State of Arkansas
Energy Assurance Plan

Prepared by the Arkansas Energy Office

ARKANSAS
Economic Development Commission
ENERGY OFFICE

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Arkansas Energy Assurance Plan

Table of Contents

Expanded Table of Contents

Appendices

1. Executive Summary

One of the goals of the American Recovery and Reinvestment Act of 2009 is to "**facilitate recovery from disruptions to the energy supply**" and to provide "**enhanced reliability and quicker repair of outages**." All states are being asked to develop standardized energy assurance and resiliency plans that can be relied on during energy supply disruptions and energy emergencies.

The production facilities, transportation networks, storage, and distribution infrastructure that comprise Arkansas's energy sector represent both a key economic asset and a significant vulnerability. Arkansas's economy depends heavily on the availability and reliability of a resilient and responsive energy infrastructure. Our state's diffuse energy infrastructure—with many pipelines, transmission lines, and electricity substations running through sparsely populated areas—makes the energy industry susceptible to a variety of hazards, including technological failures, severe weather, sabotage (both physical and cyber), and natural disasters such as earthquakes.

The Governor is ultimately responsible for preparing and responding to energy emergencies in Arkansas. However, the ability of the Governor to ensure the security and resiliency of the energy sector, which is largely privately owned, is limited by a lack of regulatory and statutory authority. There are a number of steps that the Governor can take to ensure Arkansas is well-positioned to respond to electrical blackouts, oil and gas shortages, and other energy-related crises. This Energy Assurance Plan will help contribute to the resiliency of the state's energy sector, including the electricity grid, by focusing on the entire energy supply system, which includes refining, storage, and distribution of fossil and renewable energy.

There are many stakeholders in Arkansas's energy sector; in fact, all Arkansans are essentially energy stakeholders because we all depend and rely on all forms of energy to power our lives. In the context of Energy Assurance, a stakeholder is defined as a person or organization that provides or distributes some form of energy to end-use customers. The Energy Assurance Plan will provide a clear understanding of the roles and responsibilities of each stakeholder, and this information will be available to all other stakeholders. This will help to clarify the relationships among energy sectors and provide a more comprehensive planning framework.

The Energy Assurance Plan is not an energy emergency plan, although it will be referenced in the *Arkansas Emergency Operations Plan*. Emergency coordination is a function of the Arkansas Department of Emergency Management (ADEM). The Arkansas Public Service Commission (APSC) and the Arkansas Energy Office (AEO) are both available to assist ADEM during an emergency.

The Energy Assurance Plan will provide: a vehicle for documenting and understanding our state's energy infrastructure; an updated list of contact information for all energy stakeholders; an evaluation of the risks, vulnerabilities, and interconnected issues of all sources of energy; and the future roles and impacts of renewable technologies combined with the integration and expansion of Smart Grid technologies into the electric systems of Arkansas and the surrounding region.

The Energy Assurance Plan will allow informed decisions to be made about new technological developments in areas such as Smart Grid, cyber security, critical utility infrastructure, and the integration of renewable energy into the power grid. The Plan will enhance existing energy monitoring and emergency response capabilities, and will complement national efforts on standards for Smart Grid

and cyber security. The Plan will enable Arkansas to mitigate the consequences to its citizens, businesses, and industries from energy disruptions and reduce the economic and physical impacts that might result from an energy disruption.

2. Acronyms and Definitions

Helpful Acronyms

Advanced Metering Infrastructure (AMI)
Association of Arkansas Counties (AAC)
Arkansas Economic Development Commission (AEDC)
Arkansas Electric Cooperative Corporation (AECC)
Arkansas Electric Cooperatives, Inc., (AECI)
Arkansas Energy Office (AEO)
Arkansas Public Service Commission (APSC)
American Recovery and Reinvestment Act (ARRA)
Arkansas State Highway and Transportation Department (AHTD)
Automated Meter Reading (AMR)
CAIDI (Customer Average Interruption Duration Index)
Combined Heat and Power (CHP)
Compressed Natural Gas (CNG)
Department of Emergency Management (ADEM)
Department of Energy (DOE)
Electric Distribution Companies (EDC)
Electric Power Research Institute (EPRI)
Electromagnetic Pulse (EMP)
Emergency Operations Center (EOC)
Emergency Support Function (ESF)
Energy Information Administration (EIA)
Energy Supply Disruption Tracking Process (ESDTP)
Independent Coordinator of Transmission (ICT)
Infrastructure Security and Energy Restoration (ISER)
Investor Owned Utility (IOU)
Liquefied Natural Gas (LNG)
Liquefied Petroleum Gas (LPG)
Local Distribution Company (LDC)
National Association of Counties (NACO)
National Association of Regulatory Energy Commissioners (NARUC)
National Association of Regulatory Utility Commissioners (NARUC)
National Association of State Energy Offices (NASEO)
National Center for Reliable Electric Power Transmission (NCREPT)
National Conference of State Legislators (NCSL)
National Governors' Association (NGA)
National Infrastructure Protection Plan (NIPP)
National Institute of Standards and Technology (NIST)
National Renewable Energy Laboratory (NREL)
North American Electric Reliability Corporation (NERC)
Office of Electricity Delivery and Energy Reliability (OEDER)

Office of Pipeline Safety (OPS) *Federal*
Phasor Measurement Units (PMU)
Pipeline Safety Office (PSO) *State*
Prognostic Health Management (PHM)
Public Information Officer (PIO)
Regional Entity (RE)
Regional Transmission Organization (RTO)
Renewable Technology Rebate Fund (RTRF).
SAIDI (System Average Interruption Duration Index)
SAIFI (System Average Interruption Frequency Index)
State's Emergency Operations Center (SEOC)
Southeastern Electric Reliability Council (SERC)
Southwest Power Administration (SPA)
Southwest Power Pool (SPP)
Southwestern Electric Power Company (SWEPCO)
Supervisory Control and Data Acquisition (SCADA)
U.S. Bureau of Labor Statistics (BLS)
U. S. Green Building Council (USGBC)
U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA)

Legal Definitions
When used in these regulations:

"Act" means the Emergency Petroleum Set-Aside Act ACA 15-72-801 et.seq.

"Agricultural Activities" means commercial farming, dairy, poultry, livestock, horticulture, forestry and aquaculture activities and services directly related to the planting, cultivation, harvesting, milking, processing and distribution of fiber, timber and food intended for human consumption and animal feed.

"Assignment" means an action taken by the Arkansas Energy Office, designating that a prime supplier or broker of petroleum products supply them to an authorized consumer, dealer, wholesale purchaser-consumer or wholesale purchaser-reseller to facilitate relief of emergency or hardship needs pursuant to ACA 15-72-804 of the Act.

"Blended Fuels" are mixtures composed primarily of gasoline or diesel fuel that may have additional alternative fuels blended into the petroleum products in varying percentages. For diesel fuel, B2, B5, B20 or similar conventional/biodiesel blends shall be considered to be diesel fuel. For gasoline, E10 or similar gasoline/ethanol blends shall be considered to be gasoline.

"Broker" means a marketer of petroleum products who performs none of the basic marketing functions but normally brings buyer and seller together and receives a fee or commission for his services.

"Bulk User" means any firm that is an ultimate consumer which, as a part of its normal business practices, purchases or obtains a product subject to the state set-aside from a supplier and receives delivery of that product into a storage tank substantially under the control of that firm at a fixed location.

“Consumer” or “End User” means any individual, trustee, agency, partnership association, corporation, company, municipality, political subdivision or other legal entity which purchases petroleum products for ultimate consumption in Arkansas.

“Dealer” or “retailer” means and includes any person or firm engaged in the business of selling petroleum products at retail.

“Director” means the Director of the Arkansas Energy Office who serves under the consent of the Executive Director of the Arkansas Economic Development Commission.

“Electronic transmission” means any process of communication that does not directly involve the physical transfer of paper and that is suitable for the retention, retrieval and reproduction of information by the recipient.

“Emergency” or “Hardship” means any situation which, in the judgment of the Arkansas Energy Office, presents a threat to the economic, social or personal welfare of the areas, regions or individual users for which an assignment from the state set-aside is requested.

“Emergency Services” means vital services, including but not limited to, law enforcement, firefighting, medical care, sanitation, etc.

“Executive Director” means the Executive Director of the Arkansas Economic Development Commission.

“Firm” means any association, company, corporation, estate, individual, joint venture, partnership, or sole proprietorship or any entity however organized, including charitable, or education institutions and the Federal Government, including federal corporations, departments and agencies and state and local governments.

“Industrial Activities” means all industrial activities which create or change materials into another form as well as commercial activities involving the sale of goods and services.

“Jobber of Petroleum Products” means any firm or any part or subsidiary of any firm, other than the United States Department of Defense, which supplies, sells, transfers, or otherwise furnishes any allocated product to wholesale purchasers or end-users.

“Petroleum Products” means propane, motor gasoline, blended fuels, kerosene, #2 fuel oil, diesel fuel, kerosene-base jet fuel, naphtha-base jet fuel, and aviation gasoline.

“Petroleum wholesaler” means any firm or any part or subsidiary of any firm, other than the United States Department of Defense, which supplies, sells, transfers, or otherwise furnishes any allocated product to wholesale purchasers or end-users.

"Prime Supplier" means the supplier which makes the first sale of any petroleum product subject to the state set-aside into the state distribution system for consumption within the state. Not with-standing the above, "prime supplier" shall not include any firm, or any part or subsidiary of any firm, which supplies, sells, transfers or otherwise furnishes any allocated product exclusively to utilities for generation of electric energy.

"Purchaser" means a wholesale purchaser or consumer, or both.

"Reference Month" means the calendar month and year to which the reported information on actual sales volume relates.

"Set-Aside" means, with respect to a particular prime supplier, the amount of petroleum product which is made available from the total supply of a prime supplier, pursuant to the provisions of ACA 15-72-804 of the Act, for utilization by the Arkansas Energy Office to resolve emergencies and hardships due to shortages or other dislocations in petroleum distribution systems.

"Supplier" means any firm or any part or subsidiary of any firm other than the United States Department of Defense, which supplies, sells, transfers or otherwise furnishes any allocated product to wholesale purchasers or end-users, including but not limited to refiners, importers, resellers, brokers, jobbers and retailers. Notwithstanding the above, "supplier" shall not include any firm, or any part or subsidiary of any firm, which supplies, sells, transfers or otherwise furnishes any allocated product exclusively to utilities for generation of electric energy.

"Undue Economic Burden" means, as used in ACA 15-72-804 (d) (2) (B) of the Act, any assignment which, in the judgment of the Arkansas Energy Office, creates an extraordinary and financially prohibitive burden on a prime supplier or broker. Such judgments by Arkansas Energy Office personnel shall take into account written evidence of such a burden furnished by the prime supplier or broker involved.

"Wholesale Purchaser" means a wholesale purchaser-reseller or wholesale purchaser-consumer, or both.

"Wholesale Purchaser-Consumer" means any firm that is an ultimate consumer which, as a part of its normal business practices, purchases or obtains a product subject to the state set-aside from a supplier and receives delivery of that product into a storage tank substantially under the control of that firm at a fixed location.

“Wholesale Purchaser-Reseller" means any firm, including dealers, which purchases, receives through transfers or otherwise obtains, as by consignment, a product subject to the state set-aside and resells or otherwise transfers it to other purchasers without substantially changing its form.

3. Legal Authorities and Stakeholders

Arkansas has several statutes governing the development of energy assurance planning, the declaration of an energy emergency, and various powers and additional responsibilities for managing energy emergencies. The primary statute establishing energy emergency planning is the statute creating the Arkansas Energy Office (AEO) – the *Arkansas Energy Reorganization and Policy Act* (1981). Emergency issues pertaining to motor gasoline, diesel, kerosene, aviation gasoline, kerosene, and naphtha base jet fuels and propane are assigned to the AEO. It is the primary responsibility of the AEO to carry out the Energy Assurance Plan in accordance with other state and federal mandates. The AEO is responsible for oversight of energy planning throughout the state and for monitoring energy usage with an eye toward assurance for all residents and companies. Regulation of electric and natural gas utilities, including resource planning, rates, reliability, service restoration, and operations, lies within the jurisdiction of the

Arkansas Public Service Commission (APSC). Overall emergency planning and management is assigned by the Arkansas Department of Emergency Management (ADEM).

Energy resilience related to energy assurance is authorized in several energy utilization and conservation laws, including state building energy temperature management, energy efficiency loan programs, state energy codes for building construction and energy efficiency and renewable energy responsibilities assigned to the APSC[1]

This section focuses on those portions of the statutes that relate to energy assurance management, sometimes identified in Arkansas law as "energy emergency" or "energy crisis," and those agencies that implement the statutes. Other governmental stakeholders are also noted in relation to their participation in energy matters. The principal material covered includes the statutes and regulations governing the declaration of an energy emergency and the operational responsibilities emanating from such declarations.

3.1. Principal Energy Assurance Statutes and Designated Agencies

3.1.1. Arkansas Energy Reorganization and Policy Act of 1981

The *Arkansas Energy Reorganization and Policy Act* (1981) (§15-10-201) placed the AEO into the Arkansas Economic Development Commission (AEDC). The Act allowed the AEO to retain much of its historical responsibilities. The Office (also called the Division or agency) has several major responsibilities. While all of these can be interpreted as supporting energy assurance, only those that relate to energy emergency management are listed below.

Section 15-10-205(a) states that: "The Arkansas Energy Office shall coordinate authority and planning by the state in energy-related matters and shall have the following duties and responsibilities":

- §15-10-205(a) (1), Coordinate energy matters between and among all state agencies
- §15-10-205(a) (2), Compile a supply and demand energy profile that includes both renewable and nonrenewable energy resources
- §15-10-205(a) (3), Compile data "to allocate the distribution of" motor, aviation, heating oil, and propane fuels by "wholesale jobbers and dealers within the state."[2]
- §15-10-205(a) (4), Collect "data on planning and administering emergency plans, when needed, for the conservation or rationing of motor fuels"
- §15-10-205(a) (9), Administer various federal laws, regulations, and "program functions"
- §15-10-205(a) (10), Reduce "wasteful, inefficient uses of energy;"
- §15-10-205(a) (11), Promulgate rules and regulations in order to implement "thermal and lighting efficiency standards for new building construction"
- §15-10-205(a) (12), Develop and propose similar programs for state-owned buildings and building leases
- §15-10-205(a) (13), Enhance public awareness of energy efficiency and renewable energy through appropriate programs

The Office also has the authority to:

[1] See *Energy Conservation Endorsement Act (*1977) and the *Arkansas Renewable Energy Development Act* (2001).
[2] Quotation marks are taken directly from document. Other text is paraphrased.

- §15-10-205(b) (3)(A), Implement and prescribe enforcement for thermal and lighting efficiency standards in new construction
- §15-10-205(b) (3)(B), Require cities and counties that issue new building construction permits to adopt the Arkansas Energy Code for New Building Construction
- §15-10-205(b) (4), Propose programs to implement the afore noted improvements
- §15-10-205(b) (5), "Promulgate rules and regulations for the purpose of administering emergency plans as referred to in subdivision (a) (4) of this section"

In §15-10-206, the statute states:

> "All other state agencies shall cooperate and coordinate with the Energy Office to the utmost degree within the range of action permissible within statutory authority."

3.1.2. Arkansas Petroleum Set-Aside Program

The *Arkansas Emergency Petroleum Set Aside Act 377* (§15-72-801 et.seq, -- See Appendix A) is central to the AEO's authority for mitigating petroleum emergencies. The state petroleum set-aside program is complimented by two other pieces of legislation. One is an exemption to Freedom of Information Act requirements for information gathered in carrying out the state set-aside (§15-72-805). Another is a recent addition (Act 1196, 2009) to §15-10-205 (a) (3) adding data collection for aviation gasoline to those already authorized for allocation under the set-aside.

This set-aside program is important for two additional reasons. The first is that the state has provided statutory authority for implementing a petroleum product emergency distribution program in the event of a major petroleum supply shortage. Second, it sets up a process through which the AEO can exercise other critical aspects of its emergency mitigation capabilities. In the first aspect, the AEO has developed rules and regulations for the operation of the set-aside. The second aspect of the set-aside requires some clarification.

A reading of §15-10-201, et seq. indicates that the AEO has emergency responsibilities that extend beyond petroleum. In 15-10-202 (2-5), the Declaration of Policy and findings note that:

> "(2) Arkansas must promote the efficient use of energy and the development of a reliable and economic energy delivery system which includes the use of renewable energy resources as well as conventional sources of energy such as coal, lignite, uranium, oil, and natural gas;
> (3) The need exists for comprehensive state leadership to ensure the wise and efficient production, distribution, use, and conservation of energy;
> (4) Only an agency with comprehensive duties and powers can collect, analyze, and disseminate information necessary to promote a reliable and efficient energy delivery system for the state;
> (5) It is in the best interest of the citizens of this state to establish a division within the Arkansas Economic Development Commission to coordinate the planning and execution of comprehensive energy conservation programs; and
> (6) The development and use of a diverse array of energy resources must be encouraged."

This language indicates that the AEO was created to provide oversight of petroleum products, and to promote the efficient use of renewable resources, as well as conventional sources such as coal, lignite, uranium, and natural gas (see (2)). Subsections three through five reinforce the concept of general oversight, especially with the language in subsection five declaring that a division should be created "to coordinate the planning and execution of comprehensive energy conservation programs."

