



Arkansas Alternative Energy Commission

Fourth Report to

Governor Asa Hutchinson

Senate President Jonathan Dismang

House Speaker Jeremy Gillam

January 05, 2017

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TABLE OF CONTENTS

<u>EXECUTIVE SUMMARY</u>	4
<u>OPEN LETTER FROM THE CHAIRMAN</u>	6
<u>ARKANSAS ALTERNATIVE ENERGY COMMISSION (AAEC)</u>	
1) Purpose /Acknowledgements / Recent Accomplishments Act 1301, 2009... ..	7
<u>AAEC MEMBERS</u>	
a) Current members for “Fourth Report,” 12-08-2016.....	9
b) Past members since “Third Report,” 01-08-2015.....	10
c) Past members since “Second Report,” 12-09-2012.....	11
d) Past members since “Initial Report,” 11-23-2010.....	12
<u>AAEC RECOMMENDATIONS</u>	
1) Recommendations from “Initial Report” dated 11-23-2010	13
a) Enhanced Net Metering	
b) Feed-in Tariff	
c) Suggestions for Further Study	
2) Recommendations “Second Report” dated 12-06-2012	16
a) State Energy Plan	
b) Energy Efficiency	
c) Enhanced Energy Codes	
d) Alternative Financing Mechanisms for EE and RE retrofit projects	
e) BioEnergy / BioFuels	
f) Natural Gas Utilization Plan	
g) Suggestions for Further Study	
3) Recommendations “Third Report” dated 01-08-2015	22
a) HydroPower as a secure Renewable Energy Standard	
b) Combined Heat and Power	
c) Support Efficiency Codes & Incentives	
d) Initiatives like the Interfaith Power & Light	
4) Recommendations “Fourth Report” dated 12-06-2016	23
a) Hydroelectric Power: Clean & Renewable Energy for Generations to Come	
b) ADEQ and Clean Power Plan	
c) State Energy Plan	
d) AAEC Appropriations	
e) AAEC Sunset Clause	

- f) Solar Power an Arkansas Renewable Resource
- g) Recycling Education & Awareness Programs
- h) Nuclear Spent Fuel as an Alternative Energy

<u>BACKGROUND</u> How the Commission arrived at “Topics for Consideration”.....	25
<u>AAEC STUDY PRESENTATIONS</u>	28
<u>AAEC STUDY SUMMARIES</u>.....	31
<u>APPENDICES</u>.....	96
<u>ACRONYMS & ABBREVIATIONS</u>.....	100

EXECUTIVE SUMMARY

Arkansas can be a leader in the Clean Energy Economy. With recent policy developments & enormous resources in alternative and renewable energy, our 'Land of Opportunity' depends upon our New 2017 Leadership for future jobs, economic growth & renewable success. In 2009 the American Council for an Energy Efficient Economy (ACEEE) score for Arkansas was 48th. Today our 2016 score is 27th rising four places from its 2015 ranking and tied with Texas.

The Arkansas Alternative Energy Commission (AAEC) feels a great sense of pride to know we have helped play an informative commitment to extend our energy efficiency goals in accomplishing this landmark growth performance. Our continued Arkansan civic duty to serve as an asset for the 91st General Assembly, to help navigate the renewable portfolios, resources, technologies, emerging trends and research economic energy efficient alternative fuel sources. AAEC would like to thank all those that donated their time, money and efforts to continuing to help inform our state of these ever-changing innovative alternatives. The AAEC strives to make Arkansas a regional leader in alternative fuels and a Renewable Energy State leader.

Arkansas is at an economic turning point. Our highest economic development priority should be in emerging sectors that focus on "cost effective & return of investment" in Energy Efficiency (EE) incentives, Renewable Energy (RE) policies and the encouragement of new In-State energy production that can effectively plug the leaks in our statewide economy. Depth of this commitment will have a global impact with a direct reciprocal effect stimulating Arkansas economic development, private investment, rural development & job creation far into the future.

Arkansas can mitigate the persistent barriers for Renewable Energy Standards (RES) by developing a new Arkansas State Energy Plan. We have significant untapped renewable & alternative resources when it comes to solving our future energy needs. From expanding our infrastructure with retrofits to existing hydropower & utilities, updating transportation policy, building EE codes, combined heat & power, consumer incentives for EE purchases, investing in nuclear spent fuel as an alternative energy, supporting net metering & solar power as a renewable resource, appliance EE standards, and above all is the education of Arkansans in consumer investment based incentives & energy cost options.

Arkansas can see its prosperous future through combined efforts of renewable and alternative energy resources to signal our region for investment. These developments demonstrate our commitment to transition Arkansas from last century's traditional fossil fuel industry, to this century's Clean Energy America.

We have substantial room for growth in policy and implementation to make Arkansas the regional leader by 2036-the Bicentennial of Arkansas! Until then, we have only 10 Legislative Sessions to set EE goals. Focused future legislation on the emerging sectors to grow market certainty will send a clear signal to regional private investors, ultimately resulting in a robust energy mix and a resilient diversified Arkansan economy. The energy market is capital intensive, often with rates of return 20 years out into the future. The stronger the signal; the more comprehensive, and strategic the long-range plan; the more direct and reciprocal the private investment to follow. All segments of our state must work together to educate and make the transition to a Clean Energy Economy.

The AAEC is encouraged by the progress that Arkansas has made and appreciates being included as a stakeholder in the development of the state's first Energy Plan. The Commission continues to learn of the enormous resources & opportunities in alternative clean energy within Arkansas. All recommendations from the last 7 years have been included to reflect the importance of our efforts. Refer to Study Presentations/Summaries for full accounts of presentations. The following are AAEC recommendation findings:

- 1) Develop the Arkansas State Energy Plan with Renewable Energy Standards (RES)
- 2) Enhanced Net Metering
- 3) Develop the Statewide Arkansas Feed-in Tariff
- 4) Arkansas Energy Office develops enhanced Energy Conservation Building Codes.
- 5) Cohesion of State Agencies, Commissions, Departments & Utilities to work together to encourage the growth of EE programs.
- 6) Develop Arkansas Alternative Financing Mechanisms to encourage EE and RE retrofit projects, such as: a) Property Assessed Clean Energy (PACE) b) Creation of Loan Loss Reserve to serve a Statewide Revolving Loan Fund.
- 7) Create Incentives and Programs within the Bioenergy / Biofuels sectors.
- 8) Support and pursue HydroPower as a secure Renewable Energy Portfolio Standard
- 9) Pursue the application of Combined Heat and Power
- 10) Support cost-effective Efficiency Codes & Incentives
- 11) Incorporate initiatives like the Interfaith Power & Light
- 12)Development of Nuclear Spent Fuel opportunity with the University of Arkansas
- 13)Recycling Educational Awareness Programs in Arkansas Schools, counties & communities
- 14) Develop Solar Power as an Arkansas Renewable Energy Portfolio Standard
- 15)Arkansas Department of Environmental Quality develop a state implementation plan
- 16)AAEC be a stakeholder in future efforts to create the Arkansas Energy Plan
- 17)Utilization of ACEEE <http://database.aceee.org/state/arkansas>

OPEN LETTER FROM THE CHAIRMAN

The Arkansas Alternative Energy Commission (AAEC) was created by Act 1301 of the 2009 session of the Arkansas General Assembly. The AAEC has 15 members representing the consumers and utilities equally appointed by the Governor, Senate President and the Speaker of the House. The AAEC is charged to study the feasibility of expanding alternative energy sources in Arkansas, the effects of alternative energy use on economic development and other issues related to alternative energy production and use.

The Commissioners are required by Act 1301 to research and study any subject that may be a part of recommendations presented in a report to the executive and legislative branches. The Commissioners adopted a very aggressive plan for subject matter review for the 2015-1016 session. This was made necessary due to delayed AAEC member appointments. Goals were met and the Commissioners are to be congratulated for the Herculean efforts dedicated to goal attainment.

Previous Commissions, including the current Commission, have reviewed and, in many cases, recommended alternative energy sources, technologies to reduce energy demand and educational opportunities for the Arkansas public. Energy sources reviewed include solar, wind, biomass, hydropower, compressed natural gas, combined heat and power and this year, nuclear power. Items also reviewed include alternative energy education and recycling of waste materials to reduce material demand, reduce energy consumption and eliminate solid waste environmental problems.

The Commissioners remain confident that a keen focus on alternative energy source development, the use of these sources and the efficient use of total energy are paramount to the economic success of Arkansas. These subjects are dynamic in nature and the science and technologies are rapidly changing. As such, the development of an all-inclusive State Energy Plan is fundamental to managing this process. Divorced of such a long term, comprehensive plan will result in fragmented efforts by those groups attempting to drive Arkansas energy success.

The Commissioners appreciate the support received from the executive and legislative branches and agency policy makers. The Commissioners especially appreciate the long-term support received from the Director of the Public Service Commission. His technical and practical support has been invaluable. The members of the AAEC appreciate the opportunity to support the State in the efforts to become an energy leader and to grow the economy and environmental conditions to a level that makes the State a desired place of choice for economic development.

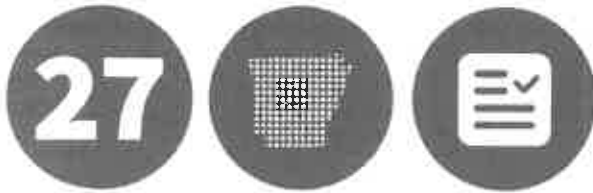
Sincerely

Warren L. Allen

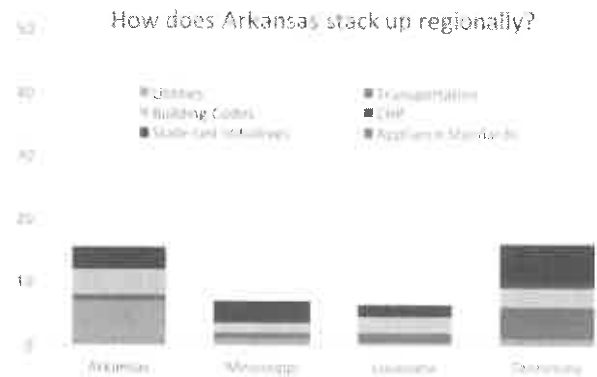
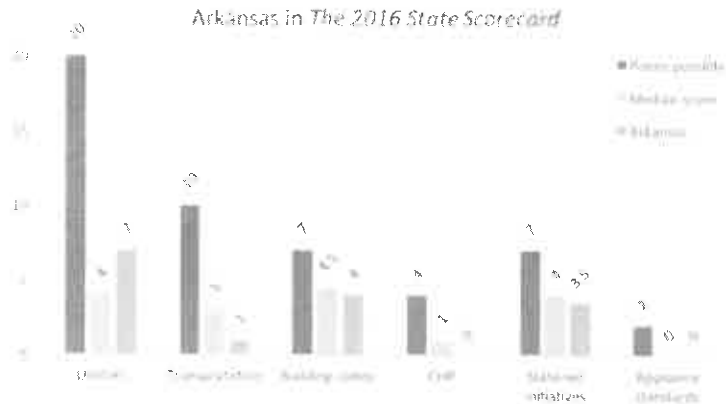
Chairman, Arkansas Alternative Energy Commission

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Arkansas



Arkansas tied for 27th in the 2016 *State Energy Efficiency Scorecard*, rising four places from its 2015 ranking. Arkansas scored 15.5 points out of a possible 50, 2.5 points more than it earned last year.



UTILITIES

Arkansas scored 7 points out of 20 for its utility policies and programs. Arkansas is one of the only states in the Southeast to have approved an energy efficiency resource standard, setting long-term savings targets and utility business model improvements for the state's utilities. Electricity savings continue to increase year after year. Utilities implement both electric and natural gas efficiency programs, although large customers are able to opt out of efficiency offerings.



TRANSPORTATION

Arkansas earned 1 point out of a possible 10 points for transportation policies. Arkansas has a dedicated transit revenue stream in place, but has not otherwise pursued policies to encourage efficient transportation systems. There is still significant room for growth in this policy area.



BUILDING ENERGY CODES

Arkansas earned 4 points out of 7 for its building energy code stringency and compliance efforts. The 2014 Arkansas Energy Code for New Building Construction, also known as the 2014 Arkansas Energy Code, is based on the 2009 IECC with amendments and is mandatory for both commercial and residential new construction. Newly constructed or remodeled public buildings must comply with ASHRAE 90.1-2007. The state has completed several code compliance activities, including a gap analysis and training and outreach. Arkansas is participating in the US Department of Energy's Residential Energy Code Field Study to measure code compliance.



COMBINED HEAT & POWER

Arkansas scored 0 out of 4 points for its combined heat and power policies. The state does not have policies

in place to encourage cost-effective and efficient CHP deployment. One new installation was set up in 2015.



STATE GOVERNMENT-LED INITIATIVES

Arkansas scored 3.5 out of 7 points for state-led energy efficiency initiatives. The state offers loans for energy-related cost reduction retrofits and green energy projects and has also enabled Property Assessed Clean Energy (PACE) financing. The Arkansas government also leads by example, benchmarking energy usage in state buildings and encouraging energy savings performance contracts. There are no energy efficiency-focused research and development programs funded by the state.



APPLIANCE STANDARDS

Arkansas has not set appliance standards beyond those required by the federal government.



HIGHLIGHTS AND OPPORTUNITIES

Arkansas continues to rank among the most energy-efficient states in the Southeast and is one of the few states in the region to set long-term efficiency targets for utilities. As its utility programs mature, Arkansas continues to achieve increasingly higher levels of savings in its homes and businesses. Yet opportunities remain for the state to improve, including strengthening building codes, pursuing more efficient transportation policies, and encouraging CHP as a resource.

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ARKANSAS ALTERNATIVE ENERGY COMMISSION (AAEC)

The Arkansas Alternative Energy Commission (AAEC) was created by Act 1301 (see appendices A) of the 2009 session of the Arkansas General Assembly, and is comprised of 15 members representing consumers and utilities, equally appointed by the Governor, Senate President and Speaker of the House.

The AAEC is charged to study:

- (1) The feasibility of creating or expanding alternative energy sources in Arkansas.
- (2) The effects of the use of alternative energy sources on economic development of the state.
- (3) Other issues related to alternative energy production and use and the impact of alternative energy that the commission considers appropriate.

The Commissioners wish to express our sincere appreciation to Governor Beebe for identifying the AAEC as a stakeholder in the development of the State Energy Plan over the past year. The Commission wishes to acknowledge recent accomplishments under the leadership of the legislative and executive branches, as well as the tremendous efforts put forth by state agencies for the Arkansas Economic Development Commission's (AEDC) Arkansas Energy Office (AEO) and the Arkansas Public Service Commission (PSC) relating to the emerging sectors of alternative energy, energy efficiency and renewable energy. The Commission wishes to highlight a few of the more significant accomplishments achieved in Arkansas in the alternative energy sector since our "Initial Report" to the Governor, dated, November 23, 2010:

- The PSC establishes clear guidelines and goals for energy efficiency programs.
- Creation for the Centers of Excellence at Pulaski Tech and NWA Community College toward retooling the work force in the areas of Energy Efficiency and Renewable Energy.
- The PSC's recent ruling striking "indemnity" language from the net metering interconnection contracts between renewable energy producers and the utilities, allowing

for public building owners, such as state and federal agencies, counties, municipalities and school districts to legally enter net metering interconnection contracts without unreasonable liability.

- Arkansas Energy Office grants for energy efficiency and renewable energy projects, start-ups, and economic development in the clean energy/clean tech sectors.

The Commission continues to examine a variety of issues relative to Alternative Energy and is aware that the State is moving forward to develop a state energy plan. This awareness influenced heavily the Commission's areas of study, and focused our research and reporting on issues prompted by the State Energy Plan Survey, (see appendices E), AEDC State Energy Plan Survey AAEC Response, dated February 29, 2012; as well as by expert testimony provided by the PSC, the AEO, the AEDC, the University of Arkansas Cooperative Extension Service, and expert testimony from individuals throughout the private sector.

The Commission wishes to extend our sincerest gratitude for their expertise in the areas of the emerging sectors for alternative energy, energy efficiency, renewable energy, and including compressed natural gas as an alternative transportation fuel source. We are of the conviction that alternative energy in the right amounts at the right times will assure a more secure energy future, create jobs, retain wealth, attract private investment, create economic development, and provide for a cleaner environment. All segments of our state must work together to educate and make this transition from the business-as-usual economy of the last century to the clean energy economy of this century with Arkansas leading the way.

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RECOMMENDATIONS from “Initial Report” dated 11-23-10

Since our ‘Initial Report’, the Commission has reexamined the two (2) previous recommendations for Enhanced Net Metering, and for a Feed-in Tariff. The Commission recommends for these two (2) previous recommendations again:

The Commission (re) recommends a revision to the Ark. Code Ann. 23-18-603(6)(b) (see appendices S) to increase generation capacity to not more than fifty kilowatts (50 kW) for residential use or three hundred kilowatts (300 kW) for any other use.

The Commission (re) recommends the state develop a Feed in Tariff.

The Commission (re) recognizes the need for the review of issues relating to alternative energy. Several such issues were identified and introduced in our ‘Initial Report’ as “Suggestions for Further Study”:

- Energy efficiency program objectives relating to cost effectiveness for planning and operational purposes. *In November of 2007, the first energy efficiency programs were introduced by the investor owned electric and natural gas utilities pursuant to the Rules for Conservation and Energy Efficiency Programs of the PSC. In July of 2009, the programs were renewed, and in July of 2010, the first comprehensive programs were introduced. Cost effectiveness has been a requirement since the adoption of the initial rules, and in July of 2011, the PSC adopted its Technical Resource Manual and established rules governing the evaluation, measurement, and verification process to examine the performance of all approved programs including consideration of the cost effectiveness of the existing, and any proposed programs. The cost effectiveness of the programs is a component of the PSC’s review of the programs proposed by the utilities. The PSC has provided guidance regarding comprehensiveness and cost effectiveness to the utilities and has ongoing proceedings to continue evaluation of those topics.*

- Loading order of efficiency relating to alternative and existing energy sources. *The AAEC has learned that Energy Efficiency is not a dispatch-able resource that can be “loaded” for the purposes of economic dispatch. However, Energy Efficiency can and does serve to reduce the amounts of capacity and energy that would otherwise be required, but for the presence of the energy efficiency programs and the associated energy savings.*
- Balancing energy efficiency with reliability, universality and affordability. *In July of 2011, the PSC established specific performance goals for the electric and natural gas energy efficiency and conservation programs. The utility performance relative to the Commission’s, goals is now a consideration in the PSC’s evaluation of existing programs and in its review and approval of proposed utility energy efficiency programs.*
- Economic disincentives currently faced by utilities when promoting energy efficiency. *In December 2010, the PSC authorized utilities to modify the energy efficiency cost recovery rider to include recovery of the lost contribution to fixed costs. Beginning in July of 2011, the energy efficiency cost recovery rider has included a component to recover the lost contribution to fixed costs due to declines in usage caused by the energy efficiency programs. This serves as a de-coupling mechanism that directly addresses the disincentive. Further, the PSC has also approved modifications to include recovery of incentives for utilities that meet and exceed the PSC’s goals, and recovery of those amounts began in November of 2012. Therefore, the disincentive issue has been addressed by the PSC.*
- Short-term and long-term rate recovery mechanisms for participating entities. *Since November 2007, each utility has recovered the costs of its energy program portfolio through the energy efficiency cost recovery rider which provides for the recovery of the program costs. Beginning in 2011, the PSC approved modifications to the energy efficiency cost recovery rider to also include recovery of the lost contribution to fixed costs and performance incentive payments. Therefore the recovery mechanisms have been established.*

- Coordinating energy efficiency efforts with non-utility efficiency programs. *Arkansas has seen the development of many energy efficiency programs such as the American Recovery and Retrofit Act (ARRA-stimulus funds), Qualified Energy Conservation Bonds (QECCB's), Community Development Block Grants (CDBG's) that went toward energy efficiency improvements on municipal buildings, at least one instance of the creation of a municipal revolving loan funds for funding energy efficiency improvements, and the Home Energy Assistance Loan (HEAL) Arkansas program.*
- Existing residential buildings codes for both rural and urban areas. *The Arkansas Energy Office (AEO) has been conducting Energy Code Workshops across the state to educate building professionals about the 2009 IECC that will likely be deployed in the summer of 2013. Arkansas will then join 32 other states with more stringent energy codes.*
- Manufacturer incentives to encourage adoption of energy efficiency measures. *Since November of 2007, a number of energy efficiency programs offered by the utilities specifically target manufacturers, as well as other commercial and industrial customers. A number of these larger consumers of energy have participated in these programs.*
- Consumer-based incentives, including low-interest revolving loans, rebates and tax incentives. *A number of energy efficiency programs approved by the PSC include rebates for energy efficiency measures. The AEO and ADFP are considering a statewide revolving loan fund as an alternative financing mechanism at lower interest rates for borrowers interested in pursuing energy efficiency measures.*
- On-bill Financing as a financial tool for cost-effective energy efficiency.
- General Disclosure Policies to ensure that consumers are fully informed as to the source of their energy.
- State Interconnection Policy Standards to encourage utility participation and ensure reliable energy resources from alternative and renewable energy producers. *There were specific*

federal interconnection standards adopted through the Public Utilities Regulatory Policy Act of 1978 (PURPA). Additionally, in 2002 the PSC adopted the rules for net metering which set interconnection standards for net metering facilities in Arkansas.

- Renewable Energy Access policies to examine the rights of both property owners and energy producers in relation to existing provisions of state and local governments, historic districts, and homeowner / property associations.

RECOMMENDATIONS from “Second Report” dated 12-09-12

The Commission recommends for the development of a State Energy Plan in 2013, as a basis for Arkansas to effectively participate in the alternative energy marketplace.

The Commission recommends that State Agencies, such as the Arkansas Public Service Commission (PSC), and the Arkansas Economic Development Commission’s (AEDC) Arkansas Energy Office (AE) support and encourage the combined development and implementation of cost effective Energy Efficiency programs and strategies; and continue efforts to mitigate the persistent barriers for Energy Efficiency investments.

