	15 years
Packaged terminal AH/HP (PTAC/PPTHP) equipment	10 years
Steam trap replacement	5 years
Unitary and split system AC/HP Equipment	15 years
Air or water cooled chilling equipment	20-25 years
Ceiling insulation (converted residence)	20 years
Ceiling insulation (small commercial)	20 years
Cool roofs	15 years metal; 10 years paint
Air infiltration (converted residences)	11 years
Roof deck insulation (small commercial)	20 years
Wall insulation (converted residences)	20 years
Window awnings (small commercial)	10 years
Window film (converted residences)	10 years
Window film (small commercial)	10 years
Commercial door air infiltration	11 years
Domestic hot water heater replacement: Heat pump water heater (HPWH)	10 years
Domestic hot water heater replacement: High efficiency commercial storage water heater	15 years
Domestic hot water heater replacement: Commercial tankless water heater	20 years

Domestic faucet aerators		7 years
Water heater jackets		7 years
Water heater pipe insulation		Water heater RUL
Low-flow showerheads		10 years
Electronically commutated motors for refrigeration and HVAC		15 years
Premium efficiency motors		15 years
Solid door refrigerators and freezers		12 years
Light emitting diode (LED) traffic signals		5-6 years
Lighting controls		8 years
Lighting efficiency	Halogen	2 years
	High intensity discharge (HID)	16 years
	Integrated-ballast cold-cathode fluorescent lamps (CCFL)	5 years
	Integrated-ballast compact fluorescent lamps (CFL)	2 years
	Linear LED lamps	15 years
	LED fixtures	15 years
	Linear fluorescent lamps (T5 and T8)	9 years
	Linear fluorescent fixtures/ballasts (T5 and T8)	16 years
	Modular CFL and CCFL	16 years
Plug load occupancy sensors		8 years
Advanced power strips		10 years
Computer power management		4 years (based on RUL of computer equipment being managed)
Beverage and snack machine controls		5 years for occupancy-based controls and 10 years for schedule-based controls
Door heater controls for refrigerated display cases (retrofit only)		12 years
Refrigerated case night covers		5 years
Strip curtains for walk-in coolers and freezers		4 years
Door gaskets for walk-in and reach-in coolers and freezers		4 years
Zero-energy doors for refrigerated cases		12 years
Evaporator fan controls		16 years
Commercial kitchen demand ventilation controls		15 years
EnergyStar pool pumps		10 years
High-speed doors for cold storage facilities		15 years
High-efficiency battery chargers		15 years
Commercial ice makers		10 years
Commercial griddles		12 years

Commercial ovens	12 years
Commercial fryers	12 years
Commercial steam cookers	12 years
Commercial underfired broilers	12 years
Commercial conveyor broilers	12 years
Commercial dishwashers	15 years for door-type and 20 years for conveyor-type
Low-flow pre-rinse spray valves	5 years