Powers and duties contained in §15-10-205, et seq. are less expansive but do give the AEO authority to coordinate "energy matters" among all state agencies (subsection one). While other subsections appear to restrict the agency's data gathering powers to petroleum products and renewable energy, subsection nine gives the agency authority to "carry out energy-related administrative and program functions established and required by federal law, regulations and guidelines."

The last section of the statute provides some additional clarification (see §15-10-206 above) by requiring all other state agencies to cooperate and coordinate with AEO. From this it appears that AEO has a central role in all state energy policy discussions even though it does not have the responsibilities and authority to regulate the state's electric and natural gas industries. Above all, however, it is clear that the legislature intended for all state entities managing energy matters to work closely with the AEO.

3.1.3. The Arkansas Public Service Commission (APSC)

The APSC is a proactive, solutions oriented agency that maximizes customer value and enhances the economic environment of the state. The APSC regulates the intrastate rates and services of the public utilities in Arkansas. These utilities provide electricity, natural gas, water, telephone and pipeline safety services.

The APSC is authorized in Title 23, *Public Utilities and Regulated Industries* (Arkansas Code of 1987, updated February 23, 2010). Among the utilities subject to the APSC's jurisdiction, the Commission regulates 22 electric companies in the state: four investor owned electric utilities (IOU), one generation and transmission cooperative, and 17 distribution cooperatives. It also regulates four natural gas utilities. There are municipal electric and natural gas utilities that are not regulated by the APSC; these will be covered in subsequent sections of the Plan.

Title 23 empowers the APSC to regulate the operations of jurisdictional utilities to ensure that electric and natural gas utilities provide safe and reliable service at a reasonable price. The Commission regulates the rates charged by the electric and natural gas utilities to ensure that the rates are reasonable and that the utilities have a reasonable opportunity to recover their reasonable and prudent costs of providing service and to earn a reasonable profit. The APSC also regulates the operations of the utilities to provide system reliability. The APSC addresses utility rates, system integrity, infrastructure protection, emergency preparedness and management, and system restoration.

Title 23 provides the APSC broad authority to regulate utility operations. The Title contains provisions that cover the entire process from generating or otherwise acquiring bulk power or natural gas to establishing and managing monitoring of supply, demand and infrastructure as well as designing and acquiring transmission capacity to meet growing demand and maintaining complex systems designed to distribute and deliver electricity and natural gas to end users. These parts of the law govern those aspects of the state electricity and natural gas markets that relate directly to energy assurance.

Safety, restoration and other priorities related to the provision of safe and reliable utility service at reasonable rates are included in the Arkansas statutes governing utility operation. These cover energy reliability issues attendant to a utilities obligations. Additionally, the APSC's General Service Rules, Special Rules – Electric, Special Rules – Gas, Resource Planning Guidelines, and Natural Gas Procurement Plan Rules set forth requirements to ensure that electric and natural gas utility facilities are constructed

and operated in a manner to ensure safe and reliable service. Further, those rules also include provisions to require the electric and natural gas utilities to develop plans to restore service in the event of any disruption of service or outage. The APSC's regulation of the electric and natural gas utilities includes provisions to ensure that the utilities have adequate facilities, supplies of electric and natural gas, and are prepared to meet the needs of their customers and to provide safe and reliable utility service. Each electric and natural gas utility maintains specific plans to address the restoration of service in the event of an outage or disruption of service.

To provide additional options for the electric utilities to address the financial impact of storm damage on their systems, the Arkansas General Assembly passed Act 434 of 2009 (Ark. Code Ann. (§23-4-112) which permits utilities to establish storm reserve accounting. Additionally, the Arkansas General Assembly also passed Act 729 of 2009 (§23-20-101 et seq.) which allows electric utilities to issue bonds secured by future storm cost recovery-related payments from consumers.

The APSC is also authorized to consider and approve energy efficiency and conservation programs pursuant to the *Energy Conservation Endorsement Act of* 1977 (Ark. Code Ann. §23-3-401 et seq.). The APSC has established Rules for Conservation and Energy Efficiency Programs and has approved a number of programs offered by the electric and natural gas utilities. Under the Commission's oversight, the electric and natural gas utilities continue to develop conservation and energy efficiency programs.

The General Assembly also passed the *Arkansas Renewable Energy Development Act of* 2001 (Ark. Code Ann. §23-18-601 et seq.) which requires the electric utilities to establish procedures to permit net metering by customers with certain renewable energy facilities designed to serve all or part of the customer's load. The Arkansas General Assembly also passed the Arkansas Clean Energy Development Act of 2007 (Ark. Code Ann. §23-18-701 et seq.) which requires all electric utilities to consider clean and renewable energy resources in the development of their resource plans.

Pursuant to Ark. Code Ann. §23-15-201 et seq., the APSC's Pipeline Safety Office routinely inspects all jurisdictional natural gas facilities in Arkansas to ensure compliance with the provisions of the federal and state pipeline codes. The provisions of the federal and state pipeline codes ensure that jurisdictional natural gas utilities and operators construct, operate, and maintain their facilities to ensure safe and reliable service and, consequently, to avoid outages and interruptions of service. The APSC's Pipeline Safety Office works closely with the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration to ensure the safe operation of natural gas facilities within Arkansas.

Figure 3.1 presents a listing of the APSC's rules governing utilities operating within Arkansas.

Figure 3.1 - Arkansas Public Service Commission Rules and Forms - Rules

Title	Group
Pole Attachment Rules	Cable, Electric, Tel.
Cogeneration Rules	Electric
Net Metering Rules	Electric
Resource planning guidelines for electric utilities	Electric
Rules of Practice & Procedure Appendix A	Electric
Special Rules Electric	Electric
Transition Cost Guidelines	Electric

Title	Group
Natural Gas Procurement Plan Rules	Electric, Gas
Rules and Regulations governing promotional practices of electric and gas public utilities	Electric, Gas
Rules and Regulations governing promotional practices of electric and gas public utilities - California manual	Electric, Gas
Rules for Conservation and energy efficiency programs	Electric, Gas
Affiliate Transaction Rules	Electric, Gas, Water
Arkansas One Call Center Rules	Electric, Gas, Water
General Service Rules	Electric, Gas, Water
Rules of Practice & Procedure Appendix A	Electric, Gas, Water
Rules of Practice & Procedure	Electric, Gas, Water, Tel .
Arkansas Gas Pipeline Code	Gas
Arkansas Gas Pipeline Code	Gas
Special Rules Gas	Gas
*The APSC also has authority over cable, telephone and water utilities	
Source: Arkansas Public Service Commission ***http://www.apscservices.info/rules_select2.asp***	

3.1.4. Pipeline Safety Office (PSO)

Title 23-15-204 authorizes the APSC to work closely with the federal Office of Pipeline Safety (OPS) to regulate natural gas pipelines safety. Arkansas gas pipeline regulations are contained in the *Arkansas Gas Pipeline Code*.[3] This Code focuses on natural gas pipelines only and covers the following areas:

- Enforcement Procedures (Part 190)
- Annual and Incident Reports (Part 191)
- Minimum Safety Standards (Part 192)
- Liquefied Natural Gas Facilities (Part 193)
- Drug and Alcohol Testing (Part 199).[4]

The PSO, like all other state pipeline safety offices, works closely with the federal OPS. The state office monitors and enforces safety for 2,081 miles of intrastate gas transmission and gathering lines, 17,692 miles of gas distribution mains, and 641,830 gas service lines. The PSO also monitors and enforces safety for four natural gas distribution utilities (Local Distribution Companies (LDCs)), 26 intrastate operators, and 331 master meters (single location meters) for a variety of multi-dwelling facilities. [5]

3.1.5. The Arkansas Department of Emergency Management (ADEM)

Arkansas Code, Title 12, *Law Enforcement, Emergency Management, and Military Affairs,* is the state's central emergency management statute. The Governor is granted broad powers to suspend legal provisions and "utilize all available resources" to mitigate the impact of emergencies (§12-75-114).These powers include executive orders, proclamations and regulations that "suspend or limit the sale, dispensing, or transportation of…combustibles;" (§12-75-114 (e) (8)).

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[3] Arkansas Public Service Commission, *Arkansas Gas Pipeline Code,* Revision of May 5, 2009 (08-167-R).
[4] These numbered sections correspond to numbered sections of Title 49, Code of Federal Regulations, Pipeline Safety Regulations.
[5] Arkansas Public Service Commission, *Pipeline Safety Office*, Home Page, http://www.apscservices.info/PSOIndex.asp

ADEM is established in Title 12 to be the state's primary agency in charge of preparing and managing the Arkansas Emergency Operations Plan. Its duties are broad and include a wide variety of emergency management tools including those that could support the aftermath of a severe energy emergency. Examples include coordination among stakeholders, communications, land-use controls, inter-governmental affairs, mobile support, temporary housing, congregant care, and assistance.

The *Arkansas Hazardous and Toxic Material Emergency Notification Act* (1991-- See *Arkansas Emergency Operations Plan* annex, Emergency Support Function #10 [ESF #10 *Oil and Hazardous Materials Response Annex]*), created reporting requirements for reacting to the release of materials that include fuels, all of which are hazardous and often toxic to one degree or another (§1-79-101 to 106). The agency is also responsible under the *Arkansas Earthquake Preparedness Act* (1989) to manage an earthquake preparedness program that includes mitigation and restoration functions applicable to energy resources.

ADEM maintains the State's Emergency Operations Center (SEOC), at which agencies involved in mitigation and recovering from a severe energy emergency would be able to meet and coordinate under one roof. Paralleling the Federal Response Framework, Arkansas has Emergency Support Function (ESF) #12 *Energy Annex* in the *Arkansas Emergency Operations Plan*, which spells out agency and stakeholder responsibilities in the event of an energy emergency. The ESF #12 *Energy Annex* is the central document governing the state's response to an energy crisis.

3.1.5.1. Emergency Support Function #12 Energy Annex (ESF #12)

ADEM selected the APSC as the Coordinator of ESF #12 (see Appendix B Emergency Support Function #12 – Energy Annex). AEDC -- AEO is the first listed Support Agency for ESF #12, followed ADEM and others. This ESF designates the "continuous and reliable energy supplies" as the primary emergency concern for the state. It also highlights "preventive measures as well as restorative actions" as essential. These designations are also key aspects of the APSC's statutory responsibility.

The APSC Staff has established contacts with electric and natural gas utilities to obtain outage information in the event of any service interruption. ESF-12 of the state emergency plan identifies interaction with state and emergency officials, including the Arkansas Department of Emergency Management, to share information. The Commission's Consumer Services Section also interacts with individual customers to provide information and resolve questions during emergency or outage situations. When the EOC is activated, there are frequently APSC Staff physically present in the EOC.

The AEO collects similar data directly from petroleum companies. Its authority in this regard is tied to that inherent in managing a state petroleum set-aside. The AEO does collect data on monthly petroleum deliveries from all major suppliers within the context of the EIA 782C data collection program. This data, plus that obtained from the media, state industry associations and through special DOE sources (see ISERnet below) is reported to the governor if there a supply problem is identified. As discussed in the Petroleum Section, there are other steps that the AEO can take to mitigate the severity of a shortage before turning to the set-aside.

The stated purpose of this ESF is "to restore damaged energy systems and components during a potential or actual disaster."

The statement of "scope" following the "purpose" includes data gathering and information sharing for several defined energy delivery and system components such as producing, refining, transporting, generating, transmitting, conserving, building, distributing and maintaining.

The goal stated under "policies," is to retain normal system operations. This effort states that ESF #12:

- Maintains lists of critical energy assets, continuously monitors them, and "addresses significant disruptions in energy supplies for any reason, whether caused by physical disruption of energy transmission and distribution systems or unexpected operational failure of such systems."
- Recognizes "the impact that damage to an energy system in one geographic region may have on energy supplies, systems, and components in other regions relying on the same system. Consequently, energy supply and transportation problems can be intrastate, interstate, and international."

The ESF #12 is to "serve as the focal point within State Government" for monitoring system operation and potential damage to "energy supply and distribution systems." The listed sources of this information highlight data that can be obtained from media, the U.S. Department of Energy (DOE), APSC, regional transmission organization (RTO), utility companies, electric reliability organizations, ADEM, and "warnings" from components of the petroleum industry.

The list of ESF #12 duties under "Concept of Operation" covers a variety of potential situations:

- Serve as the focal point within State Government regarding requirements for system design and operations, and on procedures for preparedness, prevention, recovery, and restoration
- Advise State and local authorities on priorities for energy restoration, assistance, and supply
- Assist industry, State, local, and tribal authorities with requests for emergency response actions as they pertain to the State's energy supply
- Assist departments and agencies by locating fuel for transportation, communications, and emergency operations
- Recommend actions to conserve fuel and electric power
- Provide energy supply information and guidance on the conservation and efficient use of energy to State and local governments and to the public

The first of these is specific to the regulated electric and natural gas industries. The rest define the potential scope of help that can be rendered through ESF #12. The ESF #12 recognizes the limitations of assistance when it acknowledges under "Private Sector" that:

- "The private sector owns and operates the majority of the State's energy infrastructure and participates along with the APSC in developing best practices for infrastructure design and operations.
- The private sector normally takes the lead in the rapid restoration of infrastructure-related services after an incident occurs. Appropriate entities of the private sector are integrated into ESF #12 planning and decision making processes."

The petroleum industry is not included in the ESF #12 as part one of the entities of the private sector. Local government and the electric and natural gas utilizes are noted, however.

Throughout that section of the ESF #12 titled *Organization-Actions*, the primary focus of the document is on the energy outage responsibilities of the APSC. The bulk of the ESF #12 is aimed at interruptions in the continuity of electric and natural gas service. The ESF #12 does relate to "fuel movement into shortage areas, equitable resource distribution," "location of fuel supplies (primarily gasoline and diesel fuels)," the availability of fuel for evacuation and for government activities and emergency response. But the level of participation for the petroleum industry is entirely indirect while the requirements for the electric and natural gas utilities are more specific, in keeping the relative status of these energy sources within the state's regulatory capacity.

The ESF #12 also designates the obligations of the lead and supporting agencies to manage an emergency from the State Emergency Operation Center. Elements of energy curtailment and reduced consumption by conservation are noted. In the latter, the ESF #12 takes note of conservation measures including: reducing vehicle speed, shorting the work week, and telecommuting. Examples of these measures are in Section 8.4 and Appendix M.

3.1.5.2 Arkansas Energy Office Activities

The list of Support Agency activities is on Figure 3.2. The activities assigned to the AEO are noted here.

- **Implement AEO's established plans and procedures for responding to an energy crisis**
  This Energy Assurance Plan will guide AEO in assisting APSC and ADEM in managing an energy shortage. This Plan will provide AEO with an introduction to energy market considerations that reinforces its own operating experience. Such information, and the stakeholder contacts it contains, will abet emergency responders.

- **Monitor energy related issues to preclude a surprise energy shortage**
  The ESF #12 recognizes that APSC will monitor electricity and natural gas data as it remains prepared to address energy shortage. AEO has filed an Energy Supply Disruption Tracking Plan with the DOE that will enhance this effort for all energy forms including petroleum product supply. AEO will obtain the bulk of its on-going petroleum-related information from public sources such as the DOE Energy Information Administration (EIA) while working closely with the local and national petroleum product associations and attending semi-annual supply meetings sponsored by the DOE and the National Association of State Energy Officials (NASEO). AEO may monitor petroleum data through the DOE's annual State Heating Oil and Propane price gathering effort and tap into proprietary information sources as made available to states by the DOE.

- **Work closely with the APSC to identify any utility issues that may affect other energy sources**
  AEO has statutory responsibility to plan for petroleum energy shortages. The AEO can use its knowledge of inter-energy sector issues to support the process. For example, knowledge of an impending gasoline or diesel fuel shortage could alert other state agencies to pre-position fuel for emergency response, repair and restoration crews.

  AEO needs to know about potential utility outages so that it can help APSC and ADEM identify end-users whose petroleum-related activities might be affected by a loss of electricity or natural gas. AEO also has a responsibility under law for "coordinating energy matters between and among all state agencies."

- **Coordinate with the DOE and develop procedures for responding to national or regional energy shortages**
  The DOE has a number of programs that can assist states in identifying and responding to energy shortages. AEO is in regular contact with DOE and meets with DOE officials at least annually to learn about DOE programs and training pertaining to energy assurance and emergency response.

- **Provide representation in the SEOC as needed**
  AEO representatives are able to provide perspective on all aspects of the state's energy industry as it relates to emergency management.

- **With APSC, maintain responsibility for supporting the ESF #12 – review and revise on at least an annual basis**. AEO has petroleum energy emergency planning responsibilities under law.

- **Administer the Petroleum Set-Aside Program during a declared petroleum emergency.** The AEO has resources to provide public information (and to respond to inquiries) on energy related matters. AEO has an action plan for managing a Petroleum Set-Aside Program. Arkansas law also provides AEO with significant petroleum industry data monitoring capability during a period in which the Set-Aside has been activated.

3.1.5.3 Support Agencies for ESF #12

Figure 3.2 is a copy of support agency (state energy stakeholders) duties under ESF #12. This list also includes entities that are not state agencies but have valuable, potential influence on assisting the state to respond to an energy shortage/emergency.