- A reduction in energy consumption through conservation, and energy efficiency measures would liberate money in the economy that could be used for other purposes.
- Arkansas ranks 38th in the country in energy efficiency as scored by the American Council for an Energy Efficient Economy’s (ACEEE) 2011 scorecard for energy efficiency. Although the state is improving its ranking and is a leader in the Southeast region in energy efficiency, there continues to be potential for improvement in overall energy efficiency.
- The U.S. average residential energy consumption is approximately 920 kWh/mo. The Arkansas average is approximately 1107 kWh/mo. Arkansas is 20% higher than the national average. These are opportunities to improve upon the state’s average monthly residential energy consumption.
- The total expenditure on electricity in Arkansas was approximately \$3.5 billion in 2008.

Of that total, approximately \$1.6 billion was for residential customers. Therefore, a ten percent reduction would yield savings of approximately \$350 million overall and approximately \$160 million for residential customers. Likewise, a twenty percent reduction would yield approximately \$700 million overall and approximately \$320 million for residential customers.

The Commission recommends that the Arkansas Energy Office continue to develop and enhance Energy Conservation Building Codes.

- The Arkansas Energy Office (AEO) is currently hosting Energy Code Seminars across the state to educate building professionals about the 2009 IECC International Energy Conservation Codes to be deployed in 2014.
- Building Codes are consumer protection mechanisms and including Energy Codes.
- Building Codes protect the public welfare and safety.
- Building Codes protect the insurance and finance sectors from unnecessary loss of life or of real property due to negligence, or greed.
- Energy Codes ensure that the building owner is aware of the monthly operational costs in energy consumption to own and operate their building - similar to Miles Per Gallon (MPG) standards when buying a new car.
- 32 other states have more stringent Energy Codes than Arkansas.

The Commission recommends that the State develop alternative financing mechanisms to encourage energy efficiency and renewable energy retrofit projects.

1) Property Assessed Clean Energy (PACE)

- Would allow building owners to finance Energy Efficiency improvements at a lower interest rate.
- The participants repay the borrowed loan amount as a line item assessment thru their county assessor's office.

- The loan amount stays with the property, and does not follow the borrower in the event the property is sold or changes hands.
- Default rates are low, typically between 1 and 3 percent.
- The program is voluntary.
- The Real Estate, Finance and Insurance sectors should support PACE since it captures investment in real property through value added Energy Efficiency improvements, which translate into more value, higher resale, and higher commissions.

2) A Loan Loss Reserve to leverage the creation of a Statewide Revolving Loan Fund, (RLF).

The Commission recommends the creation of a statewide district to achieve more attractive bonding capacity to encourage investors, while achieving more attractive interest rates for potential borrowers.

The Commission recommends that these alternative financing mechanisms be centralized through a single state agency, or the Arkansas Development Finance Authority (ADFA). ADFA would be responsible for development, bonding, marketing, deployment, and defaults.

The Commission recommends that ADFA apply the Qualified Energy Conservation Bonds (QECCB) to create a Loan Loss Reserve to leverage the creation of a statewide Revolving Loan Fund as an alternative financing mechanism to encourage Energy Efficiency and Renewable Energy retrofit projects.

The Commission recommends that Arkansas develop and expand Bioenergy / Biofuel opportunities in Arkansas particularly given our abundant resources in agriculture and forestry.

The Commission recommends incentives and programs to encourage investments for:

- **Feedstocks, and Biomass feedstock supply chains;**
- **Biorefineries for producing Biofuels;**
- **Biopower for Stand-alone power, Co-firing;**
- **Co-generation; and biochar coproducts.**

- There are several commercial-scale bioenergy opportunities for Biorefineries, particularly for drop-in Biofuels; Biopower for co-firing; Co-generation; and Integrated Biorefineries, Combined Heat and Power (CHP) operations; as well as bioenergy and biochar coproducts.
- Action is needed for expanded efforts to attract Bioenergy projects and investment, and including a pilot Renewable Portfolio Standard (RPS) program.
- Arkansas needs an updated statewide feedstock assessment; Assessments of co-firing potential at Arkansas' four (4) coal-fired power plants; as well as support for farm-scale litter-to-heat-and-char systems.

The Commission recommends incentives and programs to encourage biomass and bioenergy production in Arkansas, particularly for converting low-value agricultural and forestry residuals into higher value energy products, as well as production of dedicated biomass energy crops.

- The Commission recommends support for biopower and biofuels production, as well as biothermal energy where feasible. Biopower options in Arkansas could include co-firing of biomass with coal at existing coal-fired power plants, stand-alone electrical generation from biomass, and combined heat and power (CHP), in which integration improves system efficiency. Biofuels options in Arkansas could include cellulosic ethanol or drop-in biofuels that are chemically the same as petroleum-derived liquid fuels; these biofuels could be made from a wide range of residues, purpose-grown energy crops, or even the biogenic fraction of municipal solid waste.
- Stand-alone electrical generation from biomass should be encouraged where feasible with an understanding that integration can improve efficiency significantly. If the cellulosic fermentation process is supported, then it should integrate with a host to improve efficiency, for example, the pulp and paper industry in Arkansas may be a good fit for lignin precipitation, and further processing into biomass fuels.

- Oil-seed for Arkansas may make sense if feedstock is grown on marginal land and can be contracted for a low cost.
- Gasification or catalytic pyrolysis makes sense long term, but capital costs must come down to improve returns.
- Combining biomass to coal or natural gas production of liquid drop-in fuels makes sense economically.
- Arkansas should move forward with these Bioenergy options, but state policy, incentives and programs are critical. There are several federal support programs that already exist.

The Commission recommends the State develop a comprehensive natural gas utilization plan as an alternative transportation fuel.

- Arkansas has an abundance of natural gas resources. Compressed natural gas (CNG) represents an Arkansas natural resource that can be used as viable transportation applications, thereby reducing reliance on imported petroleum-derived fuels. CNG represents significant economic opportunities for Arkansas. Using natural gas for transportation energy represents savings opportunities for consumers by mitigating rising petroleum-derived fuel costs and utilizing indigenous resources. In some applications, CNG lowers vehicle maintenance costs, increases the useful life of CNG vehicles, and is ideally suited for CNG fleet vehicles with high mileage demand.
- CNG conversions will improve air quality by lowering greenhouse gas (GHG) emissions by as much as 25% per CNG vehicle conversion. Therefore, CNG supports improved environmental air quality through reduced smog emissions.
- The utilization of indigenous natural gas for transportation energy supports Arkansas' energy security. The use of CNG would make Arkansas more energy self-sufficient, and insulate our state economy from the potential shocks of market, price or commodity volatility experienced with traditional petro-chemical products.
- Since natural gas is a domestic resource, the drilling, transport, and operations of end user distribution facilities would create long-term, high-wage jobs.

- The use of natural gas in transportation applications support the federal mandate for the United States to become energy independent, and reduce our dependence upon imported fuels. Equally, Arkansas has an opportunity to become more energy independent through the utilization of an instate resource, natural gas. This will encourage our own energy independence, and reduce our dependence upon imported fuels, and create more energy security for Arkansas.

The Commission recommends a focus on public access infrastructure projects along key transportation corridors and population centers.

The Commission recommends incentives to mitigate the capital investment barriers for CNG's entry into the market for transportation and distribution.

The Commission recommends direct incentives and programs to mitigate the capital investment barriers for the infrastructure requirements toward encouraging the conversion of government owned, high mileage fleet vehicles to CNG.

The Commission recommends incentives and programs to encourage individuals and business owners to convert their vehicles from traditional gasoline/diesel fuels to CNG.

The Commission recommends incentives to certified CNG vehicle converter/installers to mitigate costs of CNG vehicle conversions from traditional gasoline/diesel fuels.

The Commission recommends providing repayable funding strictly earmarked for CNG infrastructure projects to create demand and mitigate the capital investment barriers to CNG's entry into the market place.

The Commission recommends expansion of existing consumer education efforts and the expansion of current curriculum-based programs, as part of an overall mission to reduce

consumption, and promote career training & employment options in the field of alternative energy.

Suggestions for Further Study -- The Commission recognizes the need for the review of issues relating to alternative energy that may include the following:

Hydro and Microhydro

Geothermal

Combined Heat and Power

Waste to Energy

Measuring the jobs creation potential within each of the emerging sectors of Conservation Energy Efficiency, Renewable Energy.

Transition from coal-based to renewable / alternative energy resources

Gas-To-Liquid (GTL) and X-to-Liquid to create alternative transportation fuels.

Public / consumer, and curriculum-based education program

RECOMMENDATIONS from “Third Report” dated 01-08-15

The importance of the 2014 AAEC report is to help navigate the Arkansas General Assembly with keynote tools & conversations presently taking place and to ensure policy makers are well briefed on the scope of Arkansas resources & alternatives for Clean Energy America.

Renewable energy & alternative fuel sources have received greater attention throughout our state, since the establishment of the AAEC. Our work is far from finished and the AAEC hopes to serve as an asset to making Arkansas a regional leader in alternative fuels & a Renewable Energy State. All recommendations from the last five years have also been included to reflect the importance of our efforts. Refer to Study Presentations for full accounts of information.

The Commission wishes to further recommend bringing our Hydroelectric Power systems into the 21st century as one of the best opportunities we must increase our supply of Clean & Renewable Energy for generations to come. Arkansas has the 3rd Largest waterway system in America, has generated clean, affordable electricity for more than 100 years, but has yet to realize its full potential. **(See AAEC Study Summaries on page 25)**

The Commission recommends combined heat and power (co-generation) technology opportunities and further initiatives of these cost-effective options with proven returns on investments. **(See appendix DD)**

The Commission recommends support for cost-efficient Efficiency Codes & Incentives for consumer driven approach to create consumer, builder, and municipality involvement.

The Commission recommends support for initiatives like the Interfaith Power & Light.

RECOMMENDATIONS from “NO.4 REPORT” dated 12-08-16

Our continued Arkansan civic duty to serve as an asset for the 91st General Assembly, to help navigate the renewable portfolios, resources, technologies, emerging trends and research economic energy efficient alternative fuel sources. Arkansas Alternative Energy Commission would like to thank all those that donated their time, money and efforts to continuing to help inform our state of these ever-changing innovative alternatives. The AAEC has strived to making Arkansas a regional leader in alternative fuels and a Renewable Energy State leader. Since 2009, the ACEEE score for Arkansas was 48; today our 2016 score is 27. We feel a great sense of pride to know we have helped play an informative commitment to extend our energy efficiency goals in accomplishing this landmark growth performance. All recommendations from the last 7 years have been included to reflect the importance of our efforts. Refer to Study Presentations/Summaries for full accounts of presentations. The following are AAEC recommendation findings:

The Commission wishes to again recommend bringing our Hydroelectric Power systems into the 21st century as one of the best opportunities to increase infrastructure, economic growth, job creation and our supply of Clean & Renewable Energy for generations to come. Arkansas has the 3rd Largest waterway system in America, has generated clean, affordable electricity for more than 100 years, but has yet to be tapped for its full potential. (See AAEC Study Summaries on 05.23.13, 08.09.13, 03.20.14, 06.19.14 and 12.10.2015)

The Commission recommends that hydropower, hydroelectricity and/or any energy derived from the use of water be considered as an alternative fuel and renewable energy source.

The Commission recommends that the Arkansas Department of Environmental Quality develop a state implementation plan for the Clean Power Plan, if the Supreme Court and/or Trump EPA does not modify the plan to significantly reduce its potential impact on Arkansans. The AAEC would like to be an asset in the stakeholder process. (See AAEC Study Summaries on 03.27.09, 04.14.11, 06.16.16)

The Commission recommends the support & suggest a Survey of the Speaker of the House, Senate Pro tempore, Governor, Attorney General, Mayoral and County associations, as well as the public to gain input on creating community driven renewable energy plans. A focus on strategic planning to determine the impediments to alternative energy, policies that may be in the way of innovation and what proposed legislation and/or changes are needed to remove those impediments-making sure policy does what it needs to do, not slow it down. A focus on attention to transportation components, such as reinvigorating the gaseous fuels program, removing the impediments to electric vehicles, and any assistance necessary to make energy efficiency more affordable by liberating money in the economy that could be used for other purposes or tax cuts. Goal of this recommendation is to

“bridge the gap” by connecting Commissions, Committees, Agencies and policies to create our State Energy Plan submission for the CPP.

The Commission recommends the AAEC be considered for appropriations to search and solicit expertise and benchmarks in other states, for website maintenance, mileage for Commissioner expenses, specialized speaker’s presentations, and Alternative Energy conference attendance.

The Commission recommends the AAEC continue to be an asset to the Administration and General Assembly for future years to come with the amendment of the Sunset Clause. We ask that the 91st General Assembly reconsider the expiration date of September 30, 2017. (See AAEC Study Summaries on 06.16.16)

The Commission recommends solar as an Arkansas renewable resource. Arkansas is an ideal state to investigate policies and incentives for solar generation. New solar can come from utility-scale solar selling directly to the power markets or with negotiated terms in a power purchase agreement with willing utilities, or for smaller-scale solar, through appropriate net metering implementation (See AAEC Study Summaries on 11.19.15, 07.28.16, 08.25.16)

The Commission does not recommend the conversion of the Arkansas state fleet of 9,000+ vehicles to CNG because they do not have a centralized fleet maintenance system, only 6 CNG fueling stations across Arkansas and no benefit for mass conversions nor is there supporting evidence at this time. The Commission does recommend better efficiency in the state fleet might be achieved by setting reimbursement rates for vehicle maintenance and through more reporting. (See AAEC Study Summaries on 08.16.12, 02.18.16, 07.28.16)

The Commission recommends educational awareness of recycling programs available in every Arkansas school programs, counties and communities.

The Commission recommends Nuclear spent fuel as an alternative energy and fuel source. Pursuant to the duties set forth in the enabling legislation, more specifically §15-19-802 (1) (F) “Other energy sources identified by the commission”; and (2) The effects of the use of alternative energy sources on the economic development of the state.

Preamble:

TO have a safe, continuous, reliable, sustainable, efficient, economically competitive and hydro-carbon free electric power source, and;

TO rectify the existing nuclear spent fuel waste inventory that has accumulated at Arkansas Nuclear One reactor site, and;

TO develop the Arkansas economy by having the modular reactor and reprocessing manufacturing facilities located in Arkansas, and by having a world class nuclear training center with all the associative development located in Arkansas;

The AAEC hereby approves the following resolution:

- a) **The Commission finds that a Generation IV liquid sodium fast reactor using reprocessed metal fuel has been identified and is declared an alternative energy source.**
- b) **The AAEC recommends to the Governor’s office, the Arkansas Legislature, and the Arkansas Attorney General’s office that the appropriate resolutions be passed, resources allocated, and support given to the University of Arkansas System to investigate and document recommendations for a plan to development the nuclear spent fuel opportunity. (See AAEC Study Summaries on 12.8.16, see appendices UU)**

The Commission recommends exploring more on the following issues

- **Distributed Generation**
- **Possibility of new transportation innovations such as electric cars and rail for public transportation**
- **Look at other states’ alternative energy plan and what their future holds**
- **Consider when CNG vehicles can be ordered from USA manufacturers**
- **AAEC needs of expert economist for research on realistic definitive outcomes for feasibility studies and implementations.**
- **Comparison of Solar and Wind location specific implementation**
- **Nuclear Energy and its future for Arkansas**
- **Carbon Footprint Reductions**
- **Biomass and Wood Energy**
- **CNG Conversion update**
- **Combined Heat & Power**
- **Micro hydro**
- **Battery Storage Technology**

Background - How the Commission arrived at the “Topics for Consideration”

The Commission learned from Mr. Chris Benson, Energy Advisor, to the Arkansas Economic Development Commission, that the Governor was pursuing a State Energy Plan. Mr. Benson stated that, “This plan is not a comprehensive plan, but a loose collection of strategies to guide the State’s decisions as it transitions to a sustainable economy.” Coincidentally, the Commission had previously identified 24 items as “Issues to Address,” and discovered that they fell into four (4) discrete categories for: Energy Efficiency, Renewable Energy, Transportation, and as they might affect Finance & Budget. The Commission identified these recommendations as our ‘**Alternative Energy Plan**’ in order to co-exist with the Governor’s State Energy Plan. This ‘Alternative Energy Plan’ would serve as the overarching umbrella, or main theme that the

four (4) sub-categories would fall under. Energy Efficiency was the 1st sub-category identified and studied, given its least up-front cost, least complexity, which therefore ensures the best rates of return on investment, and shortest payback. The Commission identified and ranked specific mechanisms or policy pieces for each of the four (4) main sub-categories as follows:

Energy Efficiency:

- 1) Create a Statewide Energy Efficiency Program, such as:
 - Loan Loss Reserve toward leveraging a Revolving Loan Fund
 - PACE – Property Assessed Clean Energy
- 2) Adopt enhanced Arkansas Energy Codes
- 3) General Disclosure Policy
- 4) Public Benefits for Energy Efficiency
- 5) Sales Tax Incentives for Energy Efficiency Equipment (this would also fall under the 4th category for Finance/Budget).
- 6) Consumer-based incentives, such as utility rebates, state and federal tax credits. Since November of 2007, the PSC approved several energy efficiency programs, which include rebates for energy efficiency measures. In July of 2011, the Commission established performance goals for energy efficiency program portfolios of the jurisdictional utilities in Arkansas.

Renewable Energy:

- 1) Sales Tax Incentives for Renewable Energy Equipment (this would also fall under the 4th category for Finance/Budget).
- 2) Interconnection policy standards were provided for renewable energy resources that were designated as qualifying facilities pursuant to PURPA in 1978.
- 3) Expansion of current PSC rules for net metering, to include interconnection standards for net metering facilities in Arkansas.
- 4) Renewable Energy Access Policies
- 5) Feed-in Tariff and/or a Renewable Energy Portfolio Standard (RPS)
- 6) Transition options that will move Arkansas from coal-based to renewable-power resources

AAEC STUDY PRESENTATIONS

1) 2011 Legislation of Possible Interest to Alternative Energy Commission, 2011 Legislative Review, Representative Kathy Webb, 07/14/11.....	30
2) Strategic Energy Planning for Arkansas, Status Report, Chris Benson, AEDC Energy Policy Advisor, 10/20/11.....	30
3) Building Energy Codes for Greater Efficiency, Commissioner Lolley, Executive Director, Treadwell Institute, 10/20/11.....	32
4) Report Subcommittee, “Issues to Address,” Commissioner Allen, 10/20/11.....	32
5) Handout C – Topics offered for 2012 studies, 12/15/11.....	34
6) Report-out, State Energy Plan Meeting with Governor Mike Beebe, Chairman Hauser, Commissioner Lolley, 01/13/12.....	34
7) Bioenergy Opportunities in Arkansas, Jim Wimberly, Bioenergy Systems, LLC, 02/02/12.....	35
8) “State Energy Plan Survey,” UALR’s Institute for Economic Advancement Questionnaire, Commission Response, 02/29/12.....	39
9) Building Codes and Loan Funds, Scott Hamilton, Director, Arkansas Energy Office, 04/19/12.....	39
10)Un-Encumbered Wealth: Liberating Money to Stimulate the Economy and Create Jobs, Michele Halsell, Managing Director, Applied Sustainability Center, UofA Sam M. Walton College of Business, 04/19/12.....	40
11)Property Assessed Clean Energy (PACE), Mark Roberston, MESA, 04/19/12.	44
12)Report-out to Commission, Stakeholder Meeting at Arkansas Energy Office, Chairman Hauser, Commissioner Lolley, 05/24/12.....	46
13)Dynamic Fuels: Conversion of Fats, Oils & Greases Into Fuel, Andy Rojas, Vice President of Renewable Energy, Tyson, 06/21/12.....	47
14)Energy Alternatives for Arkansas, Ben Thorp, Vice President Board Chairman, Bioenergy Deployment Consortium (BDC), 06/21/12.....	49

15)Renewable Energy Portfolio Standards, The Big Picture, Kristin Higgins,
UofA Division of Agriculture, Public Policy Center, 06/21/12..... 53

16)Compressed Natural Gas as a Motor Vehicle Fuel, Michael Gallup,
Transportation Manager, SWN, 08/16/12..... 55

17)Home Energy Performance: The Fifth Fuel, Matt Bell, Viridian, 10/18/12... 56

18)Apprenticeship: Going Green, Karen Breashears, President,
National Training Program (NAPT), 10/18/12..... 58

19) Legislative Overview: Representative Sabin and Representative Hutchinson,
05/23/13..... 58

20)Hydropower: Gene Higginbotham, Executive Director, Arkansas Waterways
Commission, 05/23/13..... 60

21) Basic Hydro Concepts, Federal Hydro System in AR, Hydro Opportunities at COE and
Other Facilities: Lee A. Beverly, Project Manager, US Army Corps of Engineers,
05/23/13..... 61

22) Small Hydro/Hydro Kinetics: Mark Lassman, Director of Energy Trading, Free Flow
Power Corp., Boston, MA/Tulsa, OK, 05/23/13..... 62

23) Hydropower Regulatory Efficiency Act of 2013, 08/09/13..... 63

24) Status on Enhanced Energy Code: JD Lowery, Policy and Sustainable Energy Manager,
Arkansas Energy Office, AEDC, 09/19/13..... 64

25) “AAEA Overview, Issues and Initiatives,” Mr. Steve Patterson, Executive Director,
Arkansas Advanced Energy Association, 11/21/13..... 66

26) Mission and Projects: Arkansas Chapter of Interfaith Power and Light, Ms. Scharmell
Roussel, Executive Director & Rev. Steve Copley, Chairman, 03/20/14..... 67

27) Hydroelectric activity/potential within the United States and Arkansas: Jeff Leahey,
Esq., Deputy Executive Director, National Hydro Association, 03/20/14..... 69

28) Co-generation Initiatives—Arkansas Opportunities: Tom Howard, Domtar Corporation,
06/19/14..... 70

29) Murray Lock and Dam Tour – Aaron K. McGee, U.S. Army Corps of Engineers,
06/19/14..... 70

30) Representative John Hutchison, 09/18/2014..... 71

31) Review Status of State Energy Plan: JD Lowery, Director, Arkansas Energy Office,
Arkansas Department of Economic Development, 10/20/14..... 72

32) Impact of Current Regulations on Electrical Generating Facilities: Andrew Lachowsky,
Arkansas Alternative Energy Commission, Commissioner, 10/22/2015 73

33) Clean Power Plan: Arkansas Attorney General Leslie Rutledge, 11/19/2015..... 74

34) Integrated Building Technologies: Mr. David Dodge, Arkansas Alternative Energy
Commission, Commissioner, 11/19/2015 75

35) Hydroelectric Power Generation: Gene Higginbotham, Director, Arkansas Waterways
Commission, 12/10/2015..... 76

36) Update on Arkansas Public Service Commission Initiatives, John Bethel, Executive
Director, Arkansas Public Service Commission, 12/10/2015 76

37) Review of Arkansas Energy Office Plans: Mitchell Simpson, Director, Arkansas Energy
Office, Arkansas Economic Development Commission, 12/10/2015 77

38) Examples of Alt. Energy Concepts and Projects in Arkansas: Stuart Spencer, Deputy
Director of Air Quality, AR Dept of Environmental Quality, 02/18/2016 78

39) Act 2 of the Third Extraordinary Session 2016 Discussion: Michael Feehan, Legislative
Attorney, Bureau of Legislative Research, 06/16/2016..... 81

40) Arkansas Real Clean Energy Economy: Frank Kelly, Solar Source Consulting,
07/28/2016 83

41) State Fleet Management: Jake Bleed, Office of Administrative Services, Arkansas
Department of Finance and Administration, 07/28/2016 84

42) Metal Roofing with Solar: Ken Gieseke, McElroy Solar, 08/25/2016 85

43) Building a Better Tomorrow: Peter Rienks, Innovateus Solar, 08/25/2016 85

44) How to Reduce Carbon Dioxide Pollution, Create Jobs, Grow the Economy & Improve
Health: Robert McAfee, Arkansas Citizens Climate Lobby, 08/25/2016 86

45) American Electric Power – Southwestern Electric Power Company’s Approach to
Renewable Modeling: Scott Fisher, Resource Planning Manager, American Electric
Power, 09/29/2016 88

46) Green and Sustainable in the Future: Don Curran and Cherie O'Mary, Executive Director, Arkansas Recycling Coalition, 10/27/2016	90
47) Is it Waste or Fuel?: John Warmack, 12/08/2016	91

AAEC STUDY SUMMARIES

All summaries are comprised of materials supplied by presenters & have not been edited.