Figure 3.2 – ESF #12 Support Agencies

Agency	Function
Arkansas Energy Office	• Implement AEO's established plans and procedures for responding to a petroleum energy crisis; • Monitor energy related issues to preclude a surprise energy shortage; • Work closely with the APSC to identify any utility issues that may affect other energy sources; • Coordinate with the Department of Energy and develop procedures for responding to national or regional energy shortages; • Provide representation in the State EOC as needed; • With APSC, will maintain responsibility for the content of ESF #12 and will review and revise the same on at least an annual basis. • Will administer the Petroleum Set-Aside Program during a declared petroleum emergency. The AEO has resources to provide public information (and to respond to inquiries) on energy related matters.
Arkansas Department of	• Inform AEO and APSC of any development during an emergency or

Emergency Management	disaster that may affect utility or other energy delivery systems or components; • Coordinate with APSC and utilities on restoration of telephone, water, gas and electric power for essential facilities; • Incorporate the content of the ESF #12 properly into the Arkansas State Emergency Operations Plan.
Arkansas Army National Guard	• Emergency Debris Clearance – National Guard personnel and equipment may be utilized to open an access path into the disaster area for emergency vehicles. • Emergency Restoration of Facilities – The National Guard has limited engineering personnel and equipment that can be used to facilitate the commercial restoration of vital utilities, roads, etc. • Other Resources – The National Guard also has other resources such as generators that are available, when commercial power is lost for an extended period.
Arkansas Department of Environmental Quality	• Provide regulatory guidance/assistance to permittees during restoration of energy supplies, services after a disruption of services. • Assist permitted facilities with temporary variances from permit requirements as needed to expedite energy supply/service restoration. • Approve temporary storage, distribution and use of lower grade and or alternate energy supplies and or sources. • Liaison with EPA to coordinate state and federal regulatory requirements. • Provide assistance with procurement of federal variances.
Arkansas State Highway and Transportation Department, Arkansas State Highway Police	• Provide assistance with permitting of oversize and overweight loads in the event of a disaster. Provides information regarding pre-designated transportation/evacuation routes so that fuel supplies may be located.
County and Local Governments	• Analyze county and local vulnerability to an interruption of utility or other energy service; • Plan for county and local utility outage or energy shortage.
U.S. Department Of Energy	• Implement ESF #12 of the NRF [National Response Framework] if an emergency shortage develops that cannot be alleviated by the state; • Inform AEO of any incidents that may affect the status of state energy supplies.
U.S. Department of Transportation, Office of Pipeline Safety	• Follow established procedures and coordinate with the APSC's Pipeline Safety Office in responding to any jurisdictional incident.
U.S. Department of Homeland Security, Federal Emergency Management Agency	• Follow established procedures and coordinate with ADEM in determining whether ESF #12, should be activated and whether a request should be made for activation of the National Response Plan ESF #12.
Federal Energy Regulatory Commission	• Follow established procedures and coordinate with the APSC in responding to a disaster, either natural or manmade, that damages utility and other energy delivery systems and components, interrupting or constraining supply; and

	• Issue orders as needed to enable the restoration of utility service.
Department of Commerce	• Provide assistance in pipeline safety.
Federal Communications Commission	• Follow established procedures and coordinate with the APSC in responding to a disaster, either natural or manmade, that damages utility and other energy delivery systems and components, interrupting or constraining supply; and • Issue orders as needed to enable the restoration of jurisdictional telecommunications service.
Utility Companies	• Coordinate with and assist state, county, and local governments during an interruption in service. • Encouraged to build/retrofit for earthquake resistance when possible; develop and maintain recovery plans; provide first responder training to personnel; and to develop Standard Operating Guidelines and Continuity of Operations Plans.

The statutes and the ESF #12 provide an outline of how an energy shortage, outage, or "emergency" is to be managed. The practice and experience of agency personnel also provides important information about how ADEM helps to mitigate an energy shortage. Following are some of the major operational issues managed by ADEM's emergency response staff.[6]

- Level 1: ADEM remains at a 24-hour state of readiness for all hazards.
- Level 2: Should an emergency become a more serious situation, a staff duty officer will be assigned to assist the regular duty officer.
- Level 3: When events require extra personnel, activation will add external staff as needed.
- Level 4: Activation may be required for a severe event. At such time, the EOC will be fully activated and staffed by ADEM personnel and ESF representatives.

ADEM is working with state energy companies to develop a database for critical infrastructure. Communications are governed by ESF #2 *Communications Annex*, ESF #15 *External Affairs Annex*, and the *Public Affairs Support Annex*. ESF #15 coordinates public information, and ESF #2 coordinates communications among affected and responding entities, agencies, and levels of government. Generally, the dissemination of information is related to the issue at hand and the extent of the emergency. ADEM works through specialized contact lists to obtain rapid assistance and information. Information can be disseminated by a variety of means managed by the agency's Public Information Officer (PIO) and by using media and Web-based services. ADEM's PIO is responsible for working with the Governor's office and other agencies to coordinate information expeditiously and to provide a consistent message.

APSC provides staffing from the EOC as needed. In practice, an APSC representative maintains contact with AEO and energy companies as events require. Energy suppliers are invited to the EOC as needed.

Under ESF #7 *Resource Support Annex*, emergency acquisition of fuel purchases will be managed by the Arkansas Department of Finance and Administration. If local fuel suppliers cannot service requests, ADEM can call on other states and utilize the resources of the *Interstate Emergency Response Support*

[6] Interview with ADEM staff in Little Rock, Arkansas, May 2010.

Plan. This Support Plan includes five states in the immediate region. Assistance from the Federal Emergency Management Agency may also be requested when the Governor declares an emergency.

ADEM regularly monitors many events that could affect energy supply. Their experience indicates that weather is the most potent factor affecting the supply and distribution of energy resources. Hence, the staff works to monitor impending weather events in order to pre-position response assets.

Energy shortage is a high priority for ADEM staff. It could be classified behind life and safety issues such as water, food, and medical needs because it is so central to all activities in the state.

ADEM notes the requirement to plan and drill on all types of emergencies throughout its response plan and provides emergency response training on a regular basis. ADEM staff observed that the state has experienced numerous actual utility events from 2008 to 2010 and that the training encouraged in the current Energy Assurance Plan will be folded into the training schedule. Monthly exercises continue to include fuel movement; local weather events such as tornadoes and ice storms; regional weather events such as hurricanes; and potential energy components of any other type of disruption or emergency.

3.2 Local Government

According to the ESF #12, "Local governments have primary responsibility for prioritizing the restoration of energy facilities." In practice, local governments would work closely with electric and natural gas utilities to request variations in company response plan priorities as needed. The restoration of electricity and natural gas is based primarily on the physical aspects of restoration with specific considerations for public safety and health.

Local governments are required to establish emergency services offices or provide a liaison officer to work with ADEM (§12-75-116, §12-75-118 (a, c, d)). Local governments are also required to develop emergency operations plans (§12-75-118 (e-g)). The Governor may also create a multi-jurisdictional office for emergencies by combining two or more local governments (§12-75-117(a)). In practice, many local jurisdictions are not equipped to manage emergencies on their own and the local liaison will contact ADEM and the Association of Arkansas Counties for assistance as needed.

3.3 General Federal Stakeholders

3.3.1 U.S. Department of Energy (DOE)

The primary federal contact for energy emergencies is the DOE Office of Electricity Delivery and Energy Reliability (OEDER). This office helps plan and fund energy emergency training throughout the U.S. It works closely with state associations such as the National Association of State Energy Offices (NASEO), the National Conference of State Legislators (NCSL), the National Association of Regulatory Utility Commissioners (NARUC) and the National Governors' Association (NGA). The Office also posts federal staff to regions and states facing energy emergencies and assists states as needed in working with regional and national energy stakeholders.

The DOE supports states through the data resources of the Energy Information Administration (EIA). Arkansas officials may find it difficult to obtain real-time petroleum product import and end-use data from companies that sell fuel. Should this happen, they may turn to an information network managed

by the OEDER. The Infrastructure Security and Energy Restoration (ISER) Division manages a Web site (ISERnet) that serves as a source for quick and efficient communications and data management among states and other public agencies through a secure Internet portal. An approved password is required for access. It is updated daily with some state-level petroleum import data without reference to proprietary sources. This network should provide useful, real-time information, but is not necessarily a source for volumetric data.

Discussions with various representatives of EIA and ISERnet users indicate that there are some differences of opinion about the level of detail provided. State energy offices and DOE continue to discuss and plan for additional training on ISERnet data.

In addition to these resources, NASEO and OE co-sponsor semi-annual spring and fall energy outlook meetings in coordination with EIA. These meetings are designed to help states forecast energy supply and demand for the coming summer and winter fuel consumption seasons. Presentations from these meetings are also available on the NASEO Web site at http://www.naseo.org/events/past.htm.

3.3.2 Federal Energy Regulatory Commission (FERC)

At one time, the federal government was particularly interested in protecting consumers regarding their relationships with public utilities. Since the repeal of the *1935 Public Utility Holding Act*, attention has been focused on the transmission siting aspects of electricity. The *2005 Energy Policy Act* directed FERC to set up a process facilitating transmission siting in order to enhance the nation's power grid. According to the Chairman of the FERC:

> "The Energy Policy Act provides for supplemental federal authorization of certain electric transmission facilities in national interest electric transmission corridors designated by the Secretary of Energy. In these corridors with power grid capacity constraints or congestion that adversely affects consumers, the Commission may issue permits to construct or modify electric transmission facilities."[7]

This can take place in a state that either "does not have siting authority," or "does not consider interstate benefits." Also important for Arkansas are the string of FERC orders -- 888, 889, and 2000 -- which helped set up the nation's relatively recent regional transmission organization (RTO) structure. Southwest Power Pool (SPP), the RTO for Arkansas and surrounding states, has a major impact on the distribution of electric power and will certainly have a major role to play in mitigating future power shortages. See Appendix P for a more comprehensive explanation of how the SPP functions.

FERC does not play an active role in the immediate restoration of power. However, it plays a part in energy assurance because its actions have long-term consequences for abetting efficiencies in the power distribution chain. As a national entity, FERC is in a position to supply leadership in utility matters that affect the public's purchase of electric power.

Several years ago, FERC expanded its interest beyond regulation to advocate for modernization of the nation's entire electric system. FERC promotes modernization from an older electromechanical system to a digital interactive system based on the so-called Smart Grid platform. This platform would tie all

[7] FERC News Release, November 16, 2007 pertaining to Docket No RM06-2-00 FERC. Washington, D.C.

aspects of the electric system together in multi-directional communications so that generators, distribution utilities, and RTOs can dispatch power to consumers and receive information in return about how and where power is consumed. Smart Grid issues will be discussed further in Section 9.

FERC also regulates natural gas pipelines. The national natural gas market was radically changed by FERC Order 636 in April 1992. Interstate natural gas pipelines essentially became common carriers devoted exclusively to natural gas. They no longer bought and sold natural gas. As part of enforcing this Order, FERC governs several areas of the national natural gas market and thus directly affects the distribution and sales of natural gas in Arkansas: Samples of the oversight undertaken by FERC include:

- Determining rate-setting methods for interstate gas pipelines
- Developing rules for pipeline company business practices
- Approving or disapproving the siting, construction, and operations of interstate gas pipelines
- Coordinating gas pipeline projects with applicable federal agencies
- Effecting environmental, endangered species, and historic preservation reviews
- Cooperating with the OPS
- Examining pipeline mergers and acquisitions in coordination with other federal agencies and state authorities

3.3.3 Petroleum Pipeline Regulation: FERC and OPS

FERC, along with OPS, has additional oversight over petroleum industry interstate pipelines. These pipelines are considered common carriers that sell capacity for a fee. The owners and operators are generally independent of the companies that send their crude oil and refined petroleum products through the pipelines. According to the Association of Oil Pipelines and the American Petroleum Institute, FERC sets the "maximum transportation fees" or rates that the pipelines can charge. FERC also sets conditions for shippers to assure parity of service and equal access to the carriers.

The OPS has jurisdiction over the interstate operation and safety of petroleum and petroleum product pipelines. However, there is no federal regulation for the production of petroleum products. Various environmental, preservation and other agencies (such as the Environmental Protection Agency, U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Bureau of Land Management and the Forest Service) are consulted when the construction of a new pipeline is proposed. For example, a thorough environmental impact analysis would need to be completed and approved for a pipeline to be built within the U.S.

According the federal OPS official Web site,

> "The Department of Transportation's Pipeline and Hazardous Material Safety Administration (PHMSA) acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Since 1986, the entire pipeline safety program has been funded by a user fee assessed on a per-mile basis on each pipeline operator OPS regulates."

The APSC also has a state Office of Pipeline Safety and, as noted above, follows and enforces federal regulations in this area.

3.4 General State Stakeholders

3.4.1 Association of Arkansas Counties (AAC)

The AAC provides a forum for county elected officials and staff to communicate and coordinate plans, programs and policies throughout the state. Nine affiliate associations of county and district officials are represented by the AAC as well. The organization represents 1327 elected county and district supporting a range of activities including issue research, legislative matters, professional training, and communications. In the area of energy assurance, as well as any other type of emergency, the AAC provides technical assistance to jurisdictions whose resources may be strained or inadequate to meet a special need. AAC also assists such jurisdictions in obtaining state government assistance and applying for federal relief as needed. In the event of a petroleum product shortage, or related energy assurance issue, the AAC can intervene on behalf of any requesting member jurisdiction and work with both state officials and energy stakeholders to mitigate the situation.

3.4.2 Arkansas Municipal League

The League is an instrumentality of municipal governments from throughout Arkansas. The Arkansas Municipal League was founded in 1934 and exists to act as the official representative of Arkansas cities and towns before the state and federal governments; provide a clearinghouse for information and answers; and offer a forum for discussion and sharing of mutual concerns.

3.5 Other Stakeholders

Other stakeholders including associations, electric and natural gas utilities, and entities of the petroleum industry will be discussed in later sections.

4 State Energy Supply, Consumption, and Demographics

4.1 Data

4.1.1 General Consumption Levels

Figure 4.1 summarizes the Arkansas energy activities in terms of energy production and consumption in 2007. This is the most recent data available. The top portion of Figure 4.1 shows Arkansas's energy production and the bottom portion addresses Arkansas's energy consumption. The total production of energy (588.7 Trillion Btu) is the total amount of produced energy by different energy resources measured in Btu. Primary energy sources include fossil fuels, nuclear power, and renewable energy. Figure 4.2 is a depiction of the same information.

Figure 4.1 – Arkansas Production and Consumption of Energy (2007)

ARKANSAS ENERGY PRIMARY ENERGY PRODUCTION 2007*				
Total Energy Production (Trillion Btu)			**588.7**	**100.0%**
			Production in Physical Units	
Coal	1.9	0.3%	83,000	Short Ton
Natural Gas	272.0	46.2%	269,886	Mcf
Crude Oil	35.0	5.9%	6,031,000	Barrels (42 gals)
Nuclear Power	162.4	27.6%	15,486,102	Megawatt Hours
Renewable Energy**	117.4	19.9%	11,195,002	Megawatt Hours