July 14, 2011 -- 2011 Legislation of Possible Interest to Alternative Energy

Commission, Legislative Review, Representative Kathy Webb (see appendices B).

Representative Kathy Webb graciously presented a spreadsheet listing pertinent Legislation that had been introduced to Joint Energy, and Insurance and Commerce Committees during the 2011 General Assembly. Many of these legislative items were clearly within the purview of the Alternative Energy Commissions responsibility; to study the needs and impacts of various forms of alternative energy on the economic future of Arkansas. These Senate and/or House Bills were either passed into Acts, died at Sine Die adjournment, or moved into Interim Study. To find current status for all Bills/Acts that were introduced, go to the General Assembly's Website, www.arkleg.state.ar.us.

October 20, 2011 – Strategic Energy Planning for Arkansas, Status Report, Chris Benson, AEDC Energy Policy Advisor (see appendices C).

Devise a strategic energy framework for advancing the Governor's energy policy goals. The framework is not a comprehensive state energy plan for meeting the State's energy needs, rather a collection of strategies that will help to guide the State's decisions as it transitions to a sustainable economy. The framework will be supported by a series of initiatives and actions that are realistic, measureable and actionable that the State can use to accomplish its objectives.

Strategic Energy Objectives

Develop *Clean* and *Secure* sources of energy to *meet* future energy demand. Participate in the

clean energy market economy to encourage *jobs creation* and *private investment*. Introduce *Sustainable Initiatives* around: *Competitiveness; Environmental Preservation; National and State Security; Economic Growth; Reduced Costs; Innovation; and Jobs*.

Where do we go from here?

Identify strategies that advance the Governor's energy priorities. Identify stakeholders in the state who have a role to play in each of these strategies. Identify barriers to implementing the strategies. Identify initiatives that address the barriers. Select initiatives that represent the best consensus solutions for reaching objectives. Measure, verify and evaluate!!!

Strategies

Encourage the adoption of energy efficiency practices and technologies. Develop alternative transportation fuels and vehicles. Pursue sustainable policies that create jobs and investments. Encourage the development of clean electric generation.

Barriers

High up front cost for energy efficiency and renewable energy systems. Transmission access is a potential limiting factor for EE/RE. Interconnection to the utility grid is a disincentive for renewable energy and cogeneration projects. Transaction costs are high for renewable and EE projects. Lack of a skilled work force to meet market demand requirements for EE and RE services. Difficulty in measuring and evaluating EE, results in perception of high risk by financial community. The supply-demand chain that supports advanced biofuels and biopower development is not well developed. Alternative fuel vehicles lack infrastructure for refueling. Split incentives between participants, and lower their interest. Transfer of ownership before investment is recovered. Low consumer awareness/knowledge leads to poor purchase and operational decisions. Utility revenue structures provide little incentive to promote energy efficiency. Lower income consumers spend a disproportionate amount of their income on energy bills.

Strategic Challenges

Arkansas lacks coordinated policies to promote alternative energy strategies; Arkansas has an energy or resource intensive economy; Arkansas imports a large share of its annual energy requirements; Arkansas has limited resources for public investment in energy programs; Many

consumers and policy makers in Arkansas lack awareness of important aspects of energy and its issues.

October 20, 2011 -- Building Energy Codes for Greater Efficiency, Commissioner Lolley, Executive Director, Treadwell Institute (see appendices D).

Building Codes, and including Energy Codes are consumer protection mechanisms. History tells us that the insurance sector was a driving force behind the original building codes in the late 19th and early 20th centuries in this country. Building Codes were in direct response to tragic events like the Chicago Fire. They were designed to protect and prevent loss-of-life, and loss-of-real-property from future tragic events. Similarly, the finance sector, banks, could be relied upon to support the adoption of more stringent Energy Codes. Why? Protect the homeowner and their investment by controlling the monthly operating costs in energy consumption. By ensuring that they are not throwing good money after bad, banks ensure that the home owner can more reliably meet their monthly mortgage obligation. Enhanced energy codes will add negligible costs the purchase of a new home, but will not price certain people out of the market as some who argue against Energy Codes would have us believe. In fact, enhanced energy codes save the consumer money, lots of money in the costs to own and operate their new home over the length of the average mortgage. Therefore, the economic case is overwhelmingly in favor of enhanced building energy codes.

By advancing Arkansas' State Energy Code to meet or exceed 2009 IECC would allow Arkansas to join 32 other states with more stringent Energy Codes.

October 20, 2011 – Report Subcommittee – “Issues to Address,” Forwarded at the Request of Commissioner Allen.

A summary list of “Issues to Address” that the Commission may wish to study. Starting where we left-off with the section in the 11/23/10 “Initial Report” that points out where Arkansas lags in comparison to other states, and the section of “Suggestions for Further Study.”

- 1) An energy efficiency program for Arkansas.

- 2) Renewable Energy Portfolio Standards (RPS)
- 3) A State Energy Plan
- 4) Compressed Natural Gas (CNG) as “alternative” transportation fuel for motor vehicles
- 5) Arkansas Energy Code
- 6) Identify Persistent Gaps and Barriers to current Arkansas Energy Programs
- 7) General Disclosure Policy
- 8) Public Benefits Funds for Energy Efficiency
- 9) Sales Tax Incentives for Renewable Energy
- 10) Sales Tax Incentives for Energy Efficiency
- 11) Property Tax Incentives for Renewable Energy
- 12) Property Assessed Clean Energy (PACE)
- 13) Loading Order of Efficiency Relating to Alternative and Existing Energy Sources
- 14) Balance Energy Efficiency with Reliability, Universality and Affordability
- 15) Economic Disincentives Currently Faced by Utilities for Promoting Energy Efficiency
- 16) Short and Long Term Recovery Mechanisms for Participating Entities
- 17) Coordinating Energy Efficiency Efforts with Non-Utility Energy Efficiency Programs
- 18) Existing Residential Building Codes for both Rural and Urban Areas
- 19) Manufacturer Incentives to Encourage Adoption of Energy Efficiency Measures
- 20) Consumer Based Incentives
- 21) On-bill Financing as a Tool for Cost Effective Energy Efficiency
- 22) State Interconnection Policy Standards
- 23) Renewable Energy Access Policies
- 24) Feed In-Tariff (added at the request of Commissioner Kindberg)

Next Steps: Attempt to prioritize this "laundry list" into a workable few issues to study.

October 26, 2011 -- U.S. Energy Information Administration, (EIA), Arkansas Energy Fact Sheet, forwarded at the request of Commissioner Moreland (see appendices E).

December 15, 2011 -- Handout C (Revised), Topics offered for consideration by the AAEC as subject matter for 2012 studies:

Renewable Energy Plan -- The plan should support the generation of alternative energy through utilization of renewable energy sources. The sources of energy, including alternative energy, should represent fuels that are reliable, available and affordable with regards to power generation. Co-generation should be a major consideration when choosing fuels and generating facility sites. Issues appearing on the "issues list" include items 9,11,22 and 23.

Renewable Energy Portfolio Standards -- The study of renewable energy portfolio standards should keenly focus on the successes and failures of other states that have already implemented such standards and examine this information against REFIT actions taken by other states. . Item 13 is included under this heading from the "issues list".

Energy Efficiency Plan -- The study of an energy efficiency plan should include the efficient utilization and generation of energy. The effective generation of energy is often left out of energy plans but is a key part of the equation of reducing the demand on fuels. The plan should also support the Governor's current energy objectives. Issues falling under this heading include items 1,3,5,6,8,10,14,15,16,17,18,19,20 and 21.

Natural Gas Utilization -- Use of natural gas should be studied with uses including vehicles and commercial and industrial facilities. Natural gas is a clean burning and efficient fuel. Natural gas is also currently a cost competitive fuel especially when assuming utilization by a new generating facility. The study should focus on the long-term availability of this fuel source. This information has been compiled for the utilization by the Arkansas Alternative Energy Commission AAEC Issues Committee.

January 13, 2012 -- Report-out to Commission, State Energy Plan Stakeholder Meeting with Governor Beebe, Chairman Hauser, and Commissioner Lolley.

The Commission was identified as a stakeholder by Governor Mike Beebe, and participated in a

meeting with him and his energy policy team on January 13, 2012. Chairman Hauser shared general themes regarding the development of Arkansas' first State Energy Plan. The Governor outlined his "all cards on the table" approach to the State Energy Plan development process; and his desire that stakeholders address current and future Energy Mix needs in Arkansas. Also present in the meeting was Commissioner Lolley, representing Treadwell Institute, Linda Smith, representing the U.S. Green Building Council, Ellen Fennel, representing Audubon Arkansas, and two members representing the Nature Conservancy. Governor Beebe's remarks reflected his depth of knowledge on the complex subjects of energy, energy efficiency, renewable energy, and bio energy potential for Arkansas; and were complimented by his acumen regarding the role and value of coal, natural gas and nuclear energy.

Chairman Hauser encouraged the Governor's support for more consumer-based education; and the opportunity to integrate school-based curriculums focusing on alternative energy, as part of the State' effort to create 21st century economic opportunities.

Commissioner Lolley respectfully requested that the Governor incorporate the return-on-investment opportunity of Energy Efficiency as part of his energy policy efforts. Commissioner Lolley also noted that energy efficiency is a very viable new economic development tool; causing monies not exported out of state for the purchase of wasted energy to be retained and re-invested in the local economies.

February 02, 2012 -- Bioenergy Opportunities in Arkansas, Jim Wimberly, President, BioEnergy Systems, LLC (see appendices F).

An Overview of Bioenergy Options & Opportunities in Arkansas -- Summary: Bioenergy is good for Arkansas. Bioenergy has environmental benefits; economic benefits; benefits for Arkansas' businesses; and benefits for the State.

Bioenergy can be good for Arkansas, but, bioenergy is not easy...

Bioenergy has numerous logistical challenges: biomass feedstock supply chains are complicated; the economics are, generally, not attractive...; biofuels cannot currently compete with petro-derived fuels without support programs such as the RFS2; biopower cannot currently compete with power from coal or NG.

But, current conditions are expected to change, and we should move forward now with these energy options. Public policies are critical, and several federal support programs already exist. To pursue commercial-scale deployment, we need to understand the details of bioenergy options and opportunities to make informed decisions about public policies that stimulate (or constrain) commercial deployment.

Bioenergy Terminology:

Feedstocks - Plant, or animal-derived material converted in value-added products. Examples: woody biomass, such as in-forest residues (IFR), ag-field residues, dedicated energy crops, and chicken litter.

Biomass feedstock supply chain - All the activities associated with delivery of biomass, such as crop establishment, production & harvesting, storage & transportation, and pre-processing.

Biofuels - Liquid transportation fuels made from biomass, such as drop-in fuels, cellulosic ethanol, and renewable diesel (different from oil-derived biodiesel).

First generation biofuels are produced at a biorefinery. Facility size and production is typically measured in millions of gallons per year, (MGY), from Corn-derived ethanol, and soy-derived biodiesel. The average cellulosic biorefinery size is equal to 40 MGY per year.

Biopower - Electricity from biomass. Biopower facilities are more suitable for base-load (like coal), and include types of facilities, such as a Stand-alone power plant, a dedicated biomass-to-electricity generating facility, and Co-firing, (biomass fuel is used to displace a fraction of coal), “Combined heat and power” (CHP), and Co-generation (“co-gen”) which is thermal energy + electricity. Most large forest products manufacturing facilities in Arkansas already have a CHP system.

Biorefineries - The primary driving factor is RFS2, or policy. To produce 12 Billion Gallons per year (BGY), would take at least 200 new biorefineries, or an average of 4 per state. But, given Arkansas’ resource base, we should be above average.

So, how many should we plan for?

One biorefinery... Imagine a hybrid paper mill and small oil refinery - Biomass feedstocks needed ~ 500,000 dry tons / year. On average, ~ 2/3rds will come from dedicated energy crops;

the balance from woody/ag residues; Capital cost: ~ \$270,000,000; Revenues from product sales: ~ \$120,000,000 per year; Jobs created: ~ 960 (direct) for 30 years.

How might Arkansas pursue biorefineries?

First, understand that we are competing with every neighboring state. Biorefineries have been initiated in MO, TN, MS, LA, TX, OK, & KS. Understand that project developers seek to reduce project risks. They need to reduce uncertainties regarding feedstock supply chains. Therefore, Arkansas needs an updated biomass resource assessment. The research community needs help addressing key issues.

Developers cannot move forward without project financing. How can we help them secure project financing? Developers need to know who to contact within the State. There needs to be more coordination between state agencies and the private sector. A new report from Winrock will shed more light on the economics of a hypothetical biorefinery in northeast Arkansas, due out by early March, 2013.

Biopower

There are several types of biopower facilities: A Stand-alone power plant, which is a dedicated biomass-to-electricity generating facility; Co-firing, where biomass fuel is used to displace a fraction of coal and still maintain same capacity and power generation; “Combined Heat & Power (CHP), and Co-generation (“co-gen”) which is thermal energy + electricity.

Co-firing

There are currently 4 coal-fired power plants in Arkansas with a total installed capacity = 4,600 MW and a typical capacity factor (CF) = 83%, or $4,600 \text{ MW} \times 8760 \text{ hours/year} \times 83\% = 33,500,000 \text{ MWh/yr} \sim 1,200 \text{ train loads of coal per year}$.

Now let us look at a 2% biomass co-firing rate at all 4 facilities... This equates to ~100 MW of biopower, requiring ~750,000 tons/year of biomass, displacing ~25 train-loads per year with home-grown fuel with a value of home-grown fuel: ~\$35,000,000 and job creation: ~200 (direct) for 30 years.

But, we need more details regarding co-firing options:

Understand that co-firing capabilities are specific to each site, and therefore the ability to co-fire will vary from one power plant to another. An assessment is needed for each of the 4 sites to evaluate the technical options: What co-firing levels could that particular boiler accommodate? What are the on-site logistics & other technical considerations? Also, evaluating the potential feedstock supplies: What types of feedstocks would be available for that site? How might a feedstock supply chain be established for that site? Need to evaluate the potential economics for: Capital costs; Operating costs; Potential rate impacts (at various target co-firing levels); and for determining potential job creation.

Co-firing...how might we pursue for AR?

First, undertake assessments to determine co-firing options. Coordinate between the key parties, e.g.: At the state level: AAEC, AEDC, APSC, ADEQ. With the various utilities that own/operate the generating facilities; Consider a pilot renewable power program, such as an RPS = Renewable Portfolio Standard which amounts to a state-level program requiring a fixed % of all electricity to be generated from renewables. 33 states already have some type of RPS in place and several others are considering an RPS or a pilot program approach. Look at what has recently been done in LA and other nearby states.

Combined-heat-and-char

Uses chicken litter as fuel. Generates thermal energy to displace propane for space heating. Also, produces biochar, a valuable byproduct. It is a farm-based renewable energy system. After 20 years of R&D, the technology is now available and has multiple benefits, such as economic benefits to broiler producers, economic benefits from Arkansas-based manufacturing, water quality benefits (from avoided land application of litter), and displacement of fossil fuels with renewable biomass.

What's needed to move this forward?

Support for a full-scale on-farm test & demonstration, and support (to UA) for evaluations of using biochar, which will be essential for development of biochar markets.

In summary

There are several commercial-scale bioenergy opportunities for: Biorefineries – particularly for drop-in fuels; Biopower via co-firing; Integrated biorefinery and CHP operation; as well as

combined heat-and-char.

Action is needed for: Expanded efforts to attract bioenergy projects, and including a pilot RPS program; An updated statewide feedstock assessment; Assessments of co-firing potential at AR's 4 coal-fired power plants; as well as support for farm-scale litter-to-heat-and-char systems.

February 29, 2012 -- "State Energy Plan Survey," UALR's Institute for Economic Advancement Questionnaire, and Commission Response (see appendices G).

April 19, 2012 -- 2011 Arkansas Energy Code, Scott Hamilton, Director, Arkansas Energy Office (see appendices H).

Three (3) Primary Components for the current Arkansas Energy Code:

- 1) **Commercial:** ASHRAE 90.1-2007 (Effective January 1, 2013), updated January 2011.
- 2) **Residential:** IECC 2003-revising to 2009 IECC
- 3) **Supplements and Amendments**

The 2009 International Energy Conservation Code (IECC) Residential Energy Standard will be adopted in first quarter of 2014.

Some key differences from 2003 IECC are: Mandatory duct pressure testing, maximum leakage rates; Requirement that 50% of lamps must be energy efficient; Consolidation of zones; Improvements to basic envelope requirements; Includes optional blower door, building pressure test; and High Efficiency equipment/insulation tradeoffs.

Energy Efficiency Financing:

Currently the Arkansas Energy Office and Arkansas Development Finance Authority are evaluating a potential Residential/Small Commercial Energy Efficient Upgrade Loan Program. They are looking at one potential funding source through Qualified Energy Conservation Bond (QECCB) in particular: QECCB's are one of the lowest cost public financing tools issued by the Department of Treasury. QECCB's are designed to fund many types of energy conservation projects. AEO and ADFA are working together to explore programs and projects to utilize

QECCB funding.

Currently there are not any reasonable financing options available to residents. Arkansans need some sort of low interest – extended terms to allow for the energy cost savings to offset finance payments. The outcomes from these types of financing options would result in: Lower energy demand from suppliers (utilities); Create highly favorable State sponsored programs; Could serve as a model for utilities and co-ops toward adoption; and would result in improvements to Arkansans quality of life.

April 19, 2012 -- Un-Encumbered Wealth: Liberating Money to Stimulate the Economy and Create Jobs, Michele Halsell, Managing Director, Applied Sustainability Center, UofA Sam M. Walton College of Business (see appendices I).

Sustainability & Economic Prosperity

The Applied Sustainability Center (ASC) views sustainability as a pathway to enhanced economic prosperity, while simultaneously safeguarding our environment, and promoting the health and well-being of all Arkansans. We are taking a page from Walmart’s playbook.

It’s simple: Energy costs money. When you save energy, you save money.

Encumbered Wealth

There is a significant amount of money in our economy that is encumbered for utility costs: In Business and Industry; in City, County; and State Government; in Schools, Churches; Non-profits, as well as in Homes.

How much money?

Total Energy \$\$ Spent in 2008: In the U.S. ~\$363,649,643,000 (1/3 of a Trillion dollars). In Arkansas ~\$3,506,799,000. Commercial & Industrial Energy \$ Spent 2008: In the U.S. ~\$208,216,609,000. In Arkansas ~ \$1,893,991,000. Residential Energy \$\$ Spent in 2008: In the U.S. ~\$155,427,208,934. In Arkansas ~\$1,612,820,386. Fayetteville ~\$26,782,507.

Hypothesis:

A reduction in energy consumption through conservation, and energy efficiency measures would free-up, or liberate money in the economy that could be used for other purposes. This would

have a positive impact on local and state economies through: Saving jobs; Increasing disposable income; Increasing sales tax collections; Reducing foreclosures; Preventing loss of equity in residential real estate markets; as well as Creating new jobs.

Saving Jobs

Through reduced operating costs for businesses, schools, churches, and government offices. The savings can be significant. For example: U of A is saving 30% on its annual \$10 million budget for utilities. How many jobs does a \$3 million reduction in energy costs save?