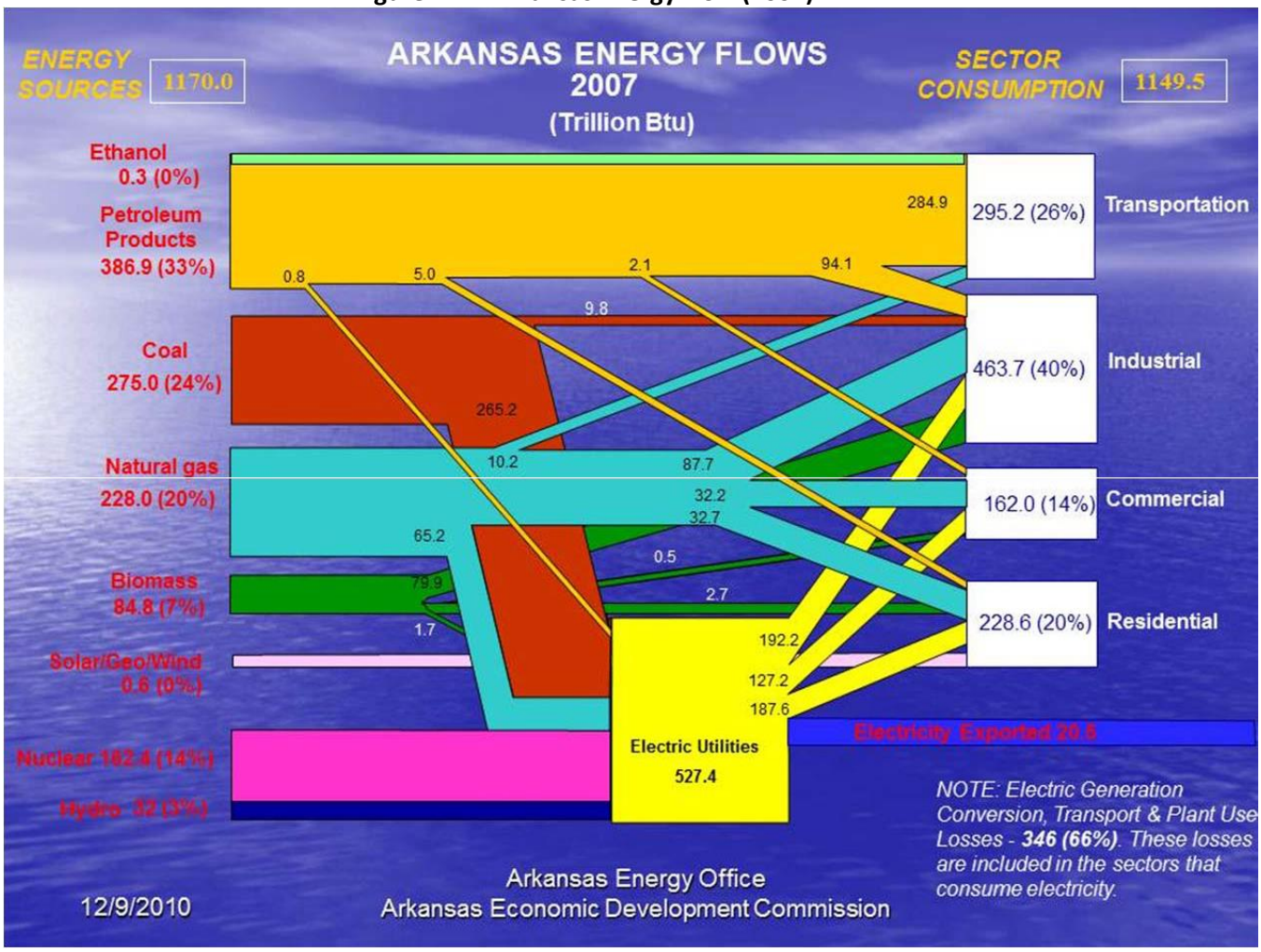
ARKANSAS ENERGY CONSUMPTION 2007		
Total Resource Energy Consumption	**1,149.3**	**100.0%**
Coal	275.0	23.9%
Natural Gas	228.0	19.8%
Petroleum	386.9	33.7%
Nuclear Electric Power	162.4	14.1%
Renewable Energy*	117.4	10.2%
Net Interstate Flow of Electricity	-20.4	na
Total Electric Power	**527.4**	**100.0%**
Coal	265.2	50.3%
Natural Gas	65.2	12.4%
Petroleum	0.8	0.2%
Nuclear Electric Power	162.4	30.8%
Renewable Energy	33.7	6.4%
Total End-Use Consumption	**1,149.3**	**100.0%**
Residential	**228.6**	**19.9%**
Coal	0.0	0.0%
Natural Gas	32.7	14.3%
Petroleum	5.0	2.2%
Retail Electricity	59.4	26.0%
Electrical System Energy Losses	128.2	56.1%
Renewable Energy	3.3	1.4%
Commercial	**162.0**	**14.1%**
Coal	0.0	0.0%
Natural Gas	32.2	19.9%
Petroleum	2.1	1.3%
Retail Electricity	40.3	24.9%
Electrical System Energy Losses	86.9	53.6%
Renewable Energy	0.5	0.3%
Industrial	**463.7**	**40.3%**
Coal	9.8	2.1%
Natural Gas	87.7	18.9%
Petroleum	94.1	20.3%
Retail Electricity	60.9	13.1%
Electrical System Energy Losses	131.3	28.3%
Renewable Energy	79.9	17.2%
Transportation	**295.1**	**25.7%**
Coal	0.0	0.0%
Natural Gas	10.2	3.5%
Petroleum	284.9	96.5%
Retail Electricity	0.0	0.0%
Electrical System Energy Losses	0.0	0.0%
Renewable Energy	0.0	0.0%

* Primary energy sources include coal, natural gas, crude oil, renewables, and nuclear power. Often there are references to energy production by fuel source in which case the energy fuel sources are coal, natural gas, and crude oil. For a discussion of this distinction, see footnote 2.

** The physical units for renewable energy were estimated by Institute for Economic Advancement using the total amount of renewable energy produced (Btu) produced and a conversion factor to convert Btu into megawatt hours.

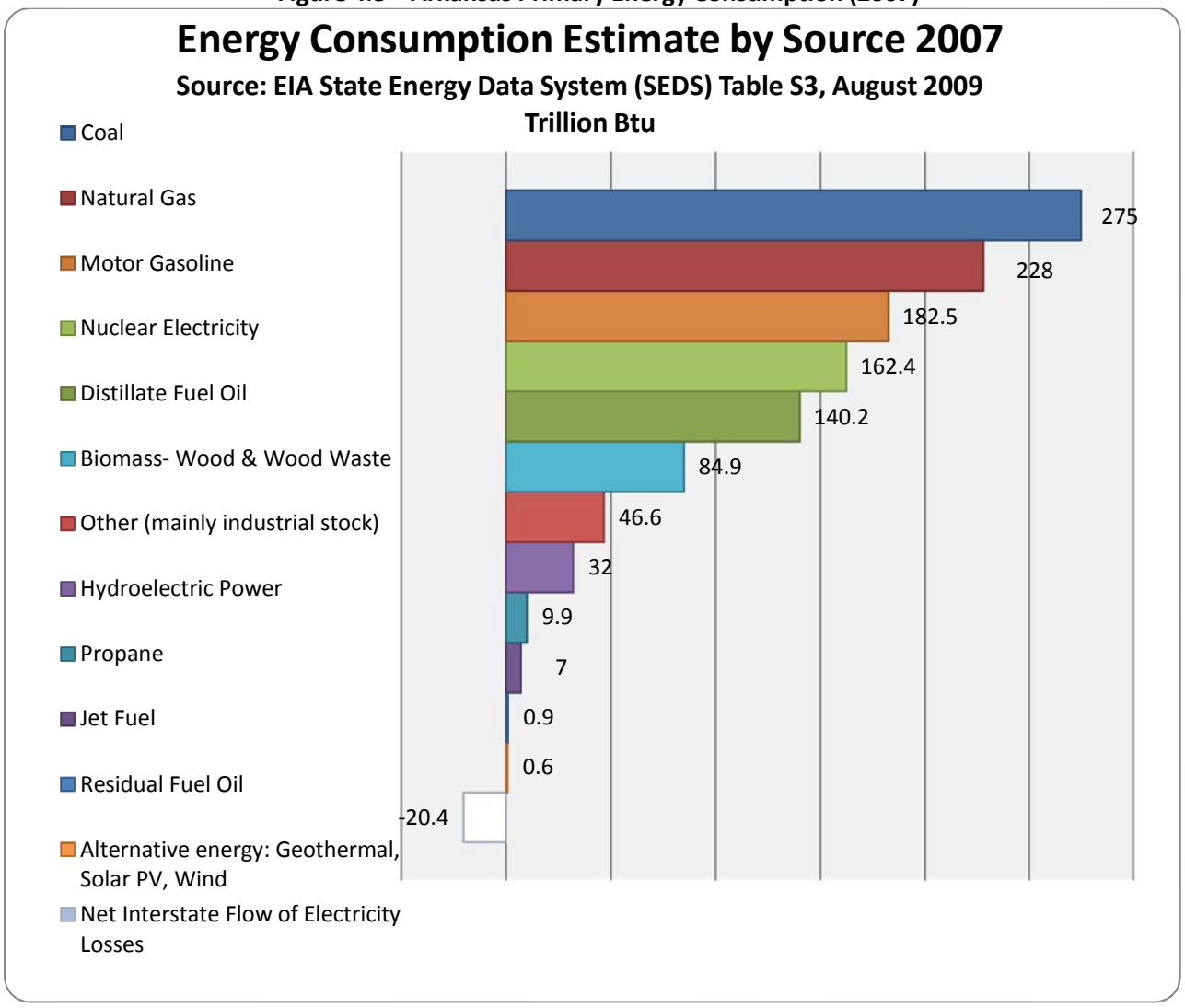
Source: U.S. Energy Information Administration, State Energy Data System, Data Files, All States and All Years, Consolidated Data File (1.1 million records), February 2010.

Figure 4.2 – Arkansas Energy Flow (2007)



Additional valuable information is updated every three years in an Energy Profile of the state. See Appendix C for a reference to this publication.

Figure 4.3 – Arkansas Primary Energy Consumption (2007)

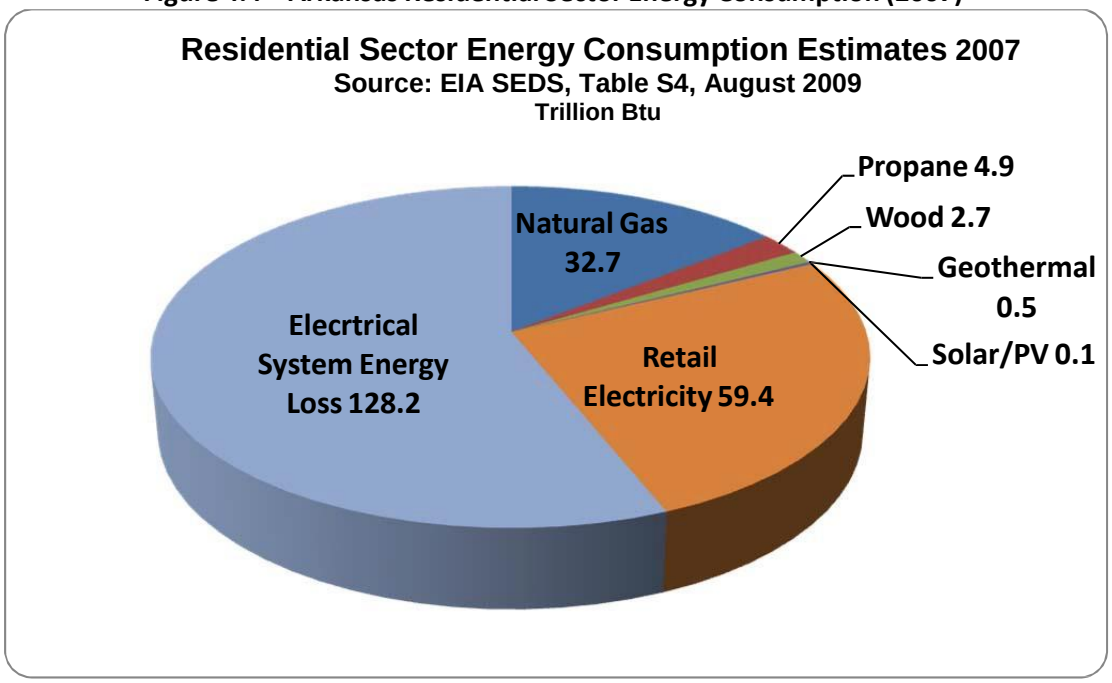


Electricity is the dominant form of energy used in Arkansas, providing 41% of the state's estimated annual energy consumption. Coal, nuclear power, and hydroelectric are the primary energy sources for electricity generation. It should be noted that the bar illustrating natural gas combines its use for space heating and electrical power generation (energy supply detail is contained in Section 6). Propane, a major fuel in the state's agriculture sector, is derived from "wet" natural gas and from petroleum refining in approximately equal quantities.

Retail electricity is the principal form of energy in the Arkansas residential sector. Figure 4.3 also illustrates the electrical system loss in order to point out the risk associated with well over one half of the state's electricity consumption in system loss.

4.1.2 Residential Sector Consumption Levels

Figure 4.4 – Arkansas Residential Sector Energy Consumption (2007)



System losses occur throughout all U.S. electric systems in generation, power lines, distribution stations, transformers, and a wide variety of infrastructure. For Arkansas, it points especially to the electric power delivery risk inherent in the state's many miles of rural power transmission and distribution lines. These lines are an area of significant vulnerability, especially when subject to ice storms and other weather-related impacts. The way the state's investor-owned, electric cooperatives, and municipal companies mitigate this risk is discussed in the Electricity Section of this Plan.

Notwithstanding risk associated with system energy loss, Arkansas enjoys a reliable supply of electric power that provides 59.22%[8] of the state's space conditioning needs. Natural gas follows supporting 32.6%. This reliable supply of natural gas is augmented by out-of-state deliveries. This is mostly on an exchange basis because the bulk of natural gas produced in Arkansas flows north via interstate pipeline. Propane, widely used throughout rural and many suburban areas, provides 4.89%. Alternative energy sources have a 3.29% foothold in the state with the majority of that coming from wood and wood waste.

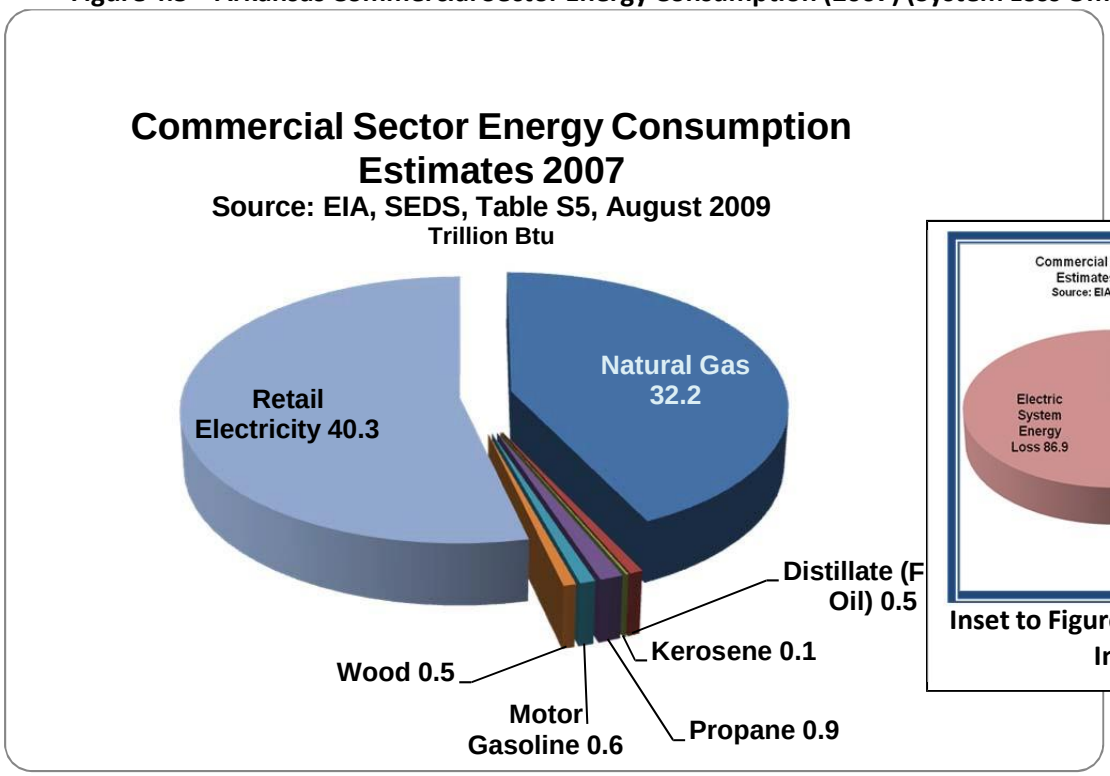
Retail electricity also supplies the bulk of power for the state's commercial sector with 53.66% of that market. Much of this electricity is consumed for lighting and space conditioning. Electricity is also crucial for many other uses such as commercial space lighting, pumps, motors and electronics.

Natural gas is a principal space conditioning energy source for the commercial sector supporting 42.88% of this end-use sector market. The consumption total for this sector, shown in Figure 3, is illustrated without system loss in order to emphasize the relative impact of each energy source in this sector.

[8] Percentages derived from EIA Data in Sector graphics. Sector End-Use graphs show TBtu only.