Reducing Foreclosures & Preserving Real Estate Equity

By reducing the cost of homeownership, we are making home ownership (and operation) more affordable. For example: Sonoma, California's energy improvement district (EID) allowed homeowners to make energy efficiency improvements in their homes, reducing their utility bills. The result: Sonoma had a lower incidence of home foreclosures during the mortgage crisis, preserving the equity of ALL homeowners.

Increase Disposable Income

Through reduced utility expenses, translates in an increase in disposable income. Lower energy costs cause other forms of consumer spending, such as dining-out, or discretionary purchasing, to increase. For example: N. Charleston, SC – energy efficiency for low income families has resulted in an average annual savings of \$1,500 on utility bills. These families have pent up demand, and spent their \$1,500 at local stores and businesses, helping to boost the local economy. Every \$1 saved on utilities has > \$1 impact on the local economy due to a multiplier effect.

Sales Tax Collections

When people reduce their utility bills, their disposable incomes increase. When people spend their added disposable income in their local economy, they help local businesses increase sales and stay healthy, and avoid layoffs. When businesses increase sales, the city and county collect additional sales tax.

What is the size of the opportunity?

The U.S. Department of Energy estimates that energy efficiency could meet up to 50% of the future energy needs of this country. The U.S. has potential to reduce energy use by 23% by

2020, (Granade, HC, Creyts, J, Derkach, A, Farese, P, Nyquist, S, & Ostrowski, K, 2009, “Unlocking Energy Efficiency in the US Economy.”) What that tells me is that we are currently wasting a lot of energy and, therefore, the opportunity is significant! Per the ACEEE 2010 scorecard for energy efficiency, Arkansas ranks 41 in the country. This is the 11th – highest energy consumption per real dollar of GDP in the country. This indicates significant energy intensity, and a significant potential for improvement in overall energy efficiency.

Residential Energy Consumption

U.S. average = 920 kWh/mo ~ Arkansas average = 1107 kWh/mo. Arkansas is 20% higher than the national avg.

Energy Efficiency is the “First Fuel”

As such, it is a resource that can be “mined” just like any other. Mining this resource creates jobs. Mining this resource saves money. Mining Energy Efficiency insulates our economy & hedges against energy price increases.

Arkansas electricity expenses 2008:

Total ~\$3.5 billion Total; \$1.6 billion Residential. A 10% reduction = \$350 million; \$160 million. A 20% reduction = \$700 million; \$320 million. 30% reduction = \$1.05 billion; \$480 million.

Analogy: Our economy is leaking . . . We are leaking energy . . . We are leaking money . . . Energy in-efficiency, and rising energy prices combine to erode budgets in businesses, homes, schools, and city government.

What if . . .

Jacksonville as a community had achieved a 20-30% reduction over the past 5 years?

Fayetteville as a community had achieved a 20-30% reduction? What if we were as serious about energy efficiency as the Department of Defense? It may take 10 years or longer to achieve the full potential for EE, so what are we waiting for? For energy to get more expensive?

Create New Green Jobs

To achieve a 10%, 20%, or 30% reduction usually requires some sort of investment. Someone must do this work! In duct sealing; Air infiltration sealing; Insulation – attic, walls, floor; High SEER Air Conditioners; Higher Efficiency Furnaces, New Windows, etc.

Energy Efficiency = Jobs!

Jobs that cannot be outsourced to Pakistan or China; Jobs that pay good wages to people in your community; Wages that will also be spent in your community.

Jobs for whom?

Graduates of our Centers of Excellence; NWA Community College; Pulaski Tech

Energy Efficiency: Engine of Economic Growth

\$16.8 billion invested in energy efficiency in 6 states in the north east would result in: A \$162 billion increase in economic activity over 15 years; A \$99 billion increase in Gross State Product; \$73 billion returned to workers through increased real household income; 51,000 new jobs over 15 years.

Energy Efficiency Standards by State:

The Arkansas Public Service Commission established an Energy Efficiency Standard for Arkansas on 12/10/2010. Arkansas became the 27th state in the nation, the only southern state, to have an Energy Efficiency Standards. IOU's must reduce kWh sold by a total of 1.5%: ~.25% in 2011; ~.50% in 2012; ~.75% in 2013.

How does Arkansas' EES compare? Range is 1.5% to 26.1%: Arkansas 1.5% over 3 years; Pennsylvania 2.98% over 3 years; Iowa 6.3% over 5 years; Texas 4.08% over 12 years; Washington 11.74% over 12 years; Massachusetts 26.1% over 12 years

Arkansas Utility Incentive Programs: Helps address the financial barrier to EE retrofits:

Entergy (\$18 million 2011); AEP / SWEPCO (\$1.6 million 2011); SourceGas (Arkansas Western Gas); Centerpoint. Incentives include Residential, Commercial and Farm, AC replacement, insulation, duct sealing, energy audits, etc.

Summary: 20%-30% IS a stretch, but it is possible. It requires an investment (insulation, ducts, high SEER AC, LED lights). That investment creates LOCAL jobs. There are utility incentives to help offset the upfront costs. The savings result in increased disposable income that benefits the local economy.

April 19, 2012 – Property Assessed Clean Energy (PACE), Mark Roberston, MESA
(see appendices J).

What is PACE? *PACE* is a local government initiative that allows property owners to finance energy efficiency and renewable energy projects for their homes and commercial buildings. Interested property owners opt-in to receive financing for improvements that is repaid through an assessment on their property taxes for up to 20 years.

PACE financing spreads the cost of energy improvements, such as weather sealing, insulation, energy efficient boilers, cooling systems, new windows, and solar installations over the expected life of the measures, and allows for the repayment obligation to transfer automatically to the next property owner if the property is sold.

PACE is unique because it: Creates badly needed local jobs; Uses private capital, not taxes or government subsidies; Saves money for building owners and increases property values; Is voluntary – not a government mandate; Promotes energy security without driving up energy costs. Avoids the need to build costly new power plants; Reduces air pollution; Is a Local government/community initiative that creates permanent private sector jobs in America and makes our nation more energy secure by promoting energy efficiency and renewable energy projects in our homes and commercial buildings.

PACE is voluntary and community based, not mandated by Washington. It provides long term funding from private capital markets at low cost and needs no government subsidies or taxes.

PACE raises property values by making buildings less expensive to heat and cool

PACE enjoys broad bipartisan support nationwide at state and local levels.

PACE enabling legislation has been adopted by a total of 27 states.

Why PACE? *PACE* solves two key barriers to increased adoption of energy efficiency and small-scale renewable energy: High upfront costs; Fear that project costs won't be recovered prior to a future sale of the property. The basic energy efficiency measures can cut energy costs by up to 35%. The annual energy savings will typically exceed the cost of the *PACE* assessments. The upfront cost barrier turns into improved cash flow for owners. Like OTHER property-based assessments, *PACE* assessments stay with a property upon sale, until they are

fully repaid by future owners who continue to benefit from the improvement measures.

PACE programs provide a way for local communities to sponsor programs that meet their individual needs.

Economic Benefits Of PACE -- If 1% of U.S. homes participated in PACE, the projects would generate*: ~226,000 jobs; ~\$42 billion in economic output; ~\$4.2 billion in combined Federal, state and local tax revenue.

* “Economic Impact Analysis of Property Assessed Clean Energy Programs (PACE).” Study conducted by EcoNorthwest, May 2011. Go to: www.pacenow.org

Benefits of PACE -- *PACE* promotes energy efficiency in ways that are good for America, our municipalities, building owners and mortgage lenders.

Benefits to Our Nation: Creates permanent private sector jobs – nationwide and across a range of skills; Uses private capital for funding – NO taxes or government subsidies; Saves owners money – lower operating costs make their buildings more valuable; Promotes energy security – without federal regulation or taxes that drive up energy costs; Avoids costly power plants – increasingly difficult to site; No budgetary impact - voluntary participants pay all fees and expenses.

Benefits to Municipalities: Permanent local jobs – as many as 10 per \$1 million in spending makes communities stronger; No debt or credit risk - bonds are secured solely by the assessment payments of op-in participants; Saves money for residents – PACE is the only assessment that creates positive cash flow; Voluntary participation – building owners who opt-in if they decide healthier.

Benefits to Property Owners: No upfront cost - PACE financing spreads costs over the life of improvements; Owners save money - programs are designed to ensure annual savings exceed assessments. Assessment transfers upon sale - new owner benefits from improvements that stay with the property; Safety - assured by best practices and guidelines established to protect all program participants; Broad applicability – residential and commercial properties can use PACE; Voluntary – only opt-in participants pay assessments (and benefit from improvements); Comfort – efficient buildings are healthier and more comfortable; Benefits to Existing Lenders; Lowers default risk – improved cash flow makes it easier for owners to pay mortgages;

Improves Loan-to-Value Ratio - buildings that are less expensive to operate are worth more;
Safety and soundness - best practices framework developed to meet all participants' concerns.
Lien risk minimized - non-acceleration of assessments in default limits senior lien PACE exposure to less than \$200 per home, on average.

Protects Taxpayers and Banks – Prequalification's:

Homes must have 15% or more positive equity to qualify; Projects are limited to 10% of the home value; Prohibits acceleration of non-delinquent payments; Projects must show a positive cash flow savings compared to the cost of the PACE investment; i.e., the estimated utility bill savings must exceed the assessment payments; Requires an energy audit or feasibility study prior to approval; Requires that the work must be performed by accredited professionals.

Requires that, prior to levying a PACE assessment, the local government determine that there are no signs of an inability to pay.

Strong Bipartisan Support Continues for HR 2599

May 24, 2012 -- Report-out to Commission, Stakeholder Meeting at Arkansas

Energy Office, Chairman Hauser and Commissioner Lolley (see appendices K).

The Arkansas Energy Office hosted a Stakeholder meeting to participate in input process for the Ten (10) Recommendations put forth by Governor Mike Beebe. The Stakeholders were to rate the recommendations based upon their impacts and if they would help to achieve policy goals:

- 1) Continue Energy Efficiency Resource Standard
- 2) Upgrade Energy Code
- 3) Amend Act 1494
- 4) PACE Funding Mechanism
- 5) Amendment 89 Energy Bonds
- 6) CNG/Electric Refueling Stations Credits/Rebates
- 7) CNG Fleet Conversion Credits/Rebates
- 8) Solar Photovoltaic Income Tax Exemption
- 9) Drop-in Biofuels Income Tax Exemption
- 10) Clean Energy Standard

June 21, 2012 -- Dynamic Fuels – Conversion of Fats, Oils & Greases into Fuel,
Andy Rojas, Vice President of Renewable Energy, Tyson (see appendices L).

Background -- Macro Factors -- Throughout the past several years, various governmental mandates (notably RFS2) emerged to drive energy independence and growth of advanced biofuels.

Context: RFS mandate initiated in 2009. It involved a variety of alternative fuels, such as Ethanol (15B), biomass-based diesel (1B), and cellulosic, and anticipated growth over time. It identified obligated parties and volume requirements based on production and significant penalties for non-compliance.

Business Challenges: CapEx needed; Training; Geography: Cold weather climates, volatile conditions; RFS administrative compliance; Pump labeling for blends >5%

Joint Venture Formation: To capitalize on the opportunity, Tyson and Syntroleum agreed to form a joint venture, Dynamic Fuels through a 50/50 partnership.

A 50% share by Tyson founded in 1935, listed on the New York Stock Exchange as TSN; a member of the S&P; FY08 Sales of \$27 Billion is the world's largest processor and marketer of chicken, beef and pork, and produces an excess of 20,000 bpd of animal fats and grease annually.

A 50% share by Syntroleum with 127 U.S. and foreign patents pending/issued is a leading synthetic fuels technology developer, and with \$300 Million invested in technology and development to date; has provided fuels to the Department of Energy (DOE) and the Department of Defense (DOD),

Value Proposition – Feedstock Processing -- Designed with the expectation that it could process “low cost” feedstocks into finished product, including feedstocks from animal fats oils and greases, such as Red Palm Oil, Lard, Chicken, Tallow Blend, Poultry Fat, Yellow Grease, Inedible Tallow, Edible Tallow.

Value Proposition: Obligated Parties -- Could also meet the requirements of an obligated parties with a “drop in” fuel.

Value Proposition: Premium Markets -- Eventually, Dynamic Fuels would be able to leverage its unique product properties to “value up” into premium markets, such as the U.S. Military for Aviation fuel, and Emissions-challenged vehicles; Commercial aviation; European refining and marketing companies, such as Shell premium V-Power; Renewable petrolatum; Standby generation in California; Consumer Goods, such as Soaps, and Detergents; Blend stock; and R10 (Commodity).

Process Overview: Chemistry -- Renewable diesel chemistry is completely different from biodiesel. Animal Fat – Transesterification = Biodiesel.

Biofuels Production Processes Hydrodeoxygenation + Hydrocracking = Renewable Diesel.

Process Overview: Technology -- The fuels production process leverages Syntroleum’s core technology suite.

Product Properties -- Renewable Diesel vs. Biodiesel Comparison -- Only renewable diesel is chemically virtually identical to conventional diesel.

Renewable Diesel -- Combine with Hydrogen; Hydrotreat & isomerize; C3 backbone converted to naphtha and LPG; Oxygen converted to H₂O.

Biodiesel -- Combine with Methanol; Esterification; C3 backbone converted to glycerin

Key Takeaway:

Renewable Diesel -- Chemically identical to the best diesel components (no aromatics or olefins); Meets the diesel spec:ASTM D975

Biodiesel -- NOT diesel; •Does NOT meet the diesel spec; •NOT fungible with diesel

Properties & Specifications: Comparison -- Renewable diesel is chemically identical to conventional diesel with significant product advantages compared to bio-diesel.

Biodiesel (B100)

Renewable Diesel (R100)

Storage stability ¹	weeks	months / years
Cloud point	0° C	-20 to -29° C
Copper strip corrosion	No. 3 max.	No. 1
Hygroscopic	Yes	No
Cetane	47	70

Implications: Simpler handling; No heating required; Carbon-steel compatible; Simpler handling; Upgrade off-spec diesel and save \$\$.

Properties & Specifications: Environmental Comparison -- In addition, renewable diesel outperforms biodiesel on various environmental properties.

Biodiesel (B100)

Renewable Diesel (R100)

NOX emissions	+10%	No change
Particulate matter	-47%	-96%
PAH emissions (carcinogens)	-80%	-100% ¹
Carbon Monoxide	-12% (B20)	-16% (R20)
Total Unburned Hydrocarbons	-20% (B20)	-48% (R20)

Implications: Non-attainment: ok; Cleaner fuel; Safer; Better for people / environment; Better for environment / people.

Properties & Specifications: Integration & Compliance Comparison -- Can significantly reduce integration and compliance costs.

Biodiesel (B100)

Renewable Diesel (R100)

•Infrastructure costs:	High cost: terminal blending	Low cost: refinery blending
•Training:	Handling training required	Not needed
•RFS contribution:	1.5 / gallon	1.7 / gallon

Implications: Compared to SME; Renewable diesel performs better; Is simpler to handle; Saves time; and saves money. Cheaper / fewer gallons needed for RFS.

June 21, 2012 -- Energy Alternatives for Arkansas, Ben Thorp, Vice President and Board Chairman, Bioenergy Deployment Consortium (BDC), (see appendices M).

Bioenergy Deployment Consortium (BDC):

Mission: To promote an efficient and sustainable bio-economy through education and brokering partnerships.

Goal: To help companies identify and deploy successful and sustainable bio-projects that will serve them, the industry, and the world well in the future.

Goal for Today: To share logic about opportunities for Arkansas, and the belief that the reliance on fossil fuels puts our nation at risk from a defense standpoint, and from an economic standpoint. Long term, the most cost effective processes will remain standing. It is logical to support projects in Arkansas that have the best chance of being cost effective long term.

Best Solution: Energy Reduction is the easiest and lowest cost solution toward the reduction of fossil fuel use within the state. Industry provides the best opportunity and benefit since they tend to be the largest consumers of energy, and present the best opportunities to utilize Combined Heat and Power (CHP) processes for efficient energy production.

Energy Consumption by Sector -- Industry Offers an Opportunity

Industry is about 65% Efficient. If industry efficiency achieved 80% energy efficiency, it would mean a savings of 2,000 trillion BTU's for the US and 25 trillion BTU's for Arkansas.

Therefore, industry is a resource. We should work with Arkansas manufacturing. It makes sense to work with the sector that is the highest energy user, who has the largest opportunities, and is highly motivated and organized, such as Tyson Foods / Pilgrims' Pride; Domtar; Murphy Oil; Georgia Pacific; Nucor; Evergreen Packaging; Riceland Foods; Clearwater Paper; Cargill; Green Bay Packaging; Alcoa; and Graphic Packaging.

The Wisconsin Model works with Industry – Focus on Energy (FOE) works with eligible Wisconsin residents and businesses to install cost-effective energy efficiency and renewable energy projects. FOE has saved \$2.50 for every \$1.00 spent and saves residents and businesses over \$319 million annually. The FOE program is open to all sectors of the economy. FOE works with industry to help them successfully deploy good projects that would, otherwise, have not been deployed. The FOE program focuses on deployment of both best practices (off the shelf technologies) and emerging technologies. FOE has developed creative financing models that fit customer needs.

Combined Heat and Power -- Efficiency depends on Use of Waste Heat. Combined Heat and Power (CHP) projects can provide steam and electricity from biomass or fossil fuels. The Pulp and Paper Industry uses this process universally to achieve high efficiency, and therefore lower

costs. There exists a very significant difference in efficiency between CHP projects that have hosts over those that are stand-alone.

Renewable Energy: It's Complicated -- A critical review of potential projects must be considered before providing state funds to promote construction. Picking the right renewable projects will serve the state well. Recommend a review committee with significant industrial make-up to review potential projects.

Suggested Criteria for Review Process: Four Critical Factors --

- 1) Ensure that low cost feedstock is available long term.
- 2) Ensure that the product mix value is sufficient for a good ROI.
- 3) Ensure that process costs are sufficiently low enough, long term to be competitive.
For example: Efficiency is important for low cost; Synergies / Integration with a host industrial site can significantly reduce costs.
- 4) Ensure that the management team is top-notch.

Low Cost Feedstock: Typically 50% to 70% of Operational Costs

Arkansas Inventory

Bio-Oilseed -- Is a substantial cost of the process. The process is simple and has easy access. The big factor is the cost of the feedstock, and the value of the diesel. Feedstocks can include: any oil-bearing seed, vegetable oil, waste oil is a low-cost feedstock for the process, such as Future Fuels, in Batesville which produces biodiesel on a large scale mainly from waste oil and producing specialty chemicals along with the biodiesel to add value to their product mix.

Sugar-Based Crop Fermentation -- Food Crop costs negatively affect this process. Common feedstocks are Sugar Cane, Corn, and Sorghum. This process is well understood, producing ethanol. The ethanol can be further processed to more valuable fuels and chemicals. Ethanol is a low value product, viable using food crops only because of government subsidy. Higher value products, such as butanol, will add value to the process.

Cellulosic Fermentation -- Feedstock costs are significantly lower. The process for Cellulosic Fermentation is the same, once the cellulose is converted to sugars through acid and enzymatic pretreatment. The feedstock costs are much lower. The process is limited to the portions that can be converted to sugars, which will affect yields.

Thermal Cellulosic: Gasification -- The process uses low cost cellulosic feedstock to produce a syngas that contains organic building blocks that can be converted to fuels and chemicals. The Fischer / Tropsch process converts the gas components to waxes and liquids that can be converted to the desired final product. Further processing can produce higher valued products. The gasification reaction is exothermic providing excess heat for use by a host mill to reduce costs.

Thermal Cellulosic: Pyrolysis -- The basic pyrolysis process produces bio-crude oil that can be burned or further processed. Fast pyrolysis with catalytic cracking produces a product more like Fuel Oil, but more processing must be done to remove oxygen and convert to fuels and chemicals. Capital costs are low for the low value product, but may be high for the processes needed to convert to drop-in fuels and chemicals. Feed stock costs should be low, unless cleanliness is an issue for catalyst life.

Hybrid Thermal-Fermentation -- The hybrid process uses gasification and fermentation. Syngas from a gasifier is bubbled through a column with bacteria designed to convert to ethanol. The mixture is separated and distilled to concentrate the ethanol. Feedstock cost should be low, but the product will have low value. Expertise is needed for the bacteria growth and maintenance.

Lignin Based Processes -- The lignin process has potential for integration with a pulp and paper mill that has recovery boiler limitations. However, precipitated lignin products are of low value now. If the lignin can be had at low cost, the chemicals can presumably be produced competitively.

X to Liquid (XTL) -- Feedstock includes fossil fuel such as natural gas or coal. A recent line of thinking is to combine biomass with fossil fuels, especially natural gas or coal, to gasify and convert to liquid fuels and chemicals. Coal or biomass can be gasified, and substituted, or combined with the natural gas. The advantage is that large-scale operations can be constructed, with substantial biomass conversion, but at lower capital risks.

Summary: Stand-alone electrical generation from biomass should not be supported. Integration improves efficiency significantly. Oil-seed for Arkansas may make sense if feedstock is grown on marginal land and can be contracted for a low cost. If the cellulosic fermentation process is

supported, then it should integrate with a host to improve efficiency. There are likely to be niches that make sense. Gasification or catalytic pyrolysis makes sense long term, but capital costs must come down to improve returns. With the pulp and paper industry in Arkansas, there may be a fit for lignin precipitation and further processing. Combining biomass to coal or natural gas production of liquid drop-in fuels makes sense economically.

June 21, 2012 – Renewable Energy Portfolio Standards, The Big Picture, Kristin Higgins, UA Division of Agriculture, Public Policy Center (see appendices N).

Defining Renewable Energy -- Is a source of energy that is not depleted by its use. Must be environmentally friendly. "Energy resource that is naturally regenerated over a short time scale and derived directly from the sun, indirectly from the sun, or from other natural movements and mechanisms of the environment. Renewable energy does not include energy resources derived from fossil fuels, waste products from fossil sources, or waste products from inorganic sources."

United States Energy Policy -- The U.S. does not have a federal policy. Therefore, states are crafting their own energy policies to guide energy infrastructure planning and to act as economic development tools through a patchwork of policies.

Renewable Portfolio Standards (RPS) -- Iowa was the first state to adopt what would become an RPS in 1983. An RPS is essentially a State law requiring electricity providers to generate a certain percentage of their energy from renewable sources by a certain date or face financial penalty. It is a policy tool to encourage renewable electricity generation, and to create a market demand.

RPS's in the United States:

Standards

- 29 states & D.C. have adopted standards with set percentages, dates and penalties.
- Eligible technologies and multipliers differ.

Goals

- 8 states have adopted less-formal goals including percentages and dates.
- Voluntary targets --no penalties.

- Some include municipal utilities, some exempt
- No two are alike

RPS Policies: 29 states + DC and PR have an RPS, (8 states have goals), and 13 states have neither.

*Source: www.dsireusa.org/ May 2012

Missouri -- Voters repealed goal in 2008 in favor of RPS for 15 % renewable energy by 2021 with a solar carve-out of 2 %. Eligible sources: solar thermal electric, photo voltaic, landfill gas, wind, biomass, municipal solid waste, anaerobic digestion, small hydroelectric, fuel cells using renewable fuels. Municipal, cooperative utilities are exempt. Penalties. Net metering available.

Oklahoma -- Legislators adopted goals in 2010 for 15 % by 2015 (energy efficiency may account for 25 % of the goal). Eligible sources: wind, solar, hydropower, hydrogen, geothermal, biomass and other sources approved by the Okla. Corporation Commission. Utilities must file annual report. Net metering available.

Texas -- Mandated 5,880 MW by 2015; goal of 10,000 MW by 2025. Eligible sources: solar water heat, solar thermal electric, photo voltaic, landfill gas, wind, biomass, hydroelectric, geothermal electric, geothermal heat pumps, tidal energy, wave energy, ocean thermal. Wind represents ½ renewables. Municipal and cooperatives exempt but can volunteer. Penalties authorized but not set. Limited net metering.

Louisiana -- No RPS or goal. Net metering available. RPS pilot study underway to determine cost effectiveness and best practices. Will issue RFPs for 350 MW. Eligible sources: solar thermal process heat, photo voltaic, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, geothermal heat pumps, municipal solid waste, CHP, black liquor, small hydroelectric, wave energy, ocean thermal, fuel cells using renewable fuels, other distributed generation technologies, geothermal direct-use.

Mississippi -- No RPS or goal. Net metering not available.

Tennessee -- No RPS or goal. Net metering not available.

Arkansas -- No RPS or goal. 2009 Legislation, state agencies to reduce building energy usage by 20 % by 2014. 2012, Gov. Beebe initiated planning process for an energy plan, with biomass possibly playing a role. Net metering available.

De Facto RPS in Arkansas -- SWEPCO was required to buy renewable energy as part of Dec.

2011 settlement over Turk coal plant. Required: 400 megawatts of wind or solar. Response: Contracts signed for 407.85 megawatts of wind from KS, OK and TX; AR does not have grid. This quadrupled SWEPCO's wind portfolio. In 2010, energy portfolio was 84 % coal/lignite and 16 % natural gas. RPS had political benefit for SWEPCO. Part of settlement ending a 4-year legal battle over new Turk coal plant.

Advantages of RPS -- Environment benefits; Creates demand for renewable energy; Stimulates RECs market and technology development; Diversifies energy sources, safety; Promotes economic development; Boosts investor confidence in renewable energy; Can be tailored to local desires/policies.

Disadvantages of RPS -- Complex to design and implement; Costs not known until after implementation; Utility costs passed on to customers in higher rates; Would dissuade use of natural gas; Promotes least-cost source development, not necessarily best source; Doesn't stimulate large volumes of capacity by itself; Jury still out on effectiveness.

August 16, 2012 – Compressed Natural Gas as a Motor Vehicle Fuel, Michael Gallup, Transportation Manager, SWN (see appendices O).

Natural Gas has economic benefits. Natural gas powered vehicles offer an economic return to fleets and individual users. Full cycle cost is lowered through reduced fuel price, fewer maintenance problems, and extended vehicle lives.

Natural Gas offers a clean alternative to traditional petroleum fuel powered vehicles. Natural gas vehicles (“NGVs”) offer an immediate reduction of 25% in GHG and smog causing emissions; cleaner air.

Natural Gas is a local resource. Southwestern utilizes Fayetteville Shale gas at our Damascus, AR CNG station, to fuel CNG powered trucks many of which were converted by suppliers based in Arkansas.

Natural Gas provides Arkansas energy security, and is an abundant domestic fuel source, which reduces our nation's dependence upon import oil.

Goals: Transition SWN's fleet to CNG ~ 160 conversions completed to date. Goal: Minimum

of 185 conversions to be completed by end of 2012. Support the development of public fueling infrastructure, such as the Damascus CNG Station, the City of North Little Rock & City of Little Rock. Incentivize employee adaptation of CNG, i.e.: 'The Big Give,' SWN Employee CNG program. More CNG advocacy and training, such as the 'Drive Natural Gas Initiative,' Houston NGV Alliance, ANGA. More certification & training for fleet maintenance group.

Summary: SWN supports CNG. See shale gas opportunities for Arkansas. Needs help in infrastructure development for CNG fueling stations. Makes sense for vehicle economics. CNG is abundant, clean, & domestic.

October 24, 2012 – Home Energy Performance, The Fifth Fuel, Matt Bell, Viridian
(see appendices P).

Energy Efficiency -- Represents a significant largely untapped opportunity for meeting the dual goals of financial returns and environmental protection. By eliminating wasted energy, the U.S. can reduce its fossil fuel use, move toward energy independence, and reduce its greenhouse gas (GHG) emissions by almost 40% by 2030.

*Source: Rocky Mountain Institute

Arkansas Home Energy Costs -- There are 1,115,000 households in Arkansas. Their average utility cost is \$1,900 per year. 62% of these households are below \$50,000 median household income, and consequently spend 23% of their after-tax income on energy.

Arkansas Average Annual Utility Costs ~ \$1,900: \$820 ~ Appliances and Light; \$412 ~ Space Heating; \$247 ~ Electric AC; \$422 ~ Water Heating

Value of Energy Efficiency -- Approximately \$2,000,000,000 spent annually on household utilities, therefore, 200 million dollars can be saved annually with just a 10% improvement.

Barriers to Energy Efficiency Implementation -- Uncertainty of Savings; Lack of Awareness and Knowledge; Access to Capital; Availability of Service Providers; A Complicated Process.

Uncertainty of Savings -- Concepts of energy efficiencies are complex and the science is confusing to consumers. No standards of energy performance reporting. So, who do you trust?

Lack of Awareness -- You can't fix what you don't measure. Most homeowners aren't aware if

they have an energy efficiency problem. What uses energy in my home?

Lack of Knowledge -- Customers don't understand the science of energy performance.

Capital -- Lenders don't recognize the value of energy efficiency savings. Many energy efficiency measures don't result in an increase in property values. Individuals with the most energy poverty have the least access to funding. Audit costs and improvement cost are often too costly. Rebate incentives may not be available. Low cost of energy in Arkansas leads to longer payback periods and less ROI.

Availability of Service Providers -- Who do I call? Very few trained home energy auditors in the state of Arkansas.

Service Providers -- Traditional Providers, HVAC Contractors, Insulation Contractors, Window Installers, Remodel Contractors, New Service Providers, Certified Energy Auditors, Home Performance Contractors, Duct and Air Sealing Professionals.

Traditional Process – 1) Contact utility provider for rebate programs; 2) Contact approved utility auditor; 3) Schedule home energy audit; 4) Review home energy audit recommendations; 5) Contact approved utility contractors for bids; 6) Obtain financing; 7) Hire multiple contractors; 8) Complete rebate documentation.

Problems with this Process – It's complicated and overwhelming to customers. It's limited to a small list of utility approved contractors. Many approved contractors are not cross trained in whole house energy performance (focused on HVAC, insulation, windows, etc.).

Comprehensive low cost solutions are often overlooked.

Progress -- Some Arkansas utilities are providing incentives for home energy audits to increase education and awareness. New service providers are starting to offer comprehensive solutions to simplify the process. Utilities have adopted standardized building science protocols to measure performance (blower door, duct blaster, etc.). Many of the utility incentives for energy efficiency measures are robust.

What We Need -- More public awareness on the financial impact of energy efficiency. More utility rebate incentives for comprehensive home energy audits. More trained home energy professionals. Lenders to recognize the value of energy efficiency.

October 24, 2012 -- Apprenticeship Going Green, Karen Breashears, President, National Training Program (NAPT), (see appendices Q and R).

Homeowners, Lenders, and appraisers do not understand the value of energy efficiency features; making it difficult for customers to afford or acquire loans to pay for them.

The Arkansas Energy Sector Partnership (AESP) is comprised of 20 two-year colleges and seven apprenticeship programs within Arkansas. The Department of Labor awarded AESP a three-year grant for implementing green training colleges and apprenticeship programs.

AESP purchased a trailer, training equipment, and created the “Green Mobile Training Unit.” By exhibiting the unit at statewide events. AESP has provided about 6,000 members of the public with knowledge about “going green.” The trailer allows AESP to mobilize its training program. The 20 two-year colleges in Arkansas have integrated a “green” component in the technical training programs.

- Plumbers must complete 2,000 hours of on-the-job training and 160 hours of technical-related classroom training.
- Electricians must complete 8,000 hours of on-the-job training and 160 hours of technical-related classroom training.
- Standards for HVAC vary and there is a need to require similar licensure programs for technicians.
- Arkansas needs more statewide incentives for EE improvements.

May 23, 2013 – Legislative Review, Representative Warwick Sabin and Representative John Hutchinson

Representative Warwick Sabin gave an overview of legislation introduced and/or passed during the 89th General Assembly affecting alternative energy generation, noting he and Representative Hutchinson were the main sponsors of HB1390 “To Create the Arkansas Distributed Generation Act.” He stated this was just a stepping stone in trying to promote more alternative energy

generation in Arkansas by only mandating up to 5% in terms of purchasing energy generated by renewable energy facilities in Arkansas. It did not set a timetable as far as when that 5% would have to be achieved. There was intense opposition from the major utilities; and the bill was referred to the Joint Interim Committee on Energy for interim study. He stated that they plan to introduce this again in the 90th General Assembly.

Representative Sabin noted Energy Legislation Enacted:

SB340 (Act 554) - TO AMEND THE GUARANTEED ENERGY COST SAVINGS ACT AND TO ALLOW STATE AGENCIES TO USE MAINTENANCE AND OPERATIONS APPROPRIATIONS FOR DEBT SERVICE RELATED TO A GUARANTEED ENERGY COST SAVINGS CONTRACT.

SB640 (Act 1074) - TO AUTHORIZE THE ESTABLISHMENT OF ENERGY IMPROVEMENT DISTRICTS TO FUND LOANS FOR ENERGY EFFICIENCY IMPROVEMENTS, RENEWABLE ENERGY PROJECTS, AND WATER CONSERVATION IMPROVEMENTS.

SB792 (Act 532) - TO CREATE THE ARKANSAS CLEAN-BURNING MOTOR FUEL DEVELOPMENT ACT; AND TO CREATE THE CLEAN-BURNING MOTOR FUEL DEVELOPMENT FUND.

Additional legislation was introduced:

SB933 - TO AMEND THE ARKANSAS ALTERNATIVE FUELS DEVELOPMENT ACT; AND TO PROVIDE A TAX CREDIT FOR THE PRODUCTION OF ALTERNATIVE FUELS.

HB1769 - TO CREATE AN INCOME TAX CREDIT FOR SOLAR ENERGY SYSTEMS.

Representative Sabin stated he believes the legislation is moving Arkansas in the right direction. Representative Hutchison stated he is a farmer from northeast Arkansas and strongly believes in renewable energy and will continue to support alternative energy legislation.

May 23, 2013 – HYDROPOWER, Arkansas Waterways: “The most efficient, economical, and environmentally friendly commercial transportation option,” Gene Higginbotham, Executive Director, Arkansas Waterways Commission (see appendices T)

Noted the AWC is the sole state agency responsible for developing, promoting and protecting waterborne transportation in Arkansas. It promotes economic development for ports on the state’s five commercially navigable rivers: Arkansas, Mississippi, Ouachita, Red, and White. Mr. Higginbotham stated he has a personal interest in alternative energy. He is currently working on a professional certificate in “Energy Efficiency and Emerging Technologies” from Stanford University. Mr. Higginbotham’s PowerPoint presentation, (Attachment 1) highlighted the following: [a copy of this handout is available at waterways.arkansas.gov.]

- Waterways are the most efficient, economical and environmentally friendly form of transportation.
 - Arkansas has the 3rd largest inland waterway system in the country, but is 33rd in what is shipped using that waterway system. The gap should be reduced.
 - Waterborne transportation requires significantly less fuel than rail or trucks. The cost per ton-mile for a barge is only \$.97, compared to \$2.53 for rail, and \$5.35 for trucking. The number of ton-miles per gallon of fuel (one gallon of fuel moving one ton of cargo) by barge is 576 miles; by train, 413 miles; and by truck, 155 miles.
 - Arkansas currently ships a lot of agricultural products on Arkansas’ waterways. Barge transportation makes the other rates drop making products more affordable for consumers and putting more money back into farmers’ pockets.
 - The Environmental Protection Agency (EPA), Emission Control Laboratory determined that tow boats emit drastically lower amounts of hydrocarbon, carbon monoxide, and nitrous oxide.
 - Arkansas is one of the few systems that has hydropower capacity on its navigation system.
- Mr. Higginbotham stated the AAEC could assist the Waterways Commission by talking to their congressional Representatives and Senators and having them help the Corps of Engineers obtain more funding necessary to upgrade their 50-year-old system.

May 23, 2013 – Arkansas Hydropower Briefing, Mr. Lee Beverly, Project Manager, U.S. Army Corps of Engineers (USACE), (see appendices U)

Presented a PowerPoint, (Attachment 2) which included the following information:

- Two things required for hydropower installation are water flow and elevation.
 - Typical hydropower turbine designs are: Pelton, Francis and Kaplan, with Kaplan the most used in Arkansas.
 - No Pelton units are used in Arkansas. They are usually found in locations such as Hoover Dam, Glen Canyon Dams and other very large high pressure and elevation dams.
 - Kaplan Units are most useful in lower head or elevation plants. Most of the hydropower development in the state in recent years has been on low head installations such as the Dardanelle plant. All the plants operated by Arkansas Electric Cooperative Corporation (AECC) are horizontal shaft Kaplan units. The three plants that were recently completed on the lower White River are horizontal shaft Kaplan units.
 - Hydrokinetic units are being developed, but none in Arkansas.
 - Energy produced in most of the plants is “peaking capacity” or “base energy”. The hydro plant’s economic value is typically in peaking capacity. The USACE plants are mainly run only during the highest demand period of the year and during occupied hours for businesses and facilities. Base energy production is suited toward the big coal and gas plants, and combined cycle plants operated in the state.
 - The two types of operation are Stored water and Run-of-River (they run when there is water, and they don’t when there is not). Stored water operation is at the large impoundments such as Greers Ferry, Norfolk, Bull Shoals, Greeson, DeGray, and Ouachita. Entergy also runs their dam on Lake Hamilton as a stored water operation. Runof-River plants are the AECC plants on the Arkansas River, the Dardanelle and Ozark plants operated by the USACE, and the three small plants Independence County runs on the lower White River.
- Hydropower plants currently operating in Arkansas are listed by capacity: Bull Shoals, Dardanelle, Beaver, Dam 2, Ozark, Greers Ferry, Norfolk, Blakely Mountain, DeGray,

Carpenter Dam, Murray, Ellis, Whillock, Narrows, Remmel Dam, Marcella, Batesville, Earnhardt and Lee Creek. Arkansas hydropower capacity is approximately 1400 megawatts (mw), which is a very significant energy contribution to Arkansas' energy production. Arkansas Nuclear One is approximately 1000 mw, so hydropower is about 1.4 times the output of one of the state's largest plants. A lot of this energy also goes out of state.

□ The federal system was established by Congress in 1944. The USACE is required by law to market to only "preference customers", either a municipal body or a non-profit entity. One of the federal system's guiding criteria is that no one should make a profit on the power either produced or sold. The Corps of Engineers produces the power and Southwestern Power Administration is responsible for its marketing and distribution. Arkansas customers are the cities of Bentonville, Clarksville, Jonesboro, AECC, Paragould, Paris and Piggott. Southwestern Power also has customers outside of Arkansas.

□ Tennessee Valley Authority (TVA) is not part of the southwestern power system. The country is divided into various administrations: Bonneville Power Administration (BPA) in the northwest; Western Area Power Administration (WAPA) in the western states; Southwestern Power Administration (SWPA), and Southeastern Power Administration (SEPA) in the southeast.

Mr. Beverly stated the USACE has a valuable role in Arkansas and is looking forward to some large and interesting projects soon, which will add to local economies.

May 23, 2013 – Free Flow Power Market-Lending US Hydropower, Mark Lassman, Director of Energy Trading, Free Flow Power Corporation, (see appendices V).

Presented a PowerPoint (Attachment 3), and noted Free Flow Power (FFP) is a clean renewable energy company focusing on hydropower, hydrokinetic and hydro pumped storage as reliable, cost-effective sources of electricity and grid stability. Mr. Lassman noted one of the biggest misconceptions is that there is limited opportunity in hydropower simply because the sites are all taken. He stated that this is just a myth and there is tremendous opportunity.

Hydro output is estimated to double by the year 2030. Most the dams in the United States have no hydro generation (77,000 out of 79,000 existing dams provide a retrofit opportunity). Some advantages of hydropower are tax benefits, greater focus on regulatory, recognition of hydro as a renewable energy, and a better market currently for hydropower. He indicated he is starting to see some of the hydro plants go for higher values. The largest pump storage facility in the world, Bath County located in Virginia, produces over 3000 mw.

Mr. Lassman stated even though Arkansas does not fall under the current Renewable Portfolio Standard (RPS) initiative, the development of hydropower makes sense. The biggest obstacle facing most of these renewable energies is the intermittent nature of the product. Therefore, hydrokinetics is a real advantage. Ms. Potts stated when Independence County began its efforts to develop the three small hydro plants, the Federal Energy Regulatory Commission (FERC) was the main obstacle. It took approximately six years to obtain a license and approximately 15 years to find a purchaser for the power. To have someone like Mr. Lassman working on their behalf would have been very helpful. Mr. Lassman stated that Arkansas will soon be going into a pool type system like the northeast which is called PJM (Pennsylvania, Jersey and Maryland). This system will be customer friendly and easier to manage generation. This is called “spot market backed” meaning no need to find a buyer for your power; it is submitted into the pool. Representative Hutchison suggested that irrigation wells be used to generate electricity since 85% of the wells are located near 3-phase power. He stated he is willing to do what is necessary to help Arkansas move forward.

Ms. Audrey House stated she would like to see Arkansas be number one in Renewable, Efficiency, Profitability and Sustainability (REPS) by 2036.

August 09, 2013 – Hydropower Regulatory Efficiency Act of 2013 signed into law by President Obama

The act promotes small hydroelectric and conduit hydropower projects, authorizes the FERC to extend preliminary permit periods, and promotes hydropower development at non-powered

dams and closed-loop pumped storage projects. Under the Federal Power Act (FPA), FERC regulates the nation's non-federal hydropower resources.

September 19, 2013 – Status on Enhanced Energy Code, J.D. Lowery, Policy and Sustainable Energy Manager, Arkansas Energy Efficiency Office (AEO) of the Arkansas Economic Development Commission, (see appendices W & X).

Gave a brief update on the “2013 Arkansas Energy Code” and “2013 Arkansas Energy Code – A market-based consumer driven approach.” Mr. Lowery stated the AEO is in the process of updating rules for the new residential construction energy standard from the International Energy Conservation Code (IECC) 2003 to IECC 2009. This process was done on the commercial side in 2011. The AEO gathered input for six months with a stakeholder group of 17 individuals representing the state home builders association, realtors, lenders, appraisers, municipal and publicly owned utilities, as well as code officials throughout the state. The AEO also opened a public comment period September 4, 2013, and ending on October 4, 2013. Once this public comment period ends, it will come before the Joint Energy Committee for its review, late October or early November. The state sets the standard for the energy code and relies on the municipalities to enforce it. He said the Home Builders Association is currently against this. Mr. Lowery stated the AEO is also proposing to add an Energy Cost Disclosure Label for new home construction, like what is found on vehicles and large appliances. He said it would provide for:

1. Consumer Involvement - allowing consumers to understand the long-term operating cost of new homes.
2. Builder Involvement - protecting investment in energy efficiency features and providing flexibility to builders.
3. Municipality Involvement - reducing burden on municipal code officials and local budgets.
4. Utilizing a Home Energy Rating Index (HERS) score.

Mr. Lowery stated the weatherization assistance program has been moved to the AEO from the Arkansas Department of Human Services, and the AEO believes this is ultimately better for state policy.

PROGRESS ON STRATEGIC ENERGY PLAN

Mr. JD Lowery also listed recommendations and progress to-date on the energy plan:

1. Update the IECC 2003 to IECC 2009

--This has been completed on the commercial side and in progress for residential construction.

2. Increase inspectors for natural gas production wells throughout the state.

--Act 121 addressed this issue.

AN ACT TO MAKE AN APPROPRIATION FOR PERSONAL SERVICES AND OPERATING EXPENSES FOR THE OIL AND GAS COMMISSION FOR THE FISCAL YEAR ENDING JUNE 30, 2014; AND FOR OTHER PURPOSES.

3. Recommendation to have a one-time tax incentive for compressed natural gas (CNG) stations and car conversions or incremental cost of purchasing a new CNG vehicle.

--Act 152 addressed this issue.

AN ACT TO PROVIDE INCENTIVES FOR CONVERTING DIESEL-POWERED MOTOR VEHICLES AND GASOLINE-POWERED MOTOR VEHICLES TO MOTOR VEHICLES POWERED BY COMPRESSED NATURAL GAS OR PROPANE GAS; TO DECLARE AN EMERGENCY; AND FOR OTHER PURPOSES.