4.1.3 Commercial Sector Consumption Levels

Figure 4.5 – Arkansas Commercial Sector Energy Consumption (2007) (System Loss Omitted)

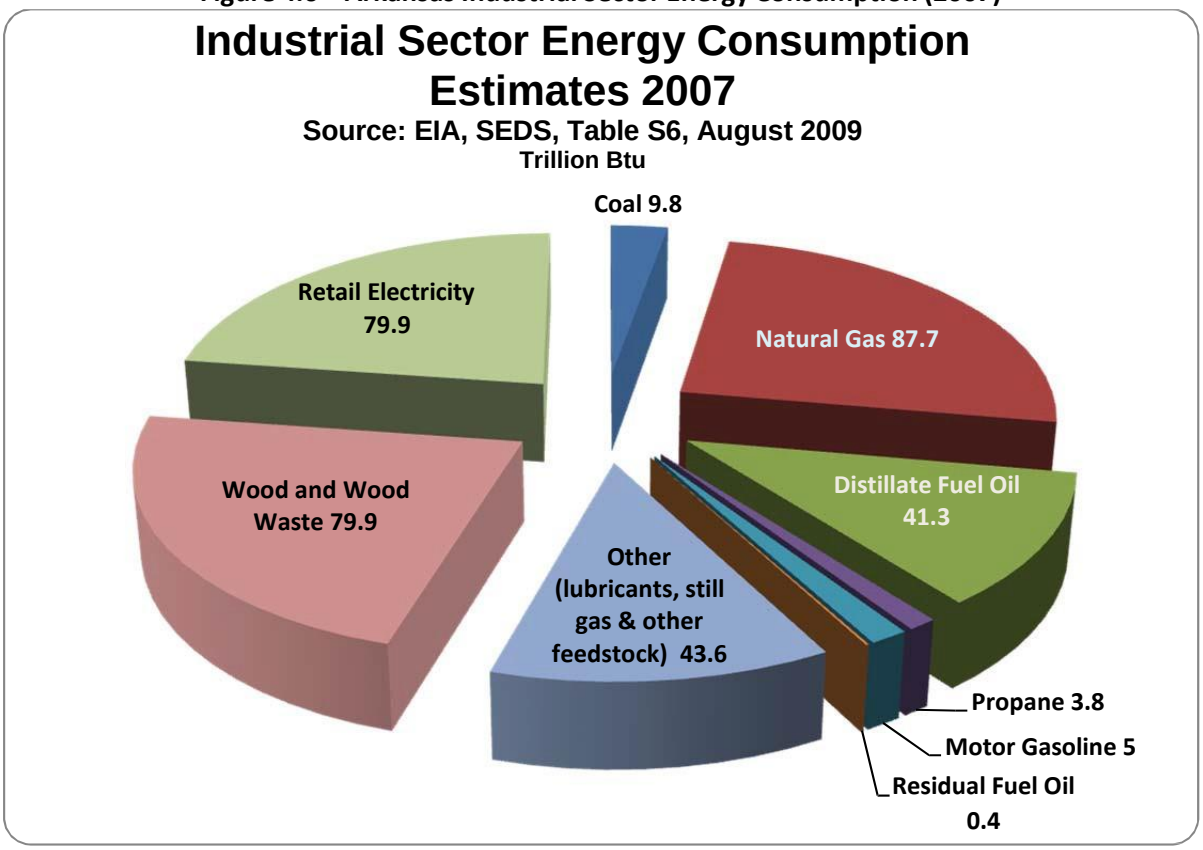


System energy loss is illustrated in the above inset. Clearly system energy loss skews the graphic view of consumption. To the degree that rural demographics intersect with the low user-per-line-mile aspect of a rural commercial market, system loss represents an increased risk just as it does in the residential sector. It is worth noting that this loss, calculated by the EIA, exceeds all other power use for the commercial sector at 53.97% of the total attributed to this sector in Figure 4.

EIA data present some additional challenges when reflecting liquid fuel use in the commercial sector because these data do not appear to reliably measure the use of commercial vehicles for uses such as sales, delivery, and freight. Such data are somewhat more accurately represented in Bureau of Transportation Statistics reports on liquid fuel consumption by type of vehicle. In those data, light and heavy trucks may be extracted from general truck data. The available data for Arkansas are out-of-date but nevertheless are useful for discerning the basic patterns and relative amount of use per truck type.

4.1.4 Industrial Sector Consumption Levels

Figure 4.6 – Arkansas Industrial Sector Energy Consumption (2007)



Energy consumption in the industrial sector is depicted in Figure 4.6. Energy supply into this sector is much more robust than the commercial sector. System loss accounts for only 28.32% in this sector and so is not illustrated in the figure. This relatively small number shows that system loss is a much lower risk in the industrial sector which is concentrated in more densely populated parts of the state where power distribution infrastructure serves many more customers per line mile than in the countryside.

Similar to the other sectors, the major fuel uses for this sector are natural gas at 24.96% of the adjusted total and electricity (electric system loss excluded) at 22.74%. The relatively large category marked "other" is composed of petroleum products such as asphalt, road oil, kerosene, and a wide variety of lubricants and other distilled products such as naphtha, waxes, liquid fuel blending components, unfinished oils and still gas. [9] While distillate in Arkansas is primarily in the form of diesel fuel, there are also industrial uses for distillate that fit well into the manufacturing process. The small amount of heavy residual oil used in Arkansas is in this sector.

[9] Still gas is used for industrial processes as petrochemical feedstock. The distilled chemicals found in still gas usually include gases and liquids such as: butane, ethane, ethylene, methane, propane and propylene.

Of particular note for Arkansas, however, is the high percentage of wood and wood waste used by industry in the state. Some of the industries highly dependent on wood combustion are the timber and the pulp and paper industries.

5 Energy Market Risk and Vulnerability Assessment

Risk is a measure of potential harm – it encompasses threat, vulnerability and consequence. An asset's risk is defined as:

1. the likely consequence of a disruption or successful attack (often referred to as the threat)
2. the asset's vulnerability to a disruption or attack

Vulnerability regarding energy assurance refers to the characteristic of an asset, system, or network's operation that renders it susceptible to destruction, incapacitation, or exploitation by mechanical failures, natural hazards, terrorist attacks, or other malicious acts.

Much of the data used in describing vulnerability and potential risk are relative to use factors that are not well documented. Interpretation of these data is often more of an art than a science.

The purpose of this section, however, is not to focus on threat, but to inform about impending energy shortages and related emergencies and help responders take steps to avoid or mitigate the impact of these events. The information and observations contained in this section are used to enhance operational assessments in subsequent sections.

5.1 The NASEO / NARUC Guidelines

The NASEO/NARUC (National Association of Regulatory Utility Commissioners) *Energy Assurance Guidelines* define the concept of risk and vulnerability in terms of evaluation and response. NASEO presents the Risk Management Framework central to the National Infrastructure Protection Plan (NIPP). The framework touches the major conceptual components of sound energy assurance planning, beginning with setting goals and objectives and ending with ongoing measurement of effectiveness. The elements of this process are key to Arkansas's risk assessment effort, beginning with system identification – understanding critical infrastructure.

NASEO posits eleven components of emergency planning that intersect with energy emergency issues. This Plan will utilize these components as it progresses from identification of certain assets to suggestions for mitigating an emergency. Figure 5.1 outlines this process.

Figure 5.1 – Key Components of Risk Assessment and Subsequent Planning

Key Components of Risk Assessment and Subsequent Planning		
	NASEO Suggestion	**Application to the Arkansas EA Plan**
1	Critical assets such as the infrastructure supporting each energy sector's supply, distribution and monitoring capability.	Risk and vulnerability analysis incorporates an examination of basic energy sector consumption in order to show end-user vulnerability in relation to each of three primary energy supply groups – electricity, natural gas, petroleum (including propane). Actual energy assets are discussed in connection with energy supply sectors in later sections in relation to potential mitigation measures.
2	Threat environment including natural and man-made disruptions.	Threat environment is discussed in relation to each energy supply and distribution section.
3	Policies, procedures and plans that govern and provide guidance for energy acquisition, management and sales.	Policy, procedures and plans are examined in relation to authorities and jurisdictional responsibilities (see #9 in this Figure).
4	Physical and cyber security such as technology, regulations, protocols and manpower to guard the safety of assets from physical and electronic interruption.	Security protocols and regulations are examined as they apply to each separate energy supply and distribution sector.
5	Operations security including general knowledge about energy sector provisions and measures plus an understanding of governmental regulations where they apply.	Operations security is a part of the discussion about authorities, policies and procedures.
6	Information systems that support energy sector activities and protocols, especially so-called network architecture as well as monitoring and testing to prevent penetration.	Information systems are included within each energy supply and distribution sector discussion.
7	Consequence analysis that identifies the impact of energy anomalies affecting consumption.	Consequence analysis is used primarily to identify cross cutting issues between and among energy supply and distribution sectors. These factors are identified in the course of energy sector discussions.
8	Risk characterization includes an assessment of asset and operational vulnerabilities built into the location, infrastructure and dynamic operation of a given energy system.	Risk assessment occurs in two places. First in a general, or overall, discussion of energy consumption factors that affect broad consumer categories and, second, in relation to each separate energy supply and distribution sector.
9	Definition of jurisdictional responsibilities, or what states and other governing bodies can do to prepare, prevent, and mitigate the consequences of energy infrastructure and system disruption including shortage or system failure.	See discussion in #3 above. Also, note that the *State Energy Assurance Guidelines* emphasize the structure set out in the National Infrastructure Protection Plan (NIPP) concerning Critical Infrastructure and Key Resources (CIKR). These emphasize mutual support,

		information sharing, strategic regional alliances, coordination with related homeland security entities and accompanying monitoring, analytical and emergency response protocols plus technology to protect national, regional, state and local energy assets and capabilities. System interdependencies are also examined.
10	Protection for sensitive information through effective editing of emergency plans in order to provide prudent information that does not breach security protocols or common sense.	This is a part of the EA Plan development process. The Arkansas EA Plan will not contain proprietary information.
11	Inclusion of energy resilience-enhancing assets that can lower the risk of energy loss by providing time for energy system restoration while lowering demand to enhance sharing of constrained energy resources.	Energy resiliency enhancing assets are analyzed separately from the primary energy sector supply and distribution discussion. Cross walks to various sectors are noted as appropriate.

These suggestions will guide the state-wide energy user risk that is the focus of this section. They will also frame a more specific vulnerability and risk examination discussed in later sections pertaining to each major energy sector's infrastructure, supply, distribution, and operational issues.

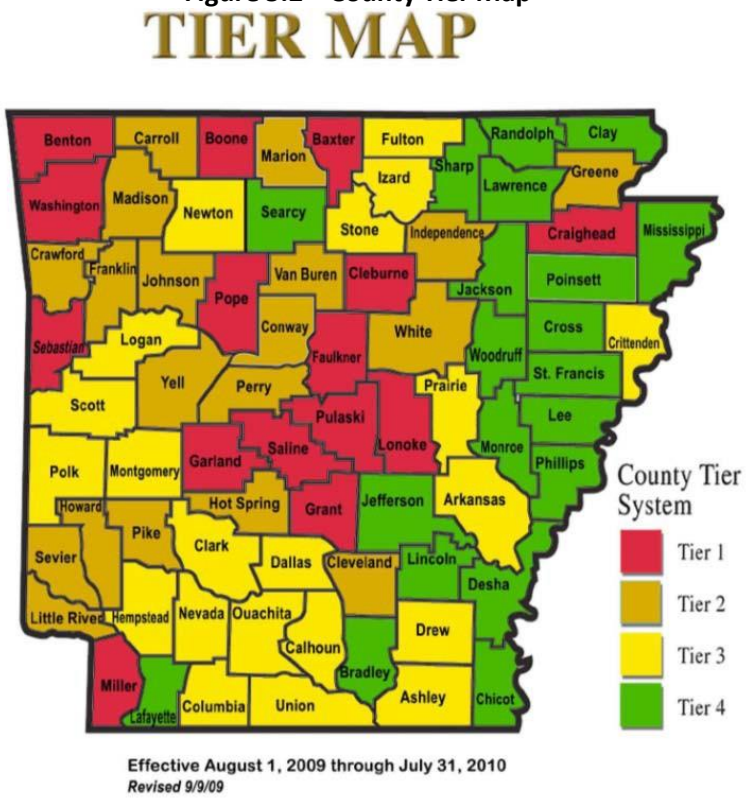
5.2 Risk Factors

The first element for understanding the risks and vulnerabilities associated with the energy structure in Arkansas is the identification of the primary energy consumption sectors within the state. This information is contained in section four of this document. Electrical system losses were also included to illustrate that these losses account for a significant amount of total energy loss. While it is beyond the scope of this plan to analyze such losses, it is expected that any improvement in energy efficiency through reduced power loss will reduce overall electric load and thereby improve overall state energy system resiliency.

5.2.1 Economic Indicators

In order to understand the economics of Arkansas, it is useful to look at the state's County Tier Map in Figure 5.2. This map provides a basic comparison to the levels of economic development in various counties, and reinforces the list of top 8 major urban centers listed in Figure 7. Red areas show the highest concentration of population and business, followed by tan, yellow and green.

Figure 5.2 – County Tier Map



Source: Arkansas Economic Development Commission, *The Arkansas Fact Book*, 2009, pp.50.

Figure 5.3 – Arkansas Population and Major Urban Centers

Population

	1990	2000	2008 estimate
United States	248,790,925	281,421,906	304,059,724
Arkansas	2,350,624	2,673,400	2,855,390

Major Urban Centers	2008 Estimate
Little Rock/North Little Rock/Conway MSA	675,069
Fayetteville/Springdale/Rogers/Bentonville MSA	443,976
Fort Smith MSA	290,977
Texarkana MSA	135,509
Pine Bluff MSA	100,647
Jonesboro/Craighead County MSA	117,361
Hot Springs MSA	97,465
Memphis/Tennessee/Arkansas/Mississippi MSA	1,285,732

Source: Source: Arkansas Economic Development Commission, *The Arkansas Fact Book*, 2009, p.10.

The state labor force is composed of approximately 1,377,100 people with current civilian employment at 1,270,700. Non-farm payroll job holders are estimated at 1,139,000. Assuming that the remainder of the workforce is associated with agriculture, the approximate number of payroll farm workers is 131,700. Due to family farming, not all farm labor is documented by payroll so this latter number should

be considered less accurate than the other numbers which were estimated by the U.S. Bureau of Labor Statistics (BLS). Also, BLS data does not appear to include migrant labor.

Figure 5.4 – Arkansas Labor Force and Primary Industries (2010)

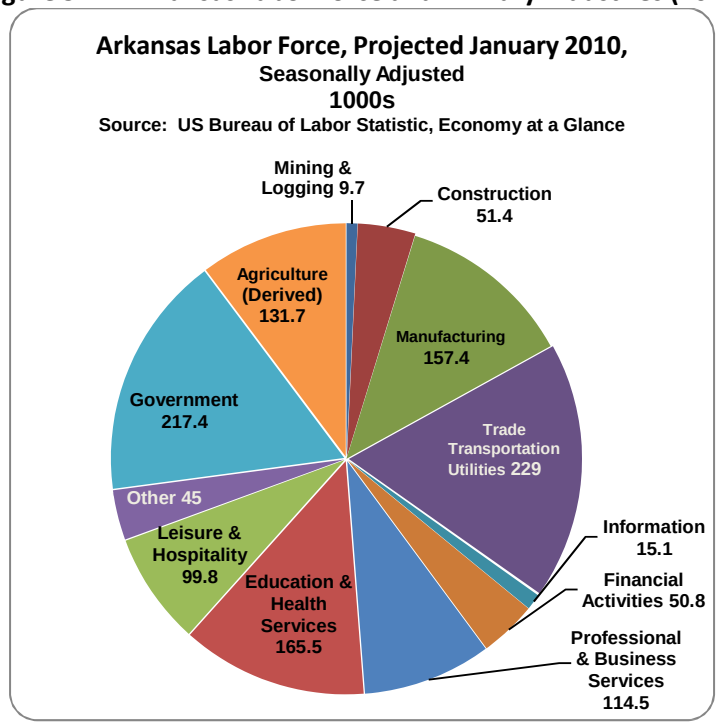


Figure 5.4 illustrates that the five largest economic sectors in Arkansas are, in order of size:

1. Trade Transportation and Utilities
2. Government
3. Education and Health Services
4. Manufacturing
5. Agriculture

Loss of primary energy sources in any of these areas can translate into economic loss and problems for residents. The magnitude of such vulnerability is dependent on the severity of such shortages and the time it takes to recover. More will be discussed about these factors in the energy sections of the Plan.

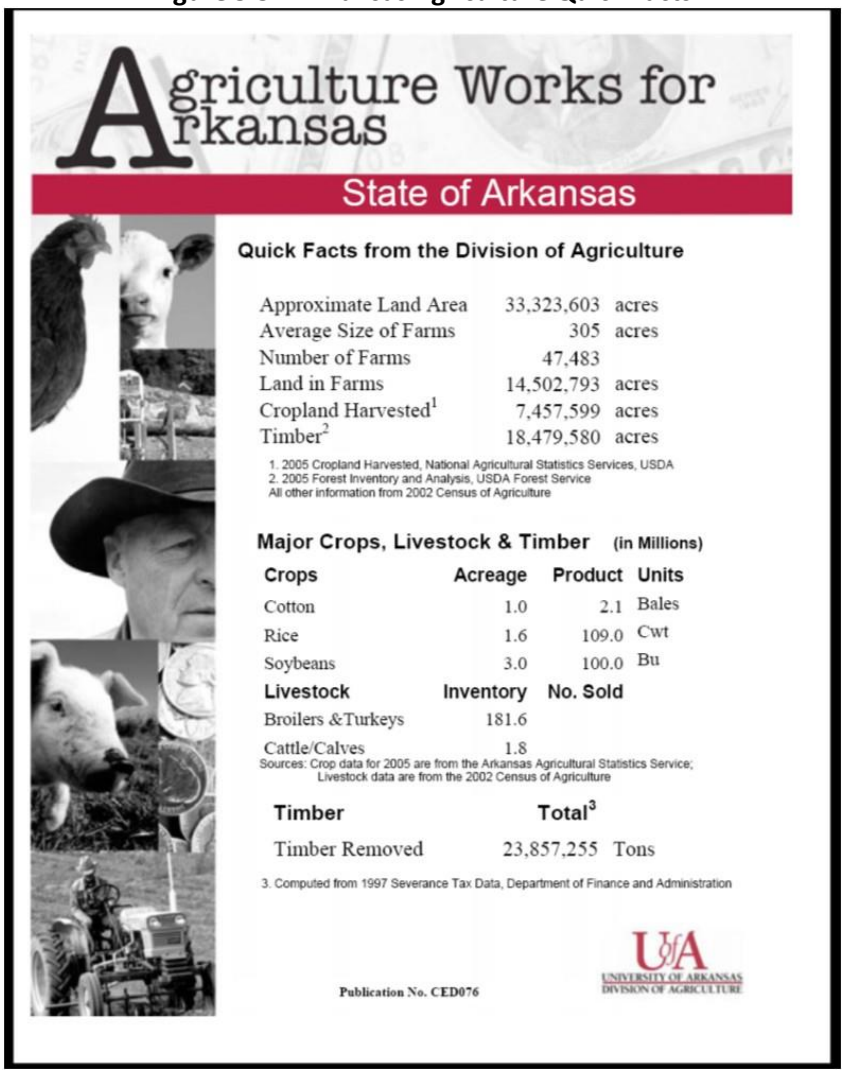
5.2.2 Agricultural Indicators

According to the University of Arkansas, agriculture is the state's largest industry. While that claim does not necessarily correlate with employment data, Figure 5.5 shows that agriculture uses more than 43% of the state's land area. Certainly agriculture occupies the most land area; there will always be some agriculture area in the state that is vulnerable to severe weather or other energy risks.