4. The Guaranteed Energy Cost Savings Act moved the procurement process from the state procurement office to the AEO for energy performance contracting with energy service companies.

--Act 554 addressed this issue.

AN ACT TO AMEND THE GUARANTEED ENERGY COST SAVINGS ACT; TO ALLOW STATE AGENCIES TO USE MAINTENANCE AND OPERATIONS APPROPRIATIONS FOR DEBT SERVICE RELATED TO A GUARANTEED ENERGY COST SAVINGS CONTRACT; AND FOR OTHER PURPOSES.

5. Act 1418 - AN ACT TO CREATE AN INCOME TAX EXEMPTION FOR QUALIFIED DROP-IN BIOFUELS MANUFACTURERS; AND FOR OTHER PURPOSES.

Mr. Lolley requested Mr. Lowery to provide a written summary of the following concerning the energy plan:

--Progress at the end of 2013

- Update from the 2013 legislative session
- Current status or what has been accomplished to-date
- Future Goals

November 21, 2013 – Overview of Issues and Initiatives, Steve Patterson, Executive Director, Arkansas Advanced Energy Association (AAEA) (see appendices Y).

Mr. Patterson’s PowerPoint Presentation] was recognized and noted advanced energy can be defined as any service or technology that makes America’s energy supply more secure, clean and affordable. This can include, but not limited to, bio-fuels and bio-products, compressed natural gas and other clean burning fuels, energy-efficient buildings, energy-saving consumer products, geothermal hydropower, nuclear, solar and wind. AAEA focused on these areas and tried to identify companies working in these areas in Arkansas.

AAEA membership is a unique blend of 90+ manufacturers, energy providers, entrepreneurs, small business owners, educators, researchers and public institutions.

He stated AAEA endorsed the following legislation enacted during the 2013 Session:

- Property Assessed Clean Energy Act 1074
- Guaranteed Energy Cost Savings Act 554
- Clean Burning Motor Fuels Development Act 532
- Revisions to Net Metering Rules Act 1221
- Energy Efficiency Bonds Authorization for State Agencies Act 1252

The AAEA has been conducting Property Assessed Clean Energy (PACE) seminars around the state since August. The PACE act is a local option law and the burden is on the communities to create a local ordinance and PACE district.

Fayetteville is the first to pass an ordinance creating the PACE district in October 2013.

Mr. Patterson listed AAEA activities:

- Presentation of General Assembly Candidate Workshops during Summer 2012 in partnership with the University of Arkansas Applied Sustainability Center
- Convening advanced energy working groups of industry leaders on energy efficiency, bio-fuels

and renewable energy

- Advanced Energy Public Opinion Survey, 2012 and 2013
- Access to Capital Report, released October 2013
- Farm-to-Fuel Community Innovation Project in the Arkansas Delta in partnership with alt. Consulting
- Supports sister organization AAEA with research and public education on advanced energy-related issues before the Arkansas Public Service Commission.

Mr. Patterson stated the Arkansas Delta's Farm-to-Fuel community innovation project in partnership with alt. Consulting was launched in Dewitt on October 29, 2013. The experimental energy crop, camelina, is a low maintenance crop that does not take away from the yields of soybean or cotton and offers farmers an opportunity to make approximately \$130-\$140/acre of camelina grown. The two main marketing opportunities for this crop are as a high nutrition source for livestock feed and camelina oil, which can be easily converted to bio-diesel fuel. He stated the mobile bio-refinery unit can produce up to one million gallons/year of bio-diesel fuel.

March 20, 2014 – Mission Projects, Reverend Steve Copley, Board Chairman, and Ms. Scharmél Roussel, Executive Director, Arkansas Chapter of Interfaith Power and Light (IPL), (see appendices Z).

Ms. Scharmél Roussel, Executive Director, IPL, was recognized and explained IPL is a nationwide organization with affiliates in forty states. They are individuals and congregations who believe the sacred writing of all faith traditions ask them to care for creation, protect the planet, and to preserve fragile ecosystems that sustain life. They see all environmental issues through a lens of faith. The goals of the organization are awareness and educational outreach, building partnerships, and energy efficiency improvements. IPL partners with the Arkansas Energy Office, Home Energy RX, AR Energy Innovation, and local churches on some projects. IPL recently completed an energy efficiency project at the Vera Lloyd Children's Home in Monticello. The anticipated savings because of this energy project is 40% in the first year.

Previous energy efficiency projects:

- Duncan United Methodist Church, Little Rock

- Wofford Missionary Baptist Church, Helena
- Simone’s Home for Foster Teenage Girls, Little Rock
- Mount Comfort Presbyterian Church, Fayetteville
- Billy Mitchell Boys & Girls Club, Little Rock
- Walters Chapel Missionary Baptist Church, Carlisle

Future energy efficiency improvement projects:

- Houses of Worship in Low-Income Areas
- Community Buildings in Low-Income Areas
- Homes of Entergy Customers
- 12th Street Corridor
- Oak Forest Neighborhood
- Wherever needs can be matched with resources

Ms. Roussel stated IPL gives presentations to children’s groups and retirement centers on recycling and energy efficiency. IPL recently conducted the “tighten-up treat bags” event. Each treat bag contained a power strip, weather stripping, faucet aerator, CFL bulb, socket sealers, a tip sheet on how to install these items, and an application to apply for a free energy audit from Entergy. IPL was among the initial trustees for Kiva Zip loans. These loans are used to help individuals start energy audit companies to assist low-income areas. Ms. Roussel stated she has an energy efficient home equipped with solar panels, and her average electric bill is \$8.25. She stated, per the Arkansas Energy Association, Arkansas has untapped solar power potential.

Suitable rooftops exist with more than six times the resources needed to provide all the energy we need. The following facilities are utilizing alternative energy methods:

- Wind turbines at St. Thomas Episcopal Church in Fayetteville-Springdale area
- Solar panels on Grace Community United Methodist Church in Fort Smith
- Solar and geothermal in use at Ferncliff Presbyterian Camp outside Little Rock
- Ferncliff’s Solar School for Mission Volunteers

Ms. Roussel stated every state must implement a plan for reducing carbon emissions. IPL hopes to be at the table for this discussion.

March 20, 2014 – Hydroelectric Activity/Potential within the United States & Arkansas, Jeff Leahey, Esp., Deputy Executive Director, National Hydropower Association, (see appendices AA, BB, CC).

[PowerPoint Presentation #2] The NHA is a forum to unite industry with a common voice and is exclusively dedicated to advancing the interest of the hydropower industry at the federal level. NHA has over 180 members and anyone who has a business interest in the hydropower industry can become a member. Hydro power is the nation's most available, reliable, affordable and sustainable energy source, requiring only the power of moving water – rivers, streams, and ocean waves and tides. Hydropower is domestic and renewable. Much of the money spent on hydropower stays in America, and expanding hydro capacity could create up to 1.4 million cumulative U.S. jobs. Mr. Leahey stated:

- *Hydropower is the largest source of renewable electricity in the U.S.*, and made up 7% of overall electricity generation and most renewable electricity in 2012. In Arkansas, hydro made up 3.4% of total generation and about 57% of renewable generation in 2012.
 - Some key characteristics of the hydro fleet are that only 3% of the 80,000 U.S. dams generate electricity and hydropower is generated in every region and benefits every state, employing up to 300,000 workers around the U.S.
 - Of total U.S. hydro generation – about half comes from the federal hydropower system and the other half from private industry.
 - With the right policies in place, the U.S. could add 60,000 megawatts (MW) of new hydro capacity by 2025, much of which can be created by maximizing existing infrastructure or with low-impact projects.
 - The FERC pipeline tops 64,831 MW across 399 projects.
- Arkansas projects under consideration: Otto, Alamo, Big Pig, David D. Terry Lock & Dam, and River Mountain Advanced Pumped Storage.
- On August 9, 2013, President Obama signed the Hydropower Regulatory Efficiency Act and

the Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act into law promoting regulatory improvements and hydropower project development.

June 19, 2014 – Co-Generation Initiatives, Tom Howard, Vice President for Governmental Affairs, Domtar Corporation, (see appendices DD).

The Arkansas Alternative Energy Commission (AAEC) elected to study systems employing combined heat and power (CHP) technology. CHP, also known as cogeneration, is the simultaneous production of process heat and electricity from a single or combination fuel source, ideally a renewable fuel source. CHP is a much more efficient process for generating heat and power than conventional electrical utility plants and manufacturing facilities that use boilers for only dedicated process steam production. Mr. Tom Howard, Domtar Corporation was invited to present, to the AAEC, information regarding CHP projects that Domtar has successfully completed at two (2) of their facilities. Mr. Howard presented details of the CHP process employed at their paper mills in Wisconsin and South Carolina. Both projects were hugely successful producing steam for their papermaking process and electricity for the mill and the utility grid. The projects were cost effective with good returns on the investment, improved environmental conditions, helped the states meet renewable energy goals, lowered fuel demand for unit output, created direct and support jobs for the community and ensured the sustainability of the existing paper mills.

June 19, 2014 – Murray Lock and Dam Tour, Aaron K. McGee, Deputy Operations Manager of the Little Rock District Russellville Project Office, U.S. Army Corps of Engineers (USACE).

Mr. Aaron K. McGee facilitated the tour. Randy Crapps, Lockmaster, presented information about the McClellan-Kerr navigation system and specifically how Murray Lock and Dam functions. He mentioned that the McClellan-Kerr navigation system goes from the mouth of the

Mississippi River to Tulsa, Oklahoma. The locks will hold up to 9 barges at one time and are in operation 24 hours each day servicing an average of 200 barges a month. There were several questions on how the lock and dam operates and the potential for more hydropower sources.

September 18, 2014 Representative John Hutchison (see appendices EE) was

recognized and invited commission members to attend the State Agencies and Governmental Affairs meeting November 10, 2014, in Room A of the Multi-Agency Complex, Little Rock, Arkansas. He stated he would be discussing Clean Line Energy's proposed transmission lines in Arkansas. Ms. Potts asked what the Arkansas Public Service Commission's position is concerning Clean Line's proposed transmission line. Mr. John Bethel, Director, Public Service Commission (PSC), stated the PSC is continuing to monitor actions on the Clean Line transmission line. There is nothing pending before the PSC regarding the line, all activities are in front of federal agencies, primarily the U.S. Department of Energy. He stated Clean Line asked for a certificate of convenience and necessity to be identified as a public utility in Arkansas, and the PSC found they did not meet the statutory requirements at that time. They have not made any other filing at the PSC. The PSC is continuing to monitor and determine whether there is any action that is required in the future. Representative Hutchison provided commission members an article titled, "Kansas Senate Votes to Repeal Renewable Mandates." [Handout 1]

Ms. House stated there was an HBO documentary concerning Kansas considering the repeal of the renewable energy mandates. The documentary was titled, "Years of Living Dangerously." She stated Kansas was fighting against the Heartland Institute. The documentary showed Mr. James M. Taylor from the Heartland Institute speaking in Little Rock, Arkansas, dismissing the need for this commission, and dismissing any kind of need for renewable portfolio standards. The Heartland Institute is stating global warming and climate change does not exist, and there is no need for renewable options.

Ms. House stated since recommendations in the 2012 report have not been addressed, they should be condensed to key elements and added to the 2014 report. Mr. Hauser asked for suggestions on possible 2015 discussion topics. Ms. House made the following

suggestions:

- Instead of being called “Alternative” it should be more about an Energy Plan
- Job creation potential
- Transition from coal-based to renewable
- Additional co-generation aspects
- Public consumer and curriculum-based education program
- Presentation from the Heartland Institute

Mr. Allen requested staff review previous meetings and send commission members the information from the Arkansas Energy Office presented on the Energy Plan.

October 20, 2014 – Review Status of State Energy Plan, J.D. Lowery, Director of the Arkansas Energy Office (AEO), (see appendices FF)

Gave a brief update on the state energy code and stated that the plan consisted of ten items: 1) To update the state energy code, including residential and commercial standards to the 2009 International Energy Conservation Code; 2) To amend Act 1494 of 2009, which is concerned with the conservation of energy and natural resources in buildings owned by public agencies and institutions of higher education (and other purposes); 3) The introduction of enabling legislation that concerns Amendment 89 Energy Bonds; 4) To propose a one-time income tax credit to encourage the installation of Compressed Natural Gas stations and credits for vehicles; 5) The establishment of a bio-energy group at AEDC that coordinates and encourages the bio-energy industry and supply-chain development; 6) To propose a limited income tax exemption for solar photovoltaic manufacturers; 7) To propose a limited income tax exemption for drop-in bio-fuel producers; 8) To provide additional field inspection resources for the Arkansas Oil and Gas Commission and the Arkansas Department of Environmental Quality to support and ensure sustainability of shale production; 9) To expand the Energy Efficiency Resource Standards targets beyond 2013; 10) The Clean Energy Standard → Legislation was not introduced in the 2013 legislative session, and there are no discussions concerning this issue for the 2015 legislative session.

October 22, 2015 – Impact of Current Regulations on Electrical Generating Facilities, Andrew Lachowsky, Commissioner, Arkansas Alternative Energy Commission (see appendices GG)

Mr. Andrew Lachowsky, Commissioner, was recognized and gave an [PowerPoint Presentation] overview, from Arkansas Electric Cooperative Corporation's (AECC) perspective, of the "Potential Impact of Environmental Protection Agency's (EPA) Clean Power Plan." He stated AECC has seventeen distribution cooperatives that serve approximately 60% of Arkansas' land area, and approximately one-fourth of the population. He stated the plan, to a significant degree, targets coal generation. In 2014, coal represented 71% of AECC's energy supply; therefore, the plan would have a significant impact on AECC. AECC has more capability to generate natural gas, but coal is used because it is a cheaper source. Noting there are considerable uncertainties with implementing the Clean Power Plan, the final plan was a considerable improvement over the proposed plan. Until Arkansas finalizes the plan the impacts are highly uncertain, however there are two key areas, load growth and gas prices. The proposed rule was issued in June 2014, and the final rule August 3, 2015. The plan's timeline requires the state to submit an initial state plan by September 6, 2016, and a final state plan by September 6, 2018. The differences between the proposed rule and final rule follow: Proposed Final 30% Nationwide Reduction in CO2 by 2030 32% Nationwide Reduction in CO2 by 2030 44% for Arkansas (7th highest) 36% for Arkansas (24% if mass-based) Begins 2020 Begins 2022 Four building blocks Three building blocks (EE removed) Switch to gas Switch to renewables

The EPA provided states with more compliance pathways, and it appears most states are selecting the mass based plan (rather than rate-based). Under a mass-based plan, states that anticipate continuing or expanding investments in energy efficiency have unlimited flexibility to leverage those investments to meet their clean power plan targets. The main benefits of the mass-based approach are utilities are accustomed to this model and it allows for trading credits across the region. Mr. John Bethel, Director, Arkansas Public Service Commission (PSC), stated the PSC and Arkansas Department of Environmental Quality (ADEQ) have begun meeting with stakeholder groups which include electric utilities, environmental groups, and consumer groups, looking at options to comply with the rule. The PSC and ADEQ websites have links to

documents associated with the Clean Power Plan and the stakeholder process.

REVIEW OF PREVIOUS ALTERNATIVE ENERGY COMMISSION RECOMMENDATIONS AND ITEMS FOR FUTURE STUDY

Ms. Audrey House, Commissioner, AAEC, was recognized and provided an overview of previous AAEC recommendations. Commission members will be emailed a copy of the previous reports which include the recommendations. Ms. House stated the commission is charged to study: 1. The feasibility of creating and expanding alternative energy sources 2. Effects and the use of alternative energy sources on economic development of our state 3. Other issues related to alternative energy production and the use and impact of alternative energy that the commission considers appropriate. Ms. House stated the creation of a renewable portfolio standard (RPS), education awareness, and updating the AAEC's website are commission goals. Mr. Allen stated the importance of finding subject matter experts to make presentations to the commission. Members made the following suggestions for discussion topics and presenters at future meetings: - Insulation and energy reduction - Micro-hydro - Arkansas Energy Plan - Update on Property Accessed Clean Energy (PACE) - Renewable Portfolio Standards (RPS) - Natural gas - Arkansas Alternative Energy Association - Arkansas Energy Office Mr. Nabholz suggested the commission focus on impediments and what proposed legislation or changes are needed to remove those impediments. He also suggested surveying the speaker of the house, senate pro tempore, governor, attorney general, mayoral and county associations, as well as the public to gain input. Ms. Potts suggested contacting the chairs of the Joint Energy Committee concerning their input on what they would like the commission to study.

November 19, 2015 –Clean Power Plan(CPP) Update, Arkansas Attorney General Leslie Rutledge

Attorney General, Leslie Rutledge, was recognized and stated she appreciates the commission's efforts to expand alternative energy sources in the state. She noted the Consumer Utilities Rate Advocacy Division advocates for consumers in rate increases, approval for sales or mergers, requesting permission to purchase or construct power, customer service rules, and other policies

that affect ratepayers. She has held roundtable discussions in 67 of the 75 counties talking to business leaders and local government. These discussions reiterate government should allow businesses to make decisions based on data and not politics. The Attorney General's Office has filed comments and testified on issues involving the Clean Power Plan (CPP), Ozone Standards, and Waters of the U.S. Rule. The office has urged the Environmental Protection Agency to withdraw the Section 111(d) rule because it would increase energy costs for Arkansans. They have also joined 23 other states in a lawsuit challenging the CPP. The primary goal is to keep energy cost affordable for the average consumer. The state's bio-mass industry has gotten a boost with two investor groups announcing multi-million dollar projects to produce commercially viable fuel from the state's vast pine and hardwoods in Monticello and Pine Bluff. These companies will bring jobs and residual economic gains to these communities.

November 19, 2015 – Integrated Building Technologies, David Dodge, Arkansas Alternative Energy Commission (see appendices HH)

Mr. David Dodge, Commissioner, was recognized and presented a video titled, "Integrated Metal Roof Retrofit with Multiple Energy Saving Technologies."

[www.youtube.com/watch?v=l8gTva48p9Y]

Mr. Robert Scichili, President, RSK Avanti Partners, was recognized and provided a brief overview of how metal roofing affects energy efficiency in homes and businesses. He stated Cool Metal Roofing is now a standard in the industry and accepted as a premier contribution to the betterment of industry and its customers.

SELECTION OF STUDY SUBJECTS AND POSSIBLE PRESENTERS

Mr. Nabholz suggested strategic planning should be done to determine focus, look at impediments to alternative energy, and if necessary, determine if legislation is required and see what has been successful in other states. The commission made the following suggestions for study subjects and presenters: - Mr. Frank Kelly, Chairman, Arkansas Renewable Energy Association - Solar Energy - Mr. Robert McAfee, Arkansas Citizens' Climate Lobby - Carbon

fee and dividend initiative - Arkansas Energy Office - Walmart - Alternative Energy Technologies - Battery storage - Compressed Natural Gas Conversion - Arkansas Department of Environmental Quality

December 10, 2015 – Hydroelectric Power Generation, Gene Higginbotham, Director, Arkansas Waterways Commission), (see appendices II)

[PowerPoint Presentation #1] Mr. Higginbotham was recognized and gave an overview of hydroelectric power generation, noting hydroelectric power is electricity produced by machines that are run by moving water. The commission's mission is to promote and protect navigation on the state's five commercially navigable rivers: Arkansas, Mississippi, Ouachita, Red and White. There are six hydropower plants on the McClellan-Kerr Arkansas River Navigation System run by North Little Rock, the electric cooperatives, and the US Army Corps of Engineers. Of the 13 lock and dams in the state, six provide hydropower. Much of the hydropower produced in the state remains in the state.

December 10, 2015 – Update on Arkansas Public Service Commission Initiatives, John Bethel, Executive Director, Arkansas Public Service Commission, (see appendices JJ)

Mr. John Bethel, Executive Director, Arkansas Public Service (PSC) [PowerPoint Presentation #2] Commission, was recognized and stated the PSC is charged with the mission of providing safe, reliable utility service at a reasonable price. He presented an overview of the utility energy efficiency programs that are provided by the utilities under the PSC's oversight. His PowerPoint titled, "Energy Efficiency (EE) Programs in Arkansas," covered the following topics: • Description of Commission • Legal Background • EE and Conservation Program Rules • Quick Start Programs • Informal Working Group Process • Overview of EE Programs • EE Program Cost Utility EE Program Budgets • Evaluation, Measurement, and Verification • EE Program Modifications

The PSC regulates the following utilities: • Four investor-owned electric utilities (Entergy, distribution cooperatives, Southwestern Electric Power Company, Oklahoma Gas and Electric • Seventeen electric distribution cooperatives • One electric generation and transmission cooperative (Arkansas Electric Cooperative Corporation) • Two electric regional transmission organizations (Midcontinent Independent System Operator and Southwest Power Pool) • Three investor-owned natural gas distribution companies (CenterPoint Energy, Arkansas Oklahoma Gas, and Arkansas Western Gas) • One water utility (operated in Pine Bluff - Liberty Utilities) • Approximately 300 telecommunications utilities

Mr. Bethel stated there is an energy efficiency tab on the PSC's website which then links to each utility for their information concerning their energy efficiency programs. Mr. Lachowsky asked Mr. Bethel for legislative recommendations concerning energy efficiency. Mr. Bethel noted from a statutory standpoint, the state is well positioned on energy efficiency, and he is not aware of any legislative improvements, but from an alternative energy standpoint, they might explore the issue of distributed generation.