Rice is the state's most well-known crop. Agriculture in Arkansas is multifaceted, including such activities as general farming, forestry, fish production, agricultural services, and processing. Figure 5.5 displays a table of facts about the state's agriculture industry. This information indicates that the agriculture

product area most at risk from energy loss is poultry, followed by soybeans, cattle, and rice. The rice crop depends on irrigation, so is especially tied to the reliability of electricity for pumping water.

Figure 5.5 – Arkansas Agriculture Quick Facts



As indicated in the County Tier map, the bulk of the state's manufacturing and industry is located in a few major urban areas. The vulnerability associated with this is that the loss of power, especially in these urban centers, can exacerbate economic loss. Economic loss is also closely associated with the duration of outage, or shortage. As will be seen in the Electricity Section of this Plan, long-term outages in the urban areas are less of a risk than in rural areas where weather (especially ice storms) can greatly increase restoration time and add to economic risk.

The primary risk associated with agriculture is its high dependency on electricity for certain vital functions, especially for growing rice and protecting livestock. Bad weather can combine with system losses related to the many miles of distribution wires that are vulnerable to high winds and ice. Mitigating this risk is the fact that many farms are reasonably self-sufficient, growing food and maintaining crops and livestock. A long-term loss of power would quickly increase the economic risk for agricultural enterprises.

Throughout the sectors, propane is a relatively minor fuel. However, a loss of propane can also create economic hardship, as can any liquid transportation fuel. Propane loss is somewhat mitigated because this fuel can also be stored in agriculture-related tertiary storage, thus providing a margin of safety until liquid fuel deliveries are restored.

5.2.3 Transportation Indicators

Figure 5.6 - Arkansas Transportation Sector Energy Consumption (2007)

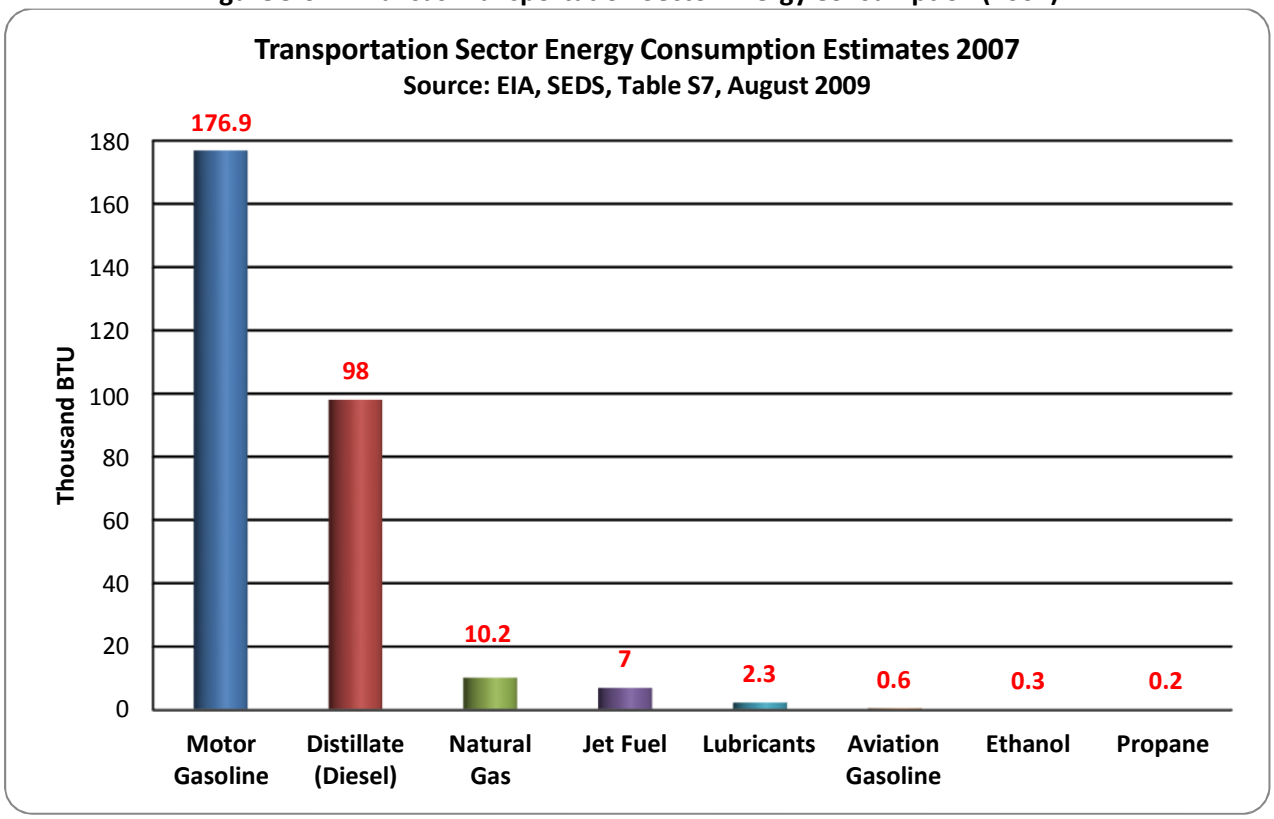


Figure 5.6 illustrates fuel consumption in the Arkansas transportation sector. Petroleum products dominate, with motor gasoline at 59.86% of the total, followed by distillate (diesel) at 33.16%. Motor gasoline supports the state's passenger vehicles primarily and diesel supports trucking. Further estimates on vehicle fuel consumption are contained in Figure 5.9. These data show that Arkansas also has a small but significant natural gas consumption positioned at 3.45% of the total.

Jet fuel supports the long distance aircraft industry; aviation gasoline generally fuels relatively short-range air travel.

Figure 5.7 provides some essential facts about Arkansas's transportation system. Highway mileage is far greater than either rail or waterway. The state's basic transportation facts show a relatively even division between automobiles and trucks. A petroleum shortage would clearly affect motor vehicles more than rail. Public mass transit is not a significant transportation factor in the state. Overall

transportation risk is reduced somewhat because approximately 15.5% of commuters do not drive to work alone. It is interesting to note than in 2000, 1.5% of workers walked to and from work.

Figure 5.7 – Basic Transportation Facts and Commuting

Transportation System Extent – 2002	Commuting (percent of workers) - 2000
All public roads: 97,600 miles Interstate: 656 miles Road bridges: 12,448 Class I railroad trackage: 2,714 miles Inland waterways: 1,860 miles Public use airports: 100 (7 certificated for air carrier operations)	Car, truck, or van—drove alone: 82.3% Car, truck, or van—carpooled: 11.6% Public transportation (including taxi): 0.4% Walked: 1.5% Other means: 1.2% Worked at home: 3%
Source: U.S. Department of Transportation, Bureau of Transportation Statistics.	

The truck section in Figure 5.8 provides details on transportation in Arkansas showing the difference between all trucks and larger trucks. Agriculture, construction, utilities, and both wholesale and retail trade stand to suffer more serious economic consequences from a long liquid fuel shortage other than business users.

Because Arkansas has 1,860 miles of inland waterway, a fuel shortage may also affect commercial river traffic. A shortage would also adversely affect recreational transportation, which includes approximately 177,000 recreational boaters.

A shortage of liquid fuels would, as expected, affect all Arkansas drivers. Without better data about use patterns for personal vehicles, it is difficult to identify the risk factors except to point out that all users would face inconvenience in a mild shortage and some would face serious issues of health and safety in a more protracted situation.

Figure 5.8 – Major Transportation Data Pertaining to Arkansas Petroleum Vulnerability (1997 – 2000)

Page and Table	Item		Number
D1 – 4-2	Licensed Drivers		1,947,867
E1 – 5-1	Motor Vehicle Registrations		
	All motor vehicles		1,838,908
	Automobiles		941,651
	Buses		1,416
	Trucks		870,843
	○ Light		858,566
	○ Farm		22,345
	○ Track Tractors		15,252
	Motorcycles		24,998
E2 – 5-3	**Trucks Operation (1997) Percent**		
	Major Use	**All trucks**	**Large trucks**
	Agriculture	6.1	11.4
	Forestry/Lumber	.9	.3
	Mining/Quarry	.2	.2
	Construction	6.8	14.3
	Manufacturing	.5	1.5
	Trade (W&R)	3.2	21.3
	For Hire	Less than .05%.	2.2
	Utilities	6.7	39.6
	Personal	74.1	7.3
	Other	1.6	1.8
E3 – 5-4	Vehicle Miles Traveled		29,167,000
A6 – 1-6	Mixed Right of Way Bus		324.3
A8 – 1-8	Aircraft Enplanements: commercial/commuter		1,676,419 659,937

Source: U.S. Department of Transportation, Bureau of Transportation Statistics, Arkansas Transportation Profile, Undated (approximately 2002).
http://www.bts.gov/publications/state_transportation_statistics/

Airplane enplanements also suggest an interesting pocket of risk. While Figure 5.6 shows that aviation gasoline appears to be a very small proportion of Arkansas's travel picture, there is a risk to in-state travel. Figure 5.7 showed that 93 of the state's 100 airports were "not certified for air carrier operations," making them commuter airfields. As derived from Figure 5.8, total state enplanements in 2000 numbered approximately 2,336,356 and commuter air traffic constituted slightly more than 28% of the total. A shortage of aviation gasoline would very likely cause significant disruption of movement around the state.

A winter storm-related aviation fuel issue or any other short-term fuel shortage affecting only Arkansas would have a relatively small impact. However, a regional or national sustained fuel shortage might have a more severe economic impact than a weather or in-state event.

5.3 Observations

Figure 5.9 illustrates the relative vulnerability for each of the three major energy end-use sectors in Arkansas – residential, commercial, and industrial.

Figure 5.9 – Relative Trillion Btu Consumption in Each Energy End-Use Sector (Electricity system loss included)

Source: Derived from EIA SEDS, State Data for Arkansas, Tables S4, S5, S6 (2009)

Sector/Energy type	Residential	Commercial	Industrial	Transportation
Retail Electricity	59.4 (61%)	41.3 (55%)	79.9 (31%)	-
Natural Gas	32.7 (34%)	32.2 (43%)	87.8 (34%)	10.2 (3%)
Petroleum	4.9 (5%)	2.1 (3%)	94.1 (36%)	285 (97%)
Net Energy per Sector *(system loss omitted)*	***97***	***75.6***	***261.7***	***295.2***

Utilizing EIA data to illustrate the relative vulnerability of each end-use sector, the following observations are made:

5.4 Risk in the Residential Sector

Vulnerability becomes a relative and somewhat opaque term here because of the varied uses for these forms of energy. For emergency planning purposes, responders may assign priority to health and safety concerns over convenience or economics. Because electricity accounts for 61% of residential energy consumption in Arkansas, it can be concluded that the state is more vulnerable to a loss of electricity than natural gas (though a loss of natural gas occurring during the winter would also have a significant impact). Electricity supports critical equipment such as furnace and boiler controls, thermostats, and emergency communications. When looking at electricity for residential use, consideration must be given to the need for:

- lighting
- and television use for critical safety needs
- food preservation
- data management
- computer use

5.5 Risk in the Commercial Sector Economic Indicators

Similar considerations can be made for the commercial sector and, when determining risk, consideration must be given to how energy is used. More commercial establishments are heated with electricity than natural gas. Electricity also provides power for lighting, controls, elevators, light machinery, office equipment, and other uses of maintaining commerce and operating institutional establishments. The advent of the high penetration of information technology and computer-based communication in the commercial sector makes the reliability of electric power crucial to the economy

As with the residential sector, it is relatively easy to note the impacts of losing a particular energy source. It is more difficult to determine which functions can be reduced or dispensed of for a selected period of time.

5.6 Risk in the Industrial Sector

Similar issues confound an analysis of energy loss affecting the industrial sector. Figures illustrating manufacturing and employment clearly show that all regions in Arkansas could face serious economic loss if energy is in short supply or disrupted. For short-term shortages, industry may be well equipped to deal with energy loss because many companies maintain auxiliary equipment that can provide short-term insurance against a loss of operations (i.e. generators). The risk in this sector then must be measured by how much loss escalates risk. Consider the impact of a loss of energy from petroleum products that constitute industrial feed-stock. A loss of energy feed stock, an essential manufacturing component, could create significant financial problems for one or more industrial process while not appearing to be as serious as a widespread electricity outage or an interruption to the operation of a natural gas pipeline.

Space conditioning, however, may not be a serious problem for manufacturing depending on whether or not waste heat from an industrial process is used to condition space. Perhaps the most imminent risk of an energy loss for the manufacturing sector is the potential impact on employee pay, jobs, or a negative change in market share and sales.

In addition to its large agriculture footprint, Arkansas's economy contains many highly skilled workers in technologically advanced manufacturing, universities, construction, and utilities supported by a strong higher education activity and sophisticated information processing. These are all highly dependent on a reliable supply of electricity as well as natural gas for space conditioning.

5.7 Risk in the Transportation Sector

The data in Figure 5.10 suggest energy use penetration in a wide variety of transportation modes. The area that would be most readily noticed by the public is vehicle movement. The data in Figure 10 show that almost 93% of the liquid motor fuel – motor gasoline and diesel fuel -- used in Arkansas is for highway vehicles (private or commercial use). Diesel serves the commercial and industrial sectors more than private motor vehicles. A loss of distillate can mean a shortage of goods and services as well as a threat to jobs.

Loss of diesel motor fuel would certainly create problems for public transit; but with only a small portion of the population using mass transit this is a relatively minor risk compared to a loss of motor gasoline.

Summary of Potential Vulnerability in Major End-Use Sectors
A summary of vulnerabilities to energy supply failures in the residential, commercial, industrial and transportation sectors is shown in Figure 5.10.

Figure 5.10 – Vulnerabilities of Residential, Commercial and Industrial Sectors to Energy Supply Risks

Sector	Propane	Petroleum	Natural Gas	Electricity
Residential	▪ Home heating, and cooking ▪ Agriculture uses	▪ Potential reduction in use of motor vehicles	▪ Home heating	▪ Lighting and appliances ▪ Home heating ▪ Heating system controls ▪ Air conditioning ▪ Technology ▪ Communications
Commercial	▪ Some rural heating ▪ Agriculture uses	▪ Commercial vehicles	▪ Space conditioning	▪ Lighting ▪ Air conditioning ▪ Data processing ▪ Building operation ▪ Communications
Industrial	▪ Processes ▪ Space heating ▪ Lift truck	▪ Process ▪ Feedstock ▪ Space heating	▪ Process ▪ Space conditioning	▪ Lighting ▪ Machinery operation ▪ Data processing ▪ Communication
Transportation		▪ Passenger cars ▪ Freight ▪ Delivery	▪ Some mass transit fleet and other vehicle users	▪ Fuel Distribution ▪ Transportation operation center activities o Communications o Data processing

5.8 The Energy Supply Disruption Tracking Process

The effort to monitor energy supply status, identify an Energy Supply Disruption Tracking Process (ESDTP), and assess the need for action by the State of Arkansas is included in this section. In accordance with the Energy Assurance Planning grant, this ESDTP emphasizes pre- and post-incident activity such as documentation of the incident from first indication of problem through restoration of normal supply along with lessons learned and recommended changes to the Energy Assurance Plan. This ESDTP may also provide general guidance for broader data acquisition and tracking efforts, but that is not the focus of this Data Tracking Plan. Specific plans to address the critical infrastructure on municipal electric and natural gas utilities in Arkansas are contained in the state Energy Assurance Plan and maintained on a proprietary basis. Energy assurance procedures and activities for the electric and natural gas utilities regulated by the APSC are already well established at all levels of the supply chain. The state actions in this regard are well defined and are referenced in the applicable sections of this document.

The process first outlines the general approach to monitoring utility system status and then describes examples of specific data to be monitored, problem identification and assessments of the need for action for the individual energy forms (electricity, natural gas, petroleum products and propane). It also contains general information about regulated utility system elements so that responders may

understand with greater clarity how to distinguish ESDTP actions for municipal utilities and the electric and natural gas utilities regulated by the APSC.

The phases are derived from the four phases of energy response suggested in the National Association of State Energy Officials' *State Energy Assurance Guidelines*.

Phase 1: Monitor and Alert

Monitoring of normal energy supply, demand, and price is ongoing until the time a monitored parameter reaches a level indicating that action is required.

Data acquired in this effort may provide a basis for subsequent, event-related, data acquisition and use. The primary sources for this data will be the U.S. DOE and EIA for petroleum incidents, municipal energy stakeholders, and the APSC regarding the electric and natural gas utilities it regulates.

The data tracking process and energy assurance activities for the electric and natural gas utilities regulated by the APSC will be addressed by the APSC and the APSC will communicate with and inform the AEO regarding any incident monitoring relating to the ESDTP.

Additional data include, but are not limited to, energy usage, peak delivery requirements, regional and local storage status, equipment status, and energy stakeholder operational capability. Other data can include, but are not limited to: information regarding Arkansas's electrical and interstate natural gas supply systems, propane suppliers and the petroleum product supply chain. Data on roadway and highway status will also be coordinated, as practical, with the Arkansas State Highway and Transportation Department (AHTD) and local jurisdictions.

Work with energy industry stakeholders to identify parameters when energy supply chain action is required.

- Identify parameters where public action or government action is required.
- AEO follows up at selected intervals to be determined and prepares and updates use profiles (mostly likely by month, day of week and temperature) so that abnormalities can be identified.
    - AEO develops regular updates of key information including storage status, expected outages for maintenance, and other information obtained from automated data reporting and contacts with key sources of information. This not only defines data, but also serves as a check on availability of contacts and changes in contact information. Other data includes:
        - Regular review of weather, energy demand, status and customer actions requested by municipal utilities and utilities regulated by the APSC to determine likelihood of problems.
        - Regular review of key news media to identify problems involving customers.

AEO follows up by describing changes in data and establishes an update frequency after an alert is issued. AEO officials describe actions associated with different parameters by the parties involved.

Phase 2: Assess and Determine Action

This assessment is divided into actions taken within the Energy Supply Structure and actions requiring government and citizen response.

- Compare acquired baseline data to additional data available, and obtained at the outset of a shortage, or related problem. This would be accomplished to the degree that personnel and time allow, given the intensity of the situation.
- Contact relevant energy sector stakeholders in order to acquire updated information as needed.

Actions that AEO should undertake pertaining to response actions (e.g., mitigation measures) and feedback during an event:

- AEO to identify data and update frequency required during action and follow-up phases:
    - Recognize that follow-up feedback could indicate a variety of outcomes such as:
        - Action should continue.
        - The situation has cleared.
        - The situation has worsened requiring different actions.

Phase 3: Action Assessment

After an action is taken in Phase 2, the data is monitored to reveal trends in light of the anticipated impact of a shortage. Results are monitored and, depending on the situation, the need for additional data acquisition is determined.

Phase 4: Review Lessons Learned

In a post-event review, the value of data acquired before, during and after the event are evaluated together with lessons-learned from actions that were taken (or may not have been taken). Recommendations for improvement to the Energy Assurance Plan are developed.

Assess results in the following areas:

- Prepare a timeline including key data monitored, alerts issued and actions taken from 24 hours prior (or as near as practical) to the alert through return to normal conditions. Specific information should be documented for the duration, response, restoration and recovery times for energy supply disruption events.
- Potential information to ask/consider:
    - Was the assessment accurate in defining the extent of the problem?
    - Did the data and monitoring frequency provide adequate warning in all phases?
    - Were the actions effective in alleviating/resolving the problem?
    - Was there timely response to the alerts by the proper organizations (state, supply chain, media, public)?
    - Were the assessment and action steps executed at the appropriate time?
    - Could a faster assessment and action or different action have yielded better results?
    - Did the historical data and thresholds for phase changes indicate a proper response?
    - What changes to the Energy Assurance Plan should be made to achieve a better result?

Obtaining information suggested in sections 1 through 5 will enhance the ability of the state to understand the nature of an impending and actual energy shortage. However, this data has one more critical purpose – providing a basis for mitigating future emergency measures. In other words, using the data obtained above before and during an emergency will enable responders to examine the efficacy of the Energy Assurance Plan and to make adjustments as data and events indicate.

The secret to successful post-event assessment is simple: Meet and do it. The reality of post-event assessment is that is difficult to gather responders after an event to discuss their experience. To ensure this crucial step is not missed, it is important to organize the following details:

- Planning
    - Suggest whom to include in the process
    - Suggest a routine for assuring that the process takes place
    - Suggest a lead agency for managing the process
    - Suggest protocols for conducting the process
    - Suggest means for integrating the results of the evaluation and assessment into the Plan
    - Encourage that changes in the Plan, resulting from the evaluation and assessment, be incorporated into future training exercises aimed at maintaining energy assurance preparedness.
- Organization – Who Should Attend
    - It is suggested that three Arkansas agencies provide the central focus for post-event: ADEM, AEO and APSC.
    - ESF #12 will provide the central focus.
    - In addition, any state and local agencies involved in the event should also be included.
    - Key industry stakeholders from the affected energy supply segments affected by the event should also be involved.
    - Key representatives of end-user groups should also be invited to participate.
- Organizing Agency
    - It is suggested that the Arkansas Energy Office take initial responsibility in developing the evaluation structure and process in close coordination with ADEM and the APSC.
        - Ultimately, ADEM or APSC may or may not wish to manage the process or take responsibility for managing the evaluation and assessment of certain kinds of events pertaining to energy systems under their oversight.

6 Energy Assurance: Electricity

This section examines essential electricity systems such as generation, transmission, and distribution so that responders will understand how the state's electricity market operates. It discusses major electricity stakeholders including IOUs; electric distribution companies (EDC) such as the Electric Cooperatives; municipal electricity utilities; and the RTO in order to identify those involved in this market. Energy shortage risks and vulnerabilities are examined together with the electricity industry's response and restoration efforts so that observers understand how shortage incidents are managed. Appendix M contains brief, illustrative descriptions of the possible response measures the state may wish to undertake in response to a severe electricity outage.

Electricity is fundamental to energy assurance in Arkansas. Electricity underpins all forms of energy supply – petroleum products and natural gas –operating pumps and monitoring devices and controls so that all forms of energy can reach customers. Figure 6.1 shows that most of the kilowatt hours consumed in Arkansas are in the commercial and residential sectors.

6.1 Data: Electricity

Figure 6.1 – Arkansas Electric Energy Consumption (2008)

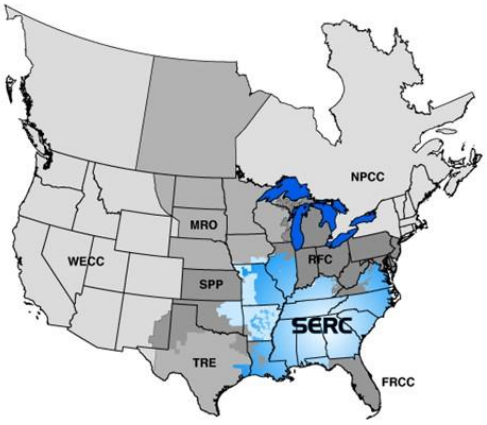
Sector	Consumption (Million kilowatt hours)
Residential	17,392
Commercial	11,703
Industrial	17,038
Transportation	2
Total	**46,135**
Source: EIA, *http://www.eia.doe.gov/cneaf/electricity/esr/table2.xls*	

The state's electric supply system comprises generation (and its fuel supply), high voltage (100's of kilovolts) transmission over long distances, and local distribution at lower voltage (10's of kilovolts) to transformers, where higher voltage is reduced to utilization levels (e.g., 240V, 120V) serving from one to several customers.

The Arkansas electricity infrastructure operates as parts of a major system. Entergy is a member of the Southeastern Electric Reliability Council (SERC). The Southwest Power Pool (SPP) (see figure 6.1), an RTO, serves as the Independent Coordinator of Transmission (ICT) for Entergy. Both SERC and the SPP Regional Entity (RE) are FERC-approved REs with responsibilities delegated to them by the North American Electric Reliability Corporation (NERC) to monitor, develop, and enforce reliability standards. SPP RE is a functionally separate part of the Organization. SPP's main function as an RTO is to ensure reliable supplies of power, adequate transmission infrastructure, and competitive wholesale prices of electricity. (See Appendix P for more details on the SPP.) Because SPP is both an RTO and an RE, monitoring and enforcement of compliance standards for both SPP as a registered entity (who must comply with standards), as well as a contract provider of independent transmission coordination for Entergy, is performed by the SERC Reliability Corporation (whose sole functions are those delegated to it by NERC).

In Arkansas, retail deregulation of electricity was never fully implemented and was repealed in 2003. The retail generation and transmission components of this system are regulated by the APSC. Wholesale sales of power and energy transmission are regulated by FERC.

Figure 6.2: SERC, SPP and other NAERC REs



Local distribution of electricity is provided by four IOUs (Entergy Arkansas, Empire District Electric, Oklahoma Gas and Electric and Southwestern Electric Power), 17 electric cooperatives, and 15 Municipal utilities.

As discussed in Section 3, *Legal Authorities and Stakeholders*, local distribution is subject to requirements established by statute and regulated by the APSC. The state is also affected by rulings made by FERC and standards set by NERC (Note on map above that the portion of Arkansas served by Entergy is part of SERC—the remainder of the state is part of SPP). State officials at the APSC continually work with the state's regulated electric distribution companies to enhance distribution system efficiency and maintenance in order to ensure the continuity of reliable service.

6.2 Energy Supply

6.2.1 Electricity Generation

Figure 6.3 shows the amount of monthly net generation in Arkansas with the megawatt hours produced by the fuels used. Coal is the primary generating fuel, followed by nuclear power and then natural gas. Understanding the relative impact of each fuel on net generation helps responders evaluate risk should a fuel source be diminished or lost. Figure 6.3 shows that there is much less risk to electricity use from a loss of renewables or hydroelectric than from a loss of coal, nuclear or natural gas (in that order). However, the U.S. DOE has asked states to think about the implications of a loss in renewable energy. In Arkansas's case, as of 2010, such a loss would have a relatively minor impact on net electric generation since renewables (biomass, solar and wind) account for only 2.27 % of net generation.

Figure 6.3: - Arkansas Net Electric Generation (May 2010)

Fuel Source	Net Electric Generation (Megawatt Hours - MWh)	Percentage of Net Generation
Petroleum	2,000	0.04%
Natural Gas	935,000	18.16%
Coal Fired	2,473,000	48.03%
Nuclear	1,334,000	25.91%
Hydroelectric	286,000	5.55%
Renewables	117,000	2.27%
Not Designated	2,000	0.04%
Net generation for Arkansas as of January 2010	5,149,000	
Source: State Energy Profiles, "Reserves & Supply", "Net Electric Generation," Arkansas, January, 2010 ***http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=AR***		

With a total of 37 electric utilities, the state system is quite complex. Independent merchant plants increase this complexity. Power is managed by IOUs, SPP and under the rules and guidance of the APSC[10].

Figure 6.4 shows the utility-owned generation capacity in the state. In Arkansas, Entergy and SWEPCO are the only IOUs with generation capacity. All four investor owned utilities also own generation facilities located outside of Arkansas that provide capacity and energy to the state. Arkansas Electric Cooperative Corporation owns eight plants and the remaining plants are owned by municipal and federal entities. Appendices C, D and E contain contact lists of all providers of electricity in Arkansas.

Figure 6.4 – Arkansas Utility Electric Power Generation Capacity (2007

Company Name	Number of Generating Plants	Generator Nameplate Capacity (Megawatts)
Entergy Arkansas, Inc.	11	7,614.8
Arkansas Electric Cooperative Corp.	8	1,362.7
Southwestern Electric Power Company	2	907.0
USCE – Little Rock District	6	889.2
Associated Electric Cooperative, Inc.	1	679.0
City of Jonesboro	1	224.3
USCE – Vickburg District	3	168.5
City of North Little Rock	1	45.4
Paragould City Light & Water Comm.	2	33.1
City of Osceola	1	9.6
City of Piggott	1	7.2
TOTAL	**37**	**11,940.8**

Note: Some Plants attributed to certain utilities are jointly owned. Source: U.S. Energy Information Administration.

[10] More detail about the SPP's role in the Arkansas electric market is noted below.

The total nameplate capacity of Arkansas's electrical generation is 16,461.7 MW (Figure 6.5). Independent plants (Figure 6.4) provide about 27% of this total (4,520.9/16,461.7 = 27%). The sale of this power is achieved by bilateral contracts and in coordination with the Energy Imbalance Service (EIS) market managed by SPP[11]. Figure 6.5 lists this infrastructure.

Figure 6.5 – Arkansas Electric Generator Nameplate Capacities by Feedstock

Type of Generator	Capacity (MW)	% of total capacity
Biomass	41.3	0.3%
Black Liquor	333.5	2.0%
Distillate Fuel Oil	22.9	0.1%
Natural Gas	8,924.2	54.2
Nuclear	1,845.0	11.2%
Subbituminous Coal	3,958.0	24.0%
Hydropower	1,336.8	8.1%
TOTAL	**16,461.7**	**100.0%**

Source: U.S. Energy Information Administration

Figure 6.6 – Arkansas Non-Utility Electric Power Generation (2007

Company Name	Number of Generating Plants	Generator Nameplate Capacity (Megawatts)
Union Power Partners, LP	1	2,428.0
Hot Spring Power Company, LLC	1	746.0
Cinergy Solutions O&M, LLC	1	714.8
Pine Bluff Energy, LLC	1	236.0
Domtar Industries Inc.	1	156.5
Crossett Paper Operations	1	92.0
Evergreen Packaging, Inc.	1	85.0
Potlatch forest Products Corporation	2	35.0
Riceland Foods, Inc.	1	18.0
WM Renewable Energy, LLC	1	4.8
Century Flooring Company, LLC	1	2.0
Little Rock Wastewater Utility	1	1.5
City of Fort Smith	1	1.3
TOTAL	**14**	**4,520.9**

Note: Some of the Plants attributed to certain utilities are jointly owned
Source: U.S. Energy Information Administration.

[11] Ibid

Physical management of Arkansas power plants is the responsibility of owners and operators. As can be seen in Figures 6.5 and 6.6 above, the state has owners and operators who are independent of either IOU or municipal electric systems. However, this does not relieve regulated EDCs from their responsibility to provide reliable electrical power. Assuming that each independently-owned and licensed generation company is properly maintained and operated, the most important generation issue for the EDCs is the marketplace where they buy electricity because that is where availability and price meet to affect supply.

6.2.2 Fuel for Power Generation

Coal is the primary generation fuel for Arkansas's electric power generation. Coal production in Arkansas is relatively minor. In 2004, the state produced approximately 7,000 short tons of coal, which made it 26th in the nation in coal production[12]. However, most of the coal consumed in Arkansas is mined in Wyoming and delivered to area power plants by rail. Rail delivery creates risk due to rail delivery issues. For example, deliveries in 2005-2006 were 15% less than contracted due to "rail delivery problems"[13].

Entergy Arkansas officials have expressed concern that environmental requirements for coal combustion may eventually reduce generation capacity. The company feels that the cost of adding new generation scrubbers and meeting environmental mandates will eventually limit the use of coal for fueling power. They feel that the state cannot afford to lose the generating capacity supplied by coal[14].

The state's nuclear plants are located near Russellville. Coal and nuclear power provide the state's electricity system with the "base" load that underpins generated power to meet demand. Nuclear fuel generates approximately one quarter of the state's electricity. Hydropower, providing 5½% of the state's demand, is also a reliable source of power. Natural gas, at just over 18%, is used primarily for meeting intermediate and peak demand.

6.3 Stakeholders: Electricity

The stakeholders listed here are the principal industry stakeholders supplying power to Arkansas customers. They include the IOUs, Cooperatives, municipal utilities and non-utility energy suppliers, among other stakeholders of interest. Section 3 lists government stakeholders involved in the state's electricity market.

Information on production and consumption of electric power, electric generator nameplate capacities by feedstock energy source, and primary energy sources consumed to produce electricity in Arkansas, are in the *Arkansas Energy Profile*, see Appendix C.

[12] Mining in Arkansas, National Mining Association, June 2008

[13] Robert G. Szabo, Consumers United for Rail Equity, "Ratepayers Getting Railroaded," NARUC Winter Committee Meeting, Washington, D.C., February 12, 2006.

[14] Interview with Entergy officials, March 2010.