December 10, 2015 – Review of Arkansas Energy Office Plans, Mitchell Simpson, Director, Arkansas Energy Office (AEO), Arkansas Economic Development Commission, (see appendices KK)

Presented a PowerPoint titled, "Arkansas Energy Office Program Priorities." He stated the AEO's mission is to promote energy efficiency, clean technology, and sustainable strategies that encourage economic development, energy security, and the environmental well-being for all citizens of Arkansas. The AEO is one of two divisions within the commission and has the following enabling legislation and specific legislative requirements: • Act 532 of 2013 - Clean-Burning Motor Fuel Act (Gaseous Fuels Rebate) Provides incentives to developers of clean alternative fuel stations as well as vehicle owners purchasing or converting to clean burning fuel vehicles. • Act 554 of 2013 - Guaranteed Energy Cost Savings Act (Performance Contracting) Allows state agencies and institutions of higher learning to engage in large-scale energy

efficiency and capital improvement projects by financing the projects with guaranteed energy savings.

- Act 1494 of 2009 - Energy-Efficient Buildings Program (State Buildings EE) Promotes the conservation of energy and natural resources in buildings owned by the state or institutions of higher education.

- Act 1111 of 2013 - Weatherization Assistance Program (WAP) [transferred from the Department of Human Services] Through a federally-funded sub-grantee network, WAP provides assistance to low-income applicants throughout Arkansas. Examples of available improvements include: weather stripping, caulking and sealing, insulation, repairing/retrofitting

The AEO's priorities are energy efficiency, transportation, financing programs, and energy efficiency market preparation initiative. Mr. Lachowsky asked if Mr. Simpson had any legislative recommendations concerning energy efficiency. Mr. Simpson suggested possibly focusing more attention to transportation components, such as reinvigorating the gaseous fuels program and focusing on removing the impediments to electric vehicles, and any assistance necessary to make energy efficiency more affordable. Ms. Potts asked if there is a state energy plan. Mr. Simpson stated *there is not a state energy plan*, just the framework. He will provide that framework to the commission.

February 18, 2016 – Examples of Alternative Energy Concepts and Projects in Arkansas, Stuart Spencer, Director of the Air Quality, Arkansas Department Environmental Quality (ADEQ) (see appendices LL)

Mr. Stuart Spencer, Deputy Director of Air Quality, [Handout #1] Arkansas Department of Environmental Quality, was recognized and presented an overview of alternative energy concepts and projects in the state. He explained the benefits of using on-site combined heat and power (CHP) from steam or hot water as an alternative energy source compared to conventional electricity and thermal energy production. Mr. Stuart explained the benefits of using biomass fuel as another alternative energy

source. He said burning biomass reduces overall carbon in the atmosphere. Many of the biomass fuels used today are wood products, dried vegetation, and crop residues. Mr. Stuart listed several CHP facilities and biomass-fueled electricity generators currently operating in the state. Mr. Stuart's handout also listed utility companies in the state which have entered into either a solar or wind project agreement with companies from other states.

February 18, 2016 – Input on Alternative Energy with Respect to Their Individual Positions/Offices

Ms. Tori Gordon, Policy Advisor to the Governor, was recognized and acknowledged the Governor's support and appreciation to each Commission member's commitment to serve and study the economic development of creating and expanding alternative energy sources in the state. Ms. Gordon expounded on several Arkansas code provisions that allow utility companies to explore and acquire clean energy resources. In addition to overall exploration, investment opportunities, and alternative energy, Ms. Gordon conveyed the Governor's requests that the Commission develop strategies and make recommendations to fund the conversion of state-owned vehicles to compressed natural gas (CNG) fuel or another alternative fuel source. Ms. Gordon stated the Governor is willing to issue a directive to the Department of Finance and Administration to determine a practical number or percentage of vehicles that can be converted in a reasonable timeframe. Ms. House requested the Governor consider additional funding to maintain the state's existing hydropower facilities, and she also asked for funding consideration for the AAEC to be able to bring in expert speakers from out of state. The Commission does not have any funding.

Representative Bob Ballinger, House Co-Chairman, Joint Energy Committee, was recognized and discussed his thoughts on the state and renewable energy: • What is the economic impact for the citizens of Arkansas? • What is the environmental impact on the state? • Can utility companies in Arkansas maintain base load capacity for customer demand? Representative Ballinger asked the Commission to find areas where government policies may be in the way of innovation. He stated the Joint Energy Committee supports the Commission's work and is open

to hear the Commission's recommendations. When asked about the Clean Line transmission issue, Representative Ballinger explained the Joint Energy Committee sent a letter to the Department of Energy expressing this is an Arkansas property rights issue and should not be dealt with at the federal level.

DISCUSSION OF LESSONS LEARNED FROM PRESENTERS

Ms. House suggested looking at the Commission's CNG Energy report findings from the previous years and how to bridge the gap between government entities and innovators. Ms. Sabin suggested the Commission focus on a particular alternative energy source as an overall energy plan. Mr. Nabholz suggested the Commission focus on the Governor's CNG requests and look at impediments to clean energy.

DISCUSSION REGARDING TOPICS FOR NEXT MEETING

Mr. Lachowsky suggested including data on electric vehicles as an alternative source. Mr. Nabholz suggested inviting a presenter from the state fleet service to talk about the number of state vehicles purchase each year, location of these vehicles, and total number of state vehicles. Also, find out when CNG vehicles can be ordered from U.S. manufacturers, and look at sites in the state where CNG fueling stations are located. Mr. Nabholz suggested also looking at impediments to the state's hydroelectric and see if anything needs to be changed. Ms. Sabin suggested looking at other states alternative energy plan and what the future of alternative energy is in the state. She will contact former Commissioner Lolley to speak on electric cars. Ms. House suggested impediments of policy on renewables, CNG transport funding strategy, mitigation of future policy, and possibility of new transport innovations such as rail for public transportation. Mr. Crabbe suggested requesting the Arkansas Department of Finance and Administration to provide a financial impact on the cost of converting state vehicles to CNG. He will speak to the Governor's office about finding a presenter from Oklahoma to speak on CNG conversion and who is the best contact person to speak about the state's fleet service. Mr. Krug will contact a Conway car dealership regarding converting vehicles to CNG; Michael Gallop,

Transportation Manager at SWN; and Mitchell Simpson at the Energy office may have cost analysis on the volatility of CNG versus unleaded fuel. Mr. Dodge suggested the Commission look at utilizing resources available in the state to hold cost down rather than import resources from other states.

June 16, 2016 – Future Sunset Clause of AAEC, Mr. Michael Feehan, Legislative Attorney, Bureau of Legislative Research (see appendices MM)

Act 2 of the Third Extraordinary Session created a *sunset date for the AAEC of September 30, 2017*. The Speaker and Pro Tempore appointees' terms will end December 31, 2016. Due to the fact that it will be a new General Assembly in January 2017, those positions will be up for appointment. The Arkansas General Assembly uses Mason's Manual of Legislative Procedure, which provides the quorum follows actual membership. The commission can keep functioning even if legislative-appointed members are not reappointed, as long as all the gubernatorial appointees are present at every meeting. The sunset dates are always set after the next regular session which allows the General Assembly time to reconsider the expiration dates. After discussion, Mr. Allen stated the AAEC would like to continue and work to change the sunset date. He noted the AAEC needs to justify its accomplishments and look at December 2016 as the report date for the 2015-2016 commission. He also mentioned that the commissioners need to contact their respective legislative appointers and let them know if you would like to be re-appointed. Ms. House made a motion to continue the AAEC and have a bill to strike the sunset date. Mr. Caspary seconded the motion and the motion carried. AAEC STRATEGIC DIRECTION PER ACT 2 Commissioners will contact legislators regarding background on establishing the expiration date. Ms. Sabin will speak with Senators Rice and Irvin. Ms. House will speak with Representative Gossage, and Mr. Berry will speak with Representative Branscum and Senator Rice. Ms. House and Ms. Sabin will draft a document highlighting the commission's benefits and accomplishments.

REVIEW OF AAEC MEETING RESEARCH SUBJECTS

Mr. Allen reviewed commission activities since October 2015: • October 22, 2015 – Andrew Lachowsky - Overview of Clean Power Plan • November 19, 2015 o Attorney General Leslie Rutledge discussed consumer advocacy and two bio-mass projects, one in Monticello and the other in Pine Bluff. o David Dodge discussed energy conservation. • December 10, 2015 o Mr. Gene Higginbotham, Director, Arkansas Waterways, explained the usage and importance of hydropower in Arkansas. o Mr. John Bethel, Director, Arkansas Public Service Commission, referenced energy efficiency programs in Arkansas. o Mr. Mitchell Simpson, Director, Arkansas Energy Office, discussed Arkansas Energy Office Programs. • February 18, 2016 o Ms. Tori Gordon, Policy Advisor to the Governor, conveyed the Governor’s requests regarding advocacy in usage of compressed natural gas (CNG) and to make recommendations for funding the conversion of state-owned fleet vehicles. o Mr. Stuart Spencer, Deputy Director of Air Quality, Arkansas Department of Environmental Quality, presented an overview of combined heat and power as well as biomass.

DISCUSSION OF SUBJECTS FOR RESEARCH

Ms. House explained she does not consider CNG a good alternative. Conservation and efficiency are a better approach. Ms. Sabin would like to hear from someone who can discuss different alternative energy trends across the United States and compare the good with the bad. She would also like to learn more about distributed generation. Mr. Dodge mentioned that solar energy is a viable source and when combined with other sources it enhances efficiency. He will make some contacts for additional information.

OPEN DISCUSSION FROM COMMISSIONERS AND PUBLIC ATTENDEES

Mr. John Bethel, Director, Public Service Commission, mentioned that the utilities have filed their three-year energy efficiency programs; therefore, the review process is underway. The PSC is also assessing distributed generation to decide if there is a need for policy or legislative changes. Mr. Bobby Ampezon, Reporter/Editor, Arkansas Public Media, KUAR of University of Arkansas in Little Rock, KASU of Jonesboro, KUAF of Fayetteville, explained they are a

voice for journalism with a goal to cover energy from every corner such as, energy sourcing, coal, nuclear, hydro, energy policy, as well as state aid for low income consumers. Ms. Potts suggested meeting with the Arkansas Recycling Coalition. She will make an inquiry for contacts and information.

July 28, 2016 – Arkansas Real Clean Energy Economy, Frank Kelly, Solar Source Consulting, (see appendices NN)

[PowerPoint Presentation] Presented a brief history of renewable energy policies in Arkansas. Mr. Kelly stated that less than 0.01% of energy generation in Arkansas is produced from solar and wind systems; however, there is enough sunlight striking the Earth every 104 minutes to power the entire world for a year. The United States has the space and sunlight to provide 100 times its annual power demand by harvesting solar energy. The installation process is much less destructive and time consuming than fossil fuels. The cost of installing solar panels has dropped 70% since 1998. Investors can benefit from distributed solar generation by installing solar panels on rooftops and farms. This power is readily consumed and solar installations can create shade to lower the cooling load. A parking lot solar canopy, able to withstand 90 mile an hour winds, is the most expensive type of installation at approximately \$4 a watt. For residential locations on a foundation the cost drops to about \$3.20 per watt. The least expensive method is to build at ground level; which would drop the cost to around \$2.00 per watt. The federal government offers a 30% tax credit for investing in solar energy. There are currently only 476 installs in Arkansas, while solar is booming in other states. Arkansas needs more policy incentives to stimulate solar generation; however, this has been met with resistance. The Rural Energy for America Program, currently on hold, was mainly for farming businesses, but less than 4 installations qualified for the program in Arkansas. The payback on a 3,000-square foot residential home, with the current reduction in installation cost compared to the negotiated rate in net-metering, is about 11-12 years. If you would like to see a solar facility or get a quote for installation you can go to www.arkansas.solar.

July 28, 2016 – State Fleet Management, Jake Bleed, Office of Administrative Services, Arkansas Department of Finance and Administration (see appendices OO)

Mr. Jake Bleed explained that Arkansas does not have a centralized fleet maintenance system, instead each agency has its own fleet management system. The state fleet consists of about 9,000 vehicles, as follows: [PowerPoint Presentation] • Department of Highways and Transportation own 2,469 vehicles • Arkansas Game and Fish Commission own 567 vehicles • Institutions of Higher Education own 1,524 vehicles • Department of Finance and Administration own 4,888 vehicles Approved 8/25/16 Each agency is responsible for the maintenance and operation of their vehicles and reports monthly to DFA. DFA reports annually to the General Assembly on the cost of fuel, insurance, and maintenance incurred by each agency, and oversees the acquisition of all new vehicles and disposal of old vehicles. Arkansas requires a five-cent tax on CNG and other alternative fuels on a per-gallon basis. The DFA, Office of State Procurement (OSP), bids on vehicle purchasing contracts on behalf of the state agencies and local government. Approximately 1,000 vehicles are purchased a year. Contracts were sought for the Chevy Volt and Nissan Leaf but were not obtained. DFA also sought contracts for various bi-fuel capable vehicles, and has three contracts at this time. Arkansas Code requires an annual report on the number of alternative fuel vehicles owned by the state. The definition of alternative fuel used in the statute is borrowed from federal regulations and includes vehicles capable of operating on ethanol. State agencies employ 1,652 vehicles classified as alternative fuel vehicles, the majority of which are E85 capable. Approximately 30 vehicles operate on hybrid electric, biodiesel, or other fuels. There are no CNG capable vehicles identified in the most-recent report. In 2013, the OSP did seek two contracts to install CNG conversion kits to state vehicles. The State did not utilize these contracts and there is no current CNG conversion contract. The prices ranged from \$9,800 - \$14,980 per conversion and the cost would have been incurred by each individual agency. There are only six CNG fueling stations across Arkansas at this time. Mr. Bleed stated he was unaware of other states performing mass conversions or any benefit from doing so to date. In further discussion, he stated better

efficiency in the state fleet might be achieved by setting reimbursement rates for vehicle maintenance and through more reporting.

UPDATE ON ARKANSAS ALTERNATIVE ENERGY COMMISSION'S

FUTURE SUNSET DATE Ms. House explained that she is still working on the issue. She has contacted Senator Stubblefield and is waiting to hear back from him.

FUTURE MEETING SUBJECTS/SPEAKERS Mr. Dodge noted he has a speaker scheduled for the August 25th meeting and will forward the information in email for the agenda. Mr. Perkins stated he has scheduled the Resource Planning Manager from American Electric Power to speak at the September 29th meeting. Ms. Potts confirmed that she had a speaker lined up for the October 27th meeting.

OTHER BUSINESS Mr. Dodge mentioned that the Arkansas Alternative Energy Commission website is outdated and hinders the ability to recruit speakers. Since the commission is unfunded, he has been in discussion with his company's web design team to possibly review the website and update it accordingly. Ms. House added that she can provide Michael Lolley's contact information as he created the website originally.

August 25, 2016 – Retrofit Metal Roofing and Solar Integration-A Perfect Match, Mr. Ken Gieseke, Vice President of Marketing, McElroy Metal, Inc., [PowerPoint Presentation #1] (see appendices QQ) – Building a Better Tomorrow, Peter Rienks, Innovateus Solar, [PowerPoint Presentation #2] (see appendices RR)

Mr. Ken Gieseke [PowerPoint Presentation #1] explained how metal roofing and solar photovoltaic panels work together. A metal roof generally lasts 40+ years and is 100% recyclable. It is the best host for solar panels which come with a 25-year warranty. Solar panels clip onto metal roofs without penetrating the metal, therefore preventing leakage. Arkansas has a great climate for solar and is a top 20 state for pre-engineered metal buildings.

Mr. Peter Rienks, Senior Account Executive, Innovates Solar, [PowerPoint Presentation #2] explained the cost of installing a solar system has decreased significantly and has the lowest facility maintenance cost while easing the grid load by adding a buffer and security. Solar is part of a balanced generating portfolio with nuclear, wind, natural gas, and coal. Mr. Rienks stated Arkansas is ranked 51st, lowest on the solar report card. 29 states have a Renewable Portfolio Standard (RPS), which is a regulatory mandate to increase production of renewable energy on a set time-line. Arkansas does not have an RPS and does not offer incentives for solar generation. A solar panel in Arkansas generates 50% more electricity than a panel in Minnesota, and Minnesota is ranked 7 on the solar report card; therefore an ideal state to investigate policies and incentives.

Mr. Rienks noted the best solar incentives are not the government “writing checks” for solar panels but are in the form of accelerated depreciation, tax incentives, as well as private funding. Obstacles to overcome while trying to expand the solar market are permit costs and utility regulation. The Department of Energy SunShot Initiative is helping reduce permit costs, but the utility companies are threatened by distributed generation, as they want control and resist people generating their own electricity; additionally, net-metering and state-to-state sales of renewables are limited due to regulation.

August 25, 2016 – How to Reduce Carbon Dioxide Pollution, Create Jobs, Grow the Economy, & Improve Health, Robert McAfee, Arkansas Citizens Climate Lobby (CCL), (see appendices PP)

[PowerPoint Presentation #3] Mr. McAfee explained a policy initiative called Revenue-Neutral Carbon Fee and Dividend, saying the plan is fair because every power plant or polluter pays the same amount for carbon dioxide emissions and each year the fee increases. The money would be put into a “carbon bank” and then distributed to each consumer. The purpose is to control and mitigate carbon dioxide pollution from burning fossil fuels. The Arkansas CCL is working with the National Citizens Climate Lobby which has a goal to have Congress pass a carbon-fee and dividend policy by the end of 2017.

Mr. Chris Balos, CCL, stated he is an advocate for carbon-fee and dividend, because he is from the Marshall Islands and has experienced the impact of rising sea levels due to global warming.

Ms. Nancy Brown, Semi-retired Psychotherapist and Retired Nurse, CCL, stated climate change has an effect on mental health. People feel overwhelmed and helpless in the global warming solutions. An important benefit to carbon-fee and dividend is helping people feel like they are supported in their efforts to save the planet, and it promotes hope.

Ms. Shelley Buonaiuto, CCL, explained Regional Economic Models, Inc. (REMI) did a study examining the potential economic, demographic, fiscal, and emissions impact of a fee on carbon dioxide emissions in Arkansas. The study focused on two rates. One is based on CCL and their proposed national legislation and the other is based on Clean Power Plan compliance (CPP).

[Handout D] • CCL – The fee begins at \$15 per metric ton of carbon dioxide emissions the first year, escalating at \$10 per year through at least the 2030. It ends at \$145 per metric ton in 2030.

• CPP – The fee begins at \$30 per metric ton of carbon dioxide emissions the first year, escalating at \$30 per year until it plateaus at \$150 per metric ton in 2021. The main policy incentives are: ♣ Adds 20,000 – 30,000 jobs over the baseline scenario ♣ Increases the gross state product and the real disposable personal income ♣ Reduces emissions by 20 - 30 million metric tons per year ♣ Power emissions approach or are below CPP regulations ♣ \$500 million to \$1 billion revenue in the first year, \$4 billion long-term ♣ Monthly rebates to household and employers over \$200 a month ♣ The long-term population of the state increases with fee ♣ Attracts a stronger labor market and availability of dividends

Ms. Buonaiuto noted at the national level, the fuel companies would pay the fee; at the state level, the utilities would pay the fee, and then pass it on to consumers. National studies show that 66% of consumers would recoup the entire cost spent. Mr. McAfee noted someone will have to pay for the removal of carbon pollution from the atmosphere and the transition from fossil fuels to a cleaner form of energy. Cap and trade policy puts a cap on emissions, where carbon-fee and dividend puts a price on emissions while giving something back to consumers.

UPDATE ON ARKANSAS ALTERNATIVE ENERGY COMMISSION'S FUTURE RELATIVE TO SUNSET DATE

Ms. House stated she spoke with Representative Gossage, and he said he would speak with the governor. She also spoke with Senator Stubblefield, and he will take her bill drafts to the Bureau of Legislative Research to make sure the language is correct. Ms. House drafted an appropriation bill and also spoke with Representative Bennett. State Agencies and Governmental Affairs would be the committees voting on the bill(s).

FUTURE MEETING SUBJECTS Mr. Allen noted that Commissioner Perkins has a speaker for the September 29th meeting, and Commissioner Potts has a speaker scheduled for October 27. He suggested members review past minutes and begin making recommendations for the report. Ms. House asked for help with the report. OTHER BUSINESS DISCUSSION FROM GUESTS Mr. Rienks stated that he would follow up with Mr. Dodge on how other states have created their Renewable Portfolio Standard.

September 29, 2016 – American Electric Power -- Southwestern Electric Power Company's Approach to Renewable Modeling, Scott Fisher, Resource Planning Manager, American Electric Power (AEP), Southwestern Electric Power Company (SWEPCO), (see appendices SS)

Mr. Scott Fisher, Resource Planning Manager, American Electric Power, (AEP), Southwestern Electric Power Company, (SWEPCO), was introduced by Commissioner Greg Perkins and explained that integrated resource planning (IRP) is balancing the needs of a variety of constituents while ensuring safe, reliable and efficient resource selections for the future of energy. The most recent 3-year IRP is available on the PSC's website. AEP is working to convert its portfolio to more sustainable by transforming the generation fleet and reducing emissions. AEP reduced its reliance on coal by 20% since 2005, and increased natural gas generation by 10%. Emission reductions are: • Sulfur Dioxide SO₂ – coal fired power plants' emissions – reduced 88% in the last 25 years. • Nitric Oxide NO_x – ozone causing gases –

reduced 87% in the last 25 years. • Mercury Hg – coal fired power plants’ emissions - reduced 54% in the last 25 years. • Carbon Dioxide CO₂ – predominately coal fired power plants – reduced 39% since 2000. SWEPCO is a unit of AEP and participates in the Southwest Power Pool (SPP) Regional Transmission Organization. SPP is responsible for the reliability of the network and establishes the planning requirements that go into developing an IRP. SWEPCO owns 5,148 megawatts (MW) of capacity made up of coal, gas and lignite as well as 470MW of wind purchase power agreements. Wind generation capacity is high at 40 - 50%. In 2015, wind provided SWEPCO customers about 7% of their energy needs and is much more economical than solar as a renewable. SWEPCO has a request for proposal out for 100MW of wind. The net-metered renewable is owned by the customer and totals about 10MW. The U.S. Congress passed, and then extended in late 2015, the Production Tax Credit (PTC) incentive which provides a \$23/MWh tax credit for investing in a wind project that is completed in 4 years. The PTC will expire in 2019. Transmission is a major component to bringing renewables across Arkansas and the United States. AEP has 14 patents on a transmission tower that is much taller and has a lower impact than the traditional structures. The Clean Power Plan has a 30% carbon intensity reduction target by 2030, and although SWEPCO didn't model it in its IRP, the preferred SWEPCO plan achieves a 29% reduction. [PowerPoint Presentation]

UPDATE ON ARKANSAS ALTERNATIVE ENERGY COMMISSION’S (AAEC) FUTURE RELATIVE TO SUNSET DATE

Ms. Jessica Sabin, AAEC Commissioner, was recognized and stated she and Ms. House have been considering the next step to save the commission or let the sunset date remain. The AAEC’s mission statement is to study the needs and impacts of various forms of alternative energy on the economic future of Arkansas. If the commission’s intention is to extend the sunset date, the focus needs to be narrowed and a 10-year overview prepared highlighting research and showing what could also be done. Ms. Sabin suggested the commission build upon the last report(s) as well as introduce a handful of good ideas to promote to the legislature for

continuance. She added that she is trying to get the AAEC's website updated so all the reports can be accessed.

REVIEW OF SUBJECTS RESEARCHED TO DATE Mr. Paul Love, AAEC Commissioner, was recognized and presented a summary of topics from past meetings. Mr. Love stated that he found three topics which were not pursued: 1. Find out when CNG vehicles can be ordered from U.S. manufacturers. 2. Look at other states' alternative energy plan and what their future holds. 3. Possibility of new transport innovations such as rail for public transportation. Mr. Love concluded the commission needs an expert economist that can add to the research for a more definitive outcome. [Handout #1]

DISCUSSION OF COMMISSION REPORT Mr. Allen stated that he has two bills that Ms. House has worked on with some legislators to exempt the commission's sunset rule and add an appropriation. He encouraged the commission to review the summary, past minutes, and reports in order to narrow details in the October meeting, and plan for a report being done by the end of this year.

October 27, 2016 – Green and Sustainable in the Future, Don Curren and Cherie O'Mary, Arkansas Recycling Coalition, (see appendices TT)

Ms. Cherie O'Mary, Executive Director, Arkansas Recycling Coalition (ARC), was introduced by Ms. Potts and explained ARC is a non-profit recycling sustainability educational firm founded in 1989 with a grant from the Winthrop Rockefeller Foundation. ARC is governed by a board of 15 directors with approximately 300 participating members, most of which are in Arkansas and several throughout the United States. ARC is registered with the Arkansas Attorney General's Office and Secretary of State's Office.

Mr. Don Curren, Facilities Manager, Virco Manufacturing Corporation-Conway Division, was introduced by Ms. O'Mary and explained Virco's Conway Division opened in 1954 making school furniture. In 1989 Virco expanded its metal recycling to include cardboard and oil. Their

goal was to be waste-free. Its Cash for Cardboard Program has paid out over \$176,000 the past twenty years to local Conway schools for various programs and projects. Over 300 million pounds of materials have been recycled at the Division. Mr. Curren explained several cost saving initiatives Virco implemented such as planting trees to reduce greenhouse gas emissions and landscaping with plants native to the area which require less watering. He said Virco has saved approximately \$300,000 upgrading old equipment and switching to energy-efficient lighting fixtures.

REVIEW AND SELECTION OF RESEARCHED SUBJECTS FOR

RECOMMENDATIONS FOR THE 2016 REPORT Mr. Allen gave an overview of the commission's research subjects. The commissioners discussed recommendations to be included in the 2016 report: • Wind and solar power cost comparison analysis • Hydropower • Conservation energy efficiency programs • Arkansas Energy office programs • Compressed natural gas for state fleets • Combined heat and power • Biomass • Metal roofing voltage and solar panels • Carbon cap and sell • Recycling energy • Spent rod nuclear generation [if presentation] • Roof insulation Ms. House stated she and Ms. Sabin will continue to work on a summation with a strong message of conservation, a comparison between solar and wind, combined heat and power, hydropower, nuclear possibility, roof insulation, CNG conversion and feasibility, recycling, biomass, and carbon footprint. Ms. House will also work on a summation regarding the commission's sunset clause, each commissioner's cost to invite speakers, and each commissioner's mileage cost to travel to meetings. Ms. House will also work on an appropriation request for reimbursement. Mr. Allen will work on a presenter for the nuclear spent fuel rod information at a future meeting. Ms. Potts will contact Arkansas Department of Environmental Quality regarding the state's recycling energy cost savings.

December 08, 2016 – “Is it waste or fuel?”, John Warmack, (see appendices UU)

Mr. Allen introduced Mr. John Warmack to make a presentation regarding a technology using spent nuclear fuel rods as an alternative energy source. Mr. Warmack provided a PowerPoint

entitled, “**Is It Waste or Is It Fuel?**” and explained the United States has no plan to deal with spent fuel, but states don’t want more spent fuel accumulating. It is a problem for which the National Nuclear Security Administration, an agency of the federal government, would like to find a solution. [PowerPoint Presentation] Arkansas’ two (2) nuclear reactors are a Generation II type, called Light Water Thermal Water Reactors. There is approximately 150 metric tons of spent fuel sitting in the Russellville parking lot. If the existing reactors were converted to Generation IV types, there would be better efficiency and 929 years of fuel sitting in that parking lot. That is a lot of nuclear energy now considered waste. Mr. Warmack asked the Commission to pass a resolution encouraging legislation to identify spent fuel as an alternate energy source, and the second component, to encourage Arkansas to pass appropriate legislation and recommendations allowing an allocation of resources to the University of Arkansas System to investigate and analyze the spent fuel opportunity. Mr. Allen asked experts to explain if this is an acceptable, practical alternative.

Dr. Mark A. Williamson, Manager, Nuclear Chemical Engineering, Nuclear Engineering Division, Argonne National Laboratory, via conference call, discussed the Experimental Breeder Reactor II (EBR-2) and why it would be the model of what they want to propose to Dr. Bobbitt. He said the EBR-2 reactor, for all intents and purposes, was a prototype Gen IV reactor. It used a metal fuel and a liquid sodium coolant and operated from approximately 1965 to 1994. Its primary purpose was research and development and showed an 85% capacity factor meaning operational time. Dr. Williamson added that in the 1980s, Argonne did a series of tests where they put the reactor in a transient condition and then stood back and let the reactor operate. The physics of the system each time took the reactor from that transient condition back to a safe normal operation called a steady state. It was an entire passive safety system, an unprecedented test demonstrating the safety features of the sodium-cooled fast reactor with metal fuel.

Dr. Temitope Taiwo, Deputy Director, Nuclear Engineering Division, Argonne National Laboratory, via conference call, addressed the economics of the proposed plan. He said Argonne’s economic evaluation expectation is that the cost of electricity used by the Gen IV

Systems, relative to that of the Arkansas Light Water Reactor currently operating, would be very similar going forward. Dr. Taiwo said to consider costs of a single Light Water Reactor; there is still additional work to be done with the spent fuel, whereas the Gen IV System alleviates costs by reusing spent fuel. Even at that, consider the implementation cost is on the order of 10% more. Note -- this is the cost of the reactor. The overall fuel cycle costs are very similar in terms of the levelized cost of electricity for each of those two (2) systems. Mr. Warmack noted a two-year timeframe for the U of A to make an initial report for what could be a fifty-year project.

Dr. Donald R. Bobbitt, President, University of Arkansas System, via conference call, said the University of Arkansas exists to serve the State of Arkansas and is ready to do its part.

Mr. Allen said, after listening to the presentation and comments he understands the Commission is being asked to consider making a recommendation to the governor and legislature to provide the necessary wherewithal to turn this subject over to subject matter experts, which would in turn take the technical, accounting, and practical end of this subject and feed that back to the state.

Ms. House made a motion to recommend this information go into the report, and with a second by Mr. Dodge, the motion carried.

This project is complex and the details needed for consensual contract are *beyond the resources of the AAEC*. The path forward is for the AAEC to clear the basic issues, pass the proposed resolution, and support the University of Arkansas System's investigation. The University of Arkansas will be empowered (funded) to solicit input from all interested parties, i.e. environmentalist, nuclear power plant operators, think tanks, National Laboratories, other Universities, anyone that can make a contribution. The work product will be a BRAC (Defense Base Closure and Realignment Commission) type report, in a consensual contract format, that will be submitted to the Arkansas Legislature and the United States Congress for an up or down vote.

The University of Arkansas will be charged with the responsibility to educate the public on these issues.

1) Has this ever been done before? 2) Is this safe? 3) What is the estimated cost of Generation IV electricity compared to today's market price? 4) How large is a nuclear reactor? 5) What happened to the Yucca Mountain Project? Is there any money in the spent fuel trust fund? 6) Has Entergy collected damage awards from the US Court of Claims for breach of contract? 7) Why is the nuclear reactor in Nebraska being closed? Same for Diablo Canyon Power Plant? 8) If this demonstration project works in Arkansas, how many new reactors are needed in the United States?

Arkansas Nuclear One - #1) 864 MW(e) #2) 930 MW(e)

The total fuel discharged from the two reactors through the end of 2016 is approximately 1,500 metric tons of heavy metal.

Fuel Comparison: for 1 kg of material - Heat Energy

Coal 8 kWh 12,400 btu/lb

Oil 12 kWh 125,000 btu/gal

U 235 24,000,000 kWh note (Generation IV can burn U 238 + An>89)

If the two existing Generation II reactors were converted to Generation IV, (using a thermal efficiency of 40%) how many years of fuel is there piled up in the Russellville Arkansas parking lot?

$1,500 \times 10^3 \times 24 \times 10^6 / ((864+930) \times 10^3 \times 24 \times 360) \times .4 = 929 \text{ years}$

929 years + (100,000 year vs. 300 years) environmental isolation.

Mr. Nabholz said there is also a request included to send a letter to the governor, but he would like to see that letter in written form. It is calling for the U of A or any Arkansas Educational

Institution to apply for grants including language for a 90/10 matching. He would like to review and discuss this in a future meeting.

UPDATE ON THE ARKANSAS ALTERNATIVE ENERGY COMMISSION (AAEC) FUTURE RELATIVE TO THE SUNSET DATE Mr. Allen called for discussion of the AAEC sunset date. Ms. House asked members to look at **[Handout 3]**. On line 4, she noted Senator Stubblefield would sponsor it. Mr. Nabholz asked if on the bill, under “alternative fuels”, spent fuel should be added, and Mr. Allen agreed. Mr. Nabholz would also like hydroelectric added under alternative fuels. Mr. Allen asked if Ms. House would take that on, and she agreed.

REVIEW OF THE AAEC 2016 REPORT Members discussed recommendations and revisions to **[Handout 4-A and B]**. **Ms. Potts made a motion to include a recommendation supporting recycling, Ms. House seconded the motion, and it carried. [Handouts 1-A, B, and C] Ms. House made a motion to approve the ACEEE Scorecard [Handout 2] to be entered into the minutes and as an attachment to the letter from the Chairman. Mr. Dodge seconded the motion, and it carried. <http://database.aceee.org/state/arkansas>**

APPENDICIES

A) Act 1301 – An act to create the Arkansas Alternative Commission,03/27/09..	76
B) July 14, 2011 – <i>Legislative Review</i> , 2011 Legislation of Possible Interest to Alternative Energy Commission, 2011, Representative Kathy Webb.....	79
C) October 20, 2011 – <i>Presentation</i> , Strategic Energy Planning for Arkansas, Status Report, Chris Benson, AEDC Energy Policy Advisor.....	80
D) October 20, 2011 – <i>Map</i> , Residential State Energy Code Status as of April 1, 2011 from BCAP.....	98
E) October 26, 2011 – <i>Arkansas Energy Fact Sheet</i> , U.S. Energy Information Administration, (EIA), Commissioner Moreland.....	99
F) February 02, 2012 – <i>Presentation</i> , Bioenergy Opportunities in Arkansas, Jim Wimberly, Bioenergy Systems, LLC.....	106
G) February 29, 2012 – “ <i>State Energy Plan Survey</i> ,” UALR, Institute for Economic Advancement Questionnaire, and Commission Response.....	116
H) April 19, 2012 – <i>Presentation</i> , Building Codes and Loan Funds, Scott Hamilton, Director, Arkansas Energy Office.....	122
I) April 19, 2012 – <i>Presentation</i> , Un-Encumbered Wealth: Liberating Money to Stimulate the Economy / Create Jobs, Michele Halsell, Managing Director, Applied Sustainability Center, UofA Sam M. Walton College of Business (see appendices K).....	128
J) April 19, 2012 – <i>Presentation</i> , Property Assessed Clean Energy (PACE), Mark Robertson, MESA.....	190
K) “State Energy Plan” -- <i>Stakeholder Meeting</i> , Attended Chairman Hauser and Commissioner Lolley, 05/24/12.....	202
L) June 21, 2012 – <i>Presentation</i> , DynamicFuels, Conversion of Fats, Oils & Greases Into Fuel, Andy Rojascki, Vice President of Renewable Energy, Tyson.....	239
M) June 21, 2012 – <i>Presentation</i> , Energy Alternatives for Arkansas, Ben Thorp, Vice President / Board Chairman, Bioenergy Deployment Consortium (BDC)...	259

N) June 21, 2012 – Presentation , Renewable Energy Portfolio Standards, The Big Picture, Kristin Higgins, UofA Division of Agriculture, Public Policy Center.....	282
O) August, 16, 2012 – Presentation , Compressed Natural Gas as a Motor Vehicle Fuel, Michael Gallup, Transportation Manager, SWN.....	302
P) October 18, 2012 – Presentation , Home Energy Performance, The Fifth Fuel, Matt Bell, Viridian.....	308
Q) October 18, 2012 – Presentation , Apprenticeship Going Green, Karen Breashears, President, National Training Program (NAPT).....	309
R) November 16, 2012 – BioEnergy Fact Sheet	312
S) Ark. Code Ann. 23-18-603(6)(b)	314
T) May 23, 2013 – Presentation , Arkansas Waterways, Gene Higginbotham, Executive Director, Arkansas Waterways Commission.....	317
U) May 23, 2013 – Presentation , Arkansas Hydropower Briefing, Lee A. Beverly, Project manager, U.S. Army Corps of Engineers.....	322
V) May 23, 2013 – Presentation , Free Flow Power, Mark Lassman, Director of Energy Trading, Free Flow Power Corporation.....	338
W) September 19, 2013 – Fact Sheet , 2013 Energy Code, J.D. Lowery, Policy and Sustainable Energy Manager, Arkansas Energy Office.....	352
X) September 19, 2013 – Fact Sheet , Energy Code Disclosure Label, J.D. Lowery, Policy and Sustainable Energy Manager, Arkansas Energy Office.....	353
Y) November 21, 2013 – Presentation , Overview of Issues and Initiatives, Steve Patterson, Executive Director, Arkansas Advanced Energy Association.....	354
Z) March 20, 2014 – Presentation , Arkansas Interfaith Power and Light, Ms. Scharmell Roussel, Executive Director, AR Interfaith Power and Light.....	382
AA) March 20, 2014 – Presentation , An Overview of Hydropower, Jeff Leahey, Deputy Executive Director, National Hydro Association.....	412
BB) March 20, 2014 – Fact Sheet , Hydropower: For a clean energy future, Jeff Leahey, Deputy Executive Director, National Hydro Association.....	459

CC) March 20, 2014 – **Presentation**, An Assessment of Energy Potential at Non-Powered Dam Sites in the U.S., Jeff Leahey, Deputy Executive Director, National Hydro Association..... 465

DD) June 19, 2014 – **Presentation**, Domtar, Tom Howard, Government Relations, Domtar Corporation..... 509

EE) September 18, 2014 – **Article**, Kansas Renewable Mandates Repealed, Rep. John Hutchison..... 540

FF) October 20, 2014 – **Fact Sheet**, Arkansas Energy Office 2014 Programs and Priorities, J.D. Lowery, Director, Arkansas Energy Office..... 541

GG) October 22, 2015 – **Presentation**, Impact of Current Regulations on Electrical Generating Facilities: Andrew Lachowsky, Arkansas Alternative Energy Commission, Commissioner

HH) November 19, 2015 – **Presentation**, Integrated Building Technologies: Mr. David Dodge, Arkansas Alternative Energy Commission, Commissioner

II) December 10, 2015 – **Presentation**, Hydroelectric Power Generation: Gene Higginbotham, Director, Arkansas Waterways Commission.....

JJ) December 10, 2015 – **Presentation**, Update on Arkansas Public Service Commission Initiatives, John Bethel, Executive Director, Arkansas Public Service Commission.....

KK) December 10, 2015 – **Presentation**, Review of Arkansas Energy Office Plans: Mitchell Simpson, Director, Arkansas Energy Office, Arkansas Economic Development Commission.....

LL) February 18, 2016 – **Presentation**, Examples of Alt. Energy Concepts and Projects in Arkansas: Stuart Spencer, Deputy Director of Air Quality, AR Dept. of Environmental Quality. Tori Gordon, Policy Advisor to the Governor; Representative Bob Ballinger, House Co-Chairman, Joint Energy Committee.....

MM) June 16, 2016 – **Presentation**, Act 2 of the Third Extraordinary Session 2016 Discussion: Michael Feehan, Legislative Attorney, Bureau of Legislative Research

- NN) July 28, 2016 – **Presentation**, Arkansas Real Clean Energy Economy: Frank Kelly, Solar Source Consulting.....
- OO) July 28, 2016 – **Presentation**, State Fleet Management: Jake Bleed, Office of Administrative Services, Arkansas Department of Finance and Administration
- PP) August 25, 2016 – **Presentation**, How to Reduce Carbon Dioxide Pollution, Create Jobs, Grow the Economy & Improve Health: Robert McAfee, Arkansas Citizens Climate Lobby.....
- QQ) August 25, 2016 – **Presentation**, Metal Roofing with Solar: Ken Gieseke, McElroy Solar.....
- RR) August 25, 2016 – **Presentation**, Building a Better Tomorrow: Peter Rienks, Innovateus Solar.....
- SS) September 29, 2016 – **Presentation**, American Electric Power – Southwestern Electric Power Company’s Approach to Renewable Modeling: Scott Fisher, Resource Planning Manager, American Electric Power.....
- TT) October 27, 2016 – **Presentation**, Green and Sustainable in the Future: Don Curren and Cherie O’Mary, Executive Director, Arkansas Recycling Coalition
- UU) December 08, 2016 – **Presentation**, “Is it waste or fuel?” John Warmack

ACRYNOMS & ABBREVIATIONS

AAEA	Arkansas Advanced Energy Association
AAEC	Arkansas Alternative Energy Commission
ACEEE	American Council for an Energy Efficient Economy
AECC	Arkansas Electric Cooperative Corporation
AEO	Arkansas Energy Office
AEP	American Electric Power
ADFA	Arkansas Development Finance Authority
ADED	Arkansas Department of Economic Development
AEDC	Arkansas Economic Development Commission
AESP	Arkansas Energy Sector Partnership
APSC	Arkansas Public Service Commission
ARC	Arkansas Recycling Coalition
ARRA	American Recovery and Reinvestment Act of 2009
ASC	Applied Sustainability Center
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning
AWC	Arkansas Waterways Commission
BGY	Billion Gallons per Year
BLM	Bureau of Land Management
BRAC	Defense Base Closure & Realignment Commission
CCL	Arkansas Citizens Climate Lobby
CCP	Clean Power Plan
CDBG	Community Development and Block Grant
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
COE	Cost of Energy
CREBS	Clean Renewable Energy Bonds (Federal)
DOE	U.S. Department of Energy

EBR-2	Experimental Breeder Reactor II
EE	Energy Efficiency
EERS	Energy Efficiency Resource Standard
EPA	U.S. Environmental Protection Agency
EIA	Energy Information Administration [U.S. DOE]
EISA	Energy Independence and Security Act of 2007
FERC	Federal Energy Regulatory Commission
FFP	Free Flow Power
FPA	Federal Power Act of 1920
FPC	Federal Power Commission (Now called FERC)
GHG	Greenhouse Gas
GCGW	[Arkansas] Governor's Commission on Global Warming
HB	House Bill
HEC	Hydrologic Engineering Center
HERS	Home Energy Rating Index Score
HREA	Hydropower Regulatory Efficiency Act of 2013
HVAC	Heating Ventilation and Air-Conditioning
IECC	International Energy Conservation Code
IFR	In-Forest Residues
IPL	Arkansas Interfaith Power & Lighting
IRP	Integrated Resource Planning
ITC	Investment Tax Credit
kW	Kilowatt
kWh	Kilowatt-hour
LLR	Loan Loss Reserve
LNG	Liquefied Natural Gas
MGY	Millions of Gallons Per Year
MPG	Miles Per Gallon
MW	Megawatt [one thousand kilowatts]

MWh	Megawatt-hour [one thousand kilowatt-hours]
NAPT	National Training Program
NG	Natural Gas
NGO	Non-Governmental Organization
NHA	National Hydropower Association
NREL	National Renewable Energy Laboratory [US DOE]
NRI	National Resources Inventory [USDA]
NFS	National Sciences Foundation
O&M	Operation and Maintenance
OSP	Office of State Procurement
PACE	Property Assessed Clean Energy
PSC	Public Service Commission
PTC	Production Tax Credit (Expired in 2013)
PURPA	Public Utility Regulatory Policies Act of 1978
PV	Photovoltaic
QECB	Qualified Energy Conservation Bond
R&D	Research and Development
RE	Renewable Energy
REC	Renewable Energy Certificate
REFIT	Renewable Energy Feed-in Tariff
REMI	Regional Economic Models Inc.
RFS	Renewable Fuel Standard
RPS	Renewable Portfolio Standard
RLF	Revolving Loan Fund
SB	Senate Bill
SEER	Seasonal Energy Efficiency Ratio
SPP	Southwest Power Pool
SWPA	Southwestern Power Administration
SWEPSCO	Southwestern Electric Power Company

T&D	Transmission and Distribution
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
USGBC	U.S. Green Building Council
WPA	Water Power Act of 1920
WTE	Waste To Energy