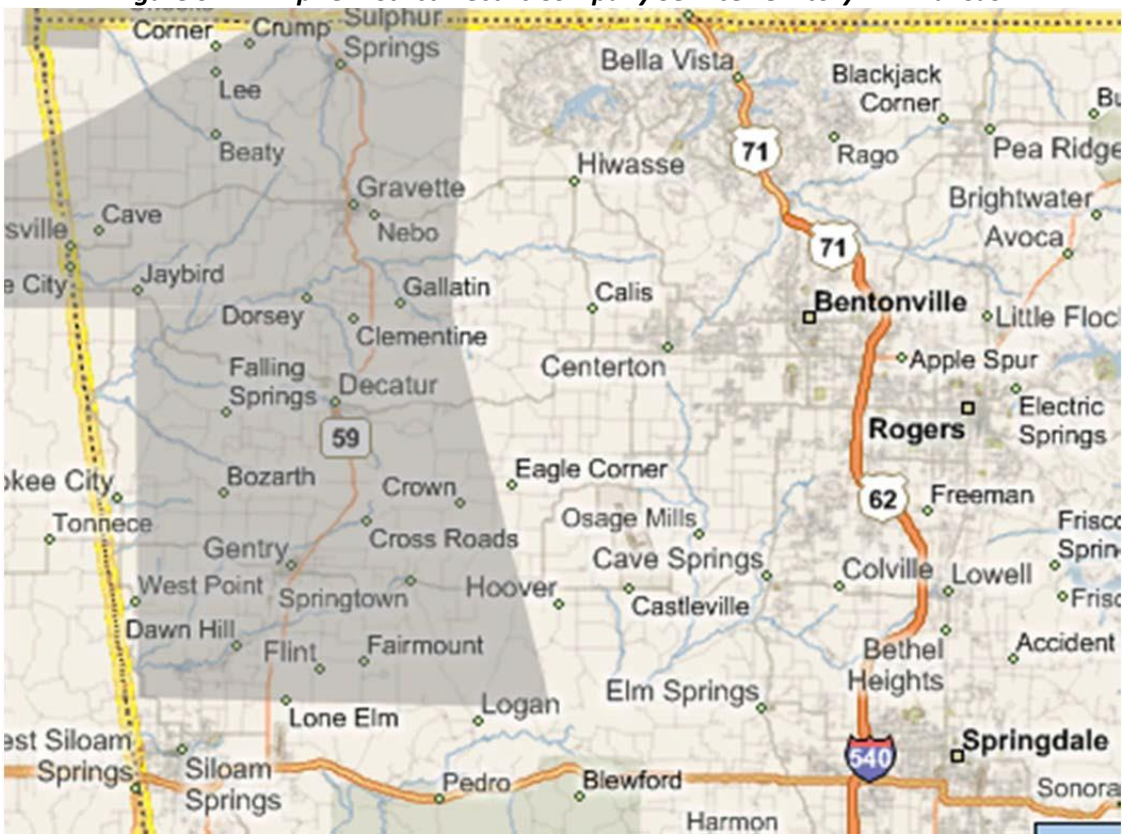
6.3.1 Regulated Investor Owned Utilities (IOU)

6.3.1.1 Empire District Electric Utility

The Empire District Electric Company serves the smallest number of IOU customers in Arkansas. This multi-state company has approximately 168,706 customers in Arkansas, Kansas, Missouri and Oklahoma. The APSC reports that 4,319 of these customers are located in northeastern Arkansas in 2009. The company is headquartered in Joplin, MO. It owns seven power plants providing a total of 1257 MW to its customer base and sold 158,239,610 kWh in Arkansas in 2008.

According to the company's 2010 newsletter, Empire recently completed environmental upgrades to three of its generating plant units – Ashbury, Latan #s 1 and 2, Plum Point and Riverton #1.

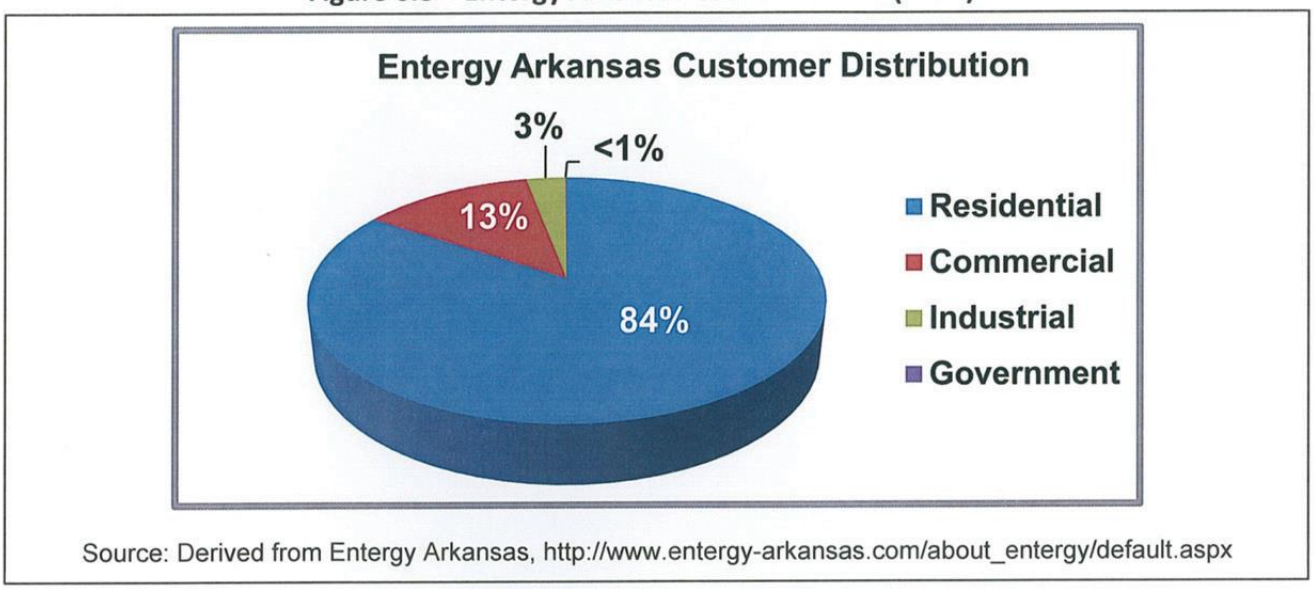
Figure 6.7 – Empire District Electric Company Service Territory in Arkansas



6.3.1.2 Entergy Arkansas

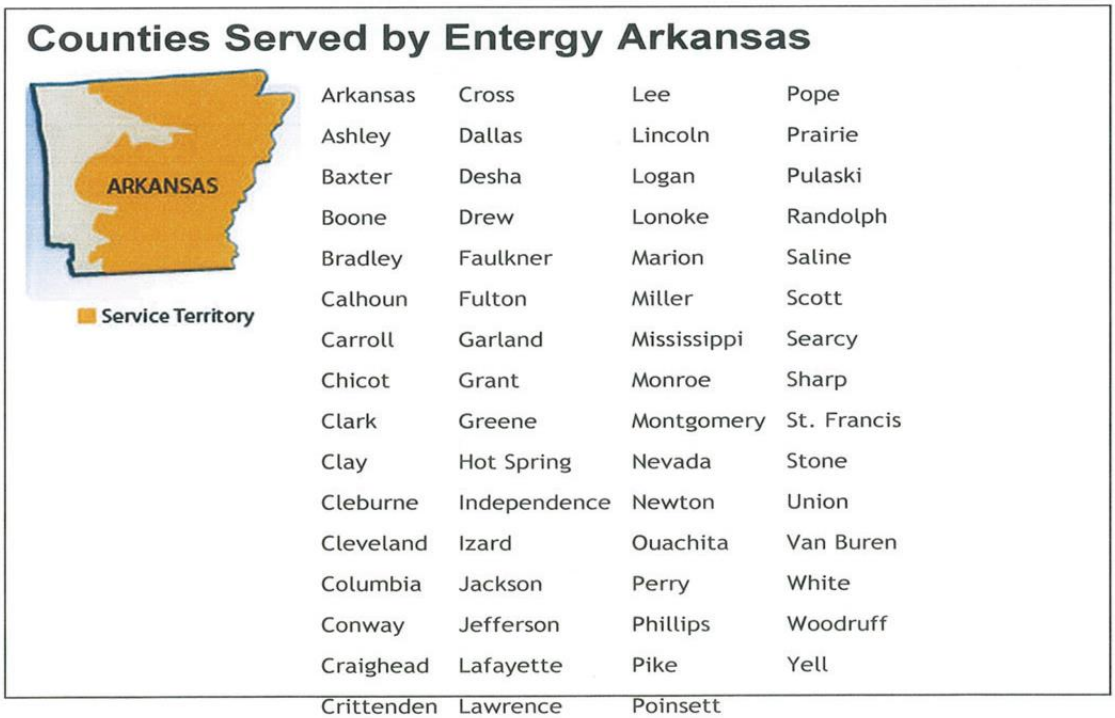
Entergy Arkansas is part of a large interstate system with customers in Arkansas, Louisiana, Mississippi, and Texas. Entergy has subsidiaries in each of these states and New Orleans, LA, and the Gulf region of that state. Inside Arkansas it served 690,498 accounts in 2009 distributed as illustrated in Figure 6.8, providing over 31 million kWh of power in 2009. The company's Arkansas service territory covers most of the state and is show in Figure 6.9.

Figure 6.8 – Entergy Arkansas Customer Base (2010)



Source: Derived from Entergy Arkansas, http://www.entergy-arkansas.com/about_entergy/default.aspx

Figure 6.9 – Entergy Arkansas Service Area



In order to manage potential changes and issues related to cost recovery, Entergy Arkansas has held conferences to evaluate options for future organization. Its corporate leadership has initiated a discussion that includes changing the company's present status and adopting one of the following options:

- Become a stand-alone utility,
- Enter an arrangement with SPP or other system management organization,
- Create a successor arrangement with other Entergy operating companies.

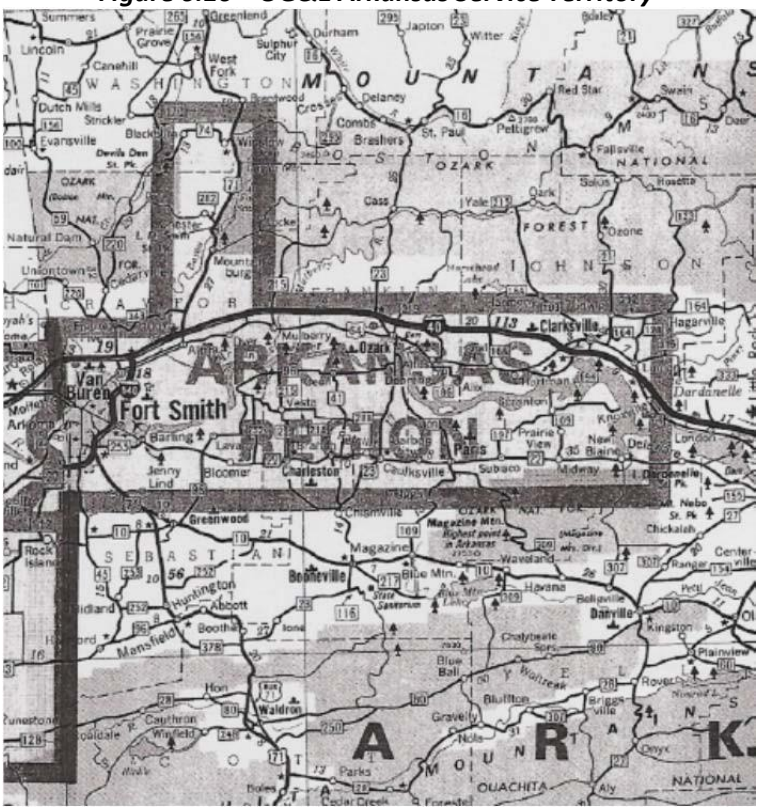
The company's ownership would not change under any of these options. Because Entergy is the state's principal electric utility, its determinations, in light of whatever position is taken by the APSC, will be of interest to all of Arkansas's energy stakeholders.

6.3.1.3 Oklahoma Gas & Electric Services (OG&E)

Oklahoma Gas & Electric Services has a substantial profile in Arkansas's neighboring state. In 2009 it served more than 779,000 retail customers in both states and more than 64,600 accounts in a relatively small area of the middle-western portion of Arkansas. The company sells power generated by western coal, natural gas, and wind and sold 3,411,168,118 kWh in 2009.

OG&E's service territory includes the Arkansas towns of Alix, Alma, Altus, Barling, Branch, Caulksville, Central City, Charleston, Chester, Clarksville, Coal Hill, Denning, Dyer, Fort Smith, Hartman, Lamar, Lavaca, Morrison, Mountainburg, Mulberry, Ozark, Ratcliff, Scranton, Subiaco, Van Buren, and Winslow.

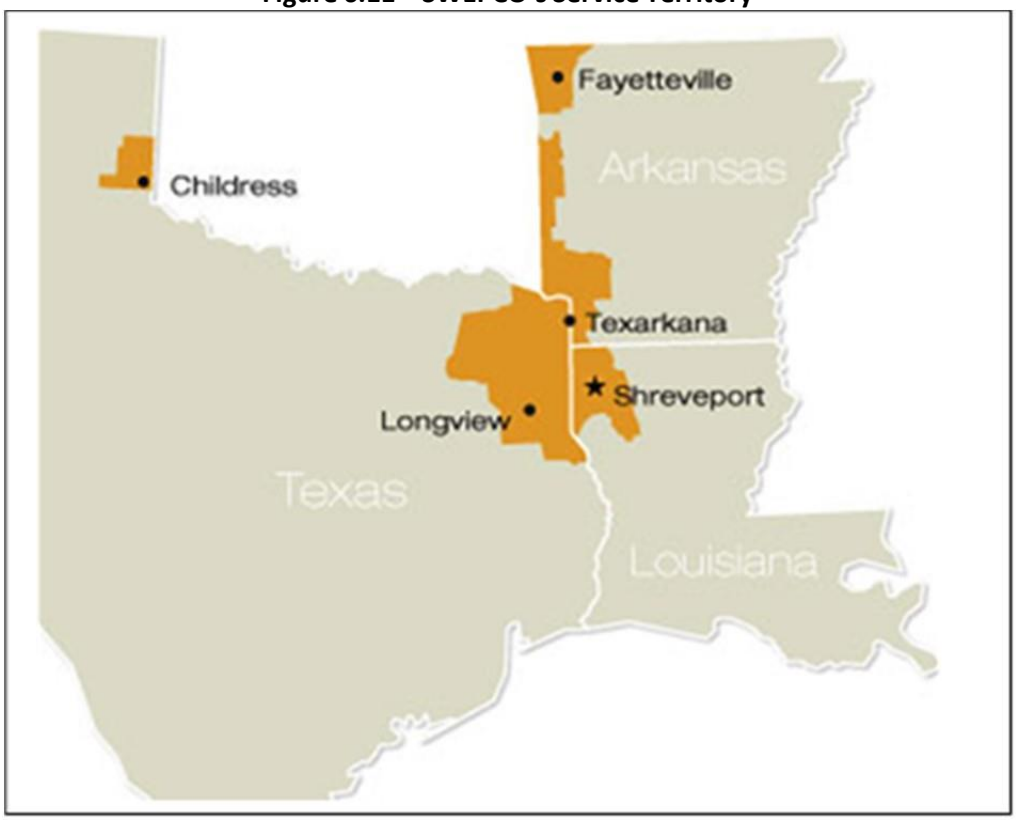
Figure 6.10 – OG&E Arkansas Service Territory



6.3.1.4 Southwestern Electric Power Company (SWEPCO)

SWEPCO is an American Electric Power Company that serves approximately 480,700 customers in its four service areas: Arkansas, Louisiana, and two regions in Texas. In 2009, almost 2% of these customers, 113,000, were located in 10 Arkansas counties including the cities of Fayetteville and Texarkana. It has 4,850 MW of generating capacity for its entire territory, and sold 5,171,772,120 kWh in Arkansas in 2009. Figure 6.11 shows a map of SWEPCO's service areas.

Figure 6.11 – SWEPCO's Service Territory



6.3.2 Cooperatives

There are 18 regulated electric cooperatives in Arkansas. Seventeen of these are Distribution Cooperatives that own distribution infrastructure and sell power to customers in each cooperative's respective service territory. The 18th cooperative is a Generation and Transmission Cooperative, Arkansas Electric Cooperative Corporation (AECC) that is owned by the 17 distribution cooperatives. AECC owns and operates 11 generating plants selling wholesale power to its member cooperatives supplying over 490,000 customers. AECC generation plants are listed in Figure 6.12. In 2009, Arkansas's cooperatives sold 26,318,237,446 kWh of power to their customers.

Figure 6.12 – AECC Generating Plants

Plant Name: Flint Creek Power Plant **City:** Gentry, Arkansas **Operation:** Unit 1 July 1978 **Ownership:** AECC owns 50% of this plant **Fuel:** Low-sulfur coal mined near Gillette, Wyoming **Capability:** 528 megawatts
Plant Name: Independence Steam Electric Station **City:** Newark, Arkansas **Operation:** Unit 1 - January 1983/Unit 2 - December 1984 **Ownership:** AECC leases 35% of Unit 2 **Fuel:** Low-sulfur coal mined near Gillette, Wyoming **Capability:** 1,678 megawatts
Plant Name: Thomas B. Fitzhugh Generating Station **City:** Ozark, Arkansas **Operation:** Unit 1 - 1963; Unit 2 - 2003 **Ownership:** AECC owns 100% of this plant **Fuel:** Primary-Natural Gas, Backup-#2 Fuel Oil **Capability:** 170.6 megawatts
Plant Name: Clyde T. Ellis Hydroelectric Generating Station **Plant Address:** Arkansas River Dam No. 13 **City:** Barling, Arkansas **Operation:** 1988 **Ownership:** AECC owns 100% of this plant **Fuel:** Arkansas River **Capability:** 32.4 Megawatts
Plant Name: Carl E. Bailey Generating Station **City:** Augusta, Arkansas **Operation:** Unit 1 - 1966 **Ownership:** AECC owns 100% of this plant **Fuel:** Primary-Natural Gas, Backup-#6 Fuel Oil **Capability:** 122 megawatts
Plant Name: Carl S. Whillock Hydroelectric Generating Station **Plant Address:** Arkansas River Dam #9 **City:** Morrilton, Arkansas **Operation:** 1993 **Ownership:** AECC owns 100% of this plant **Fuel:** Arkansas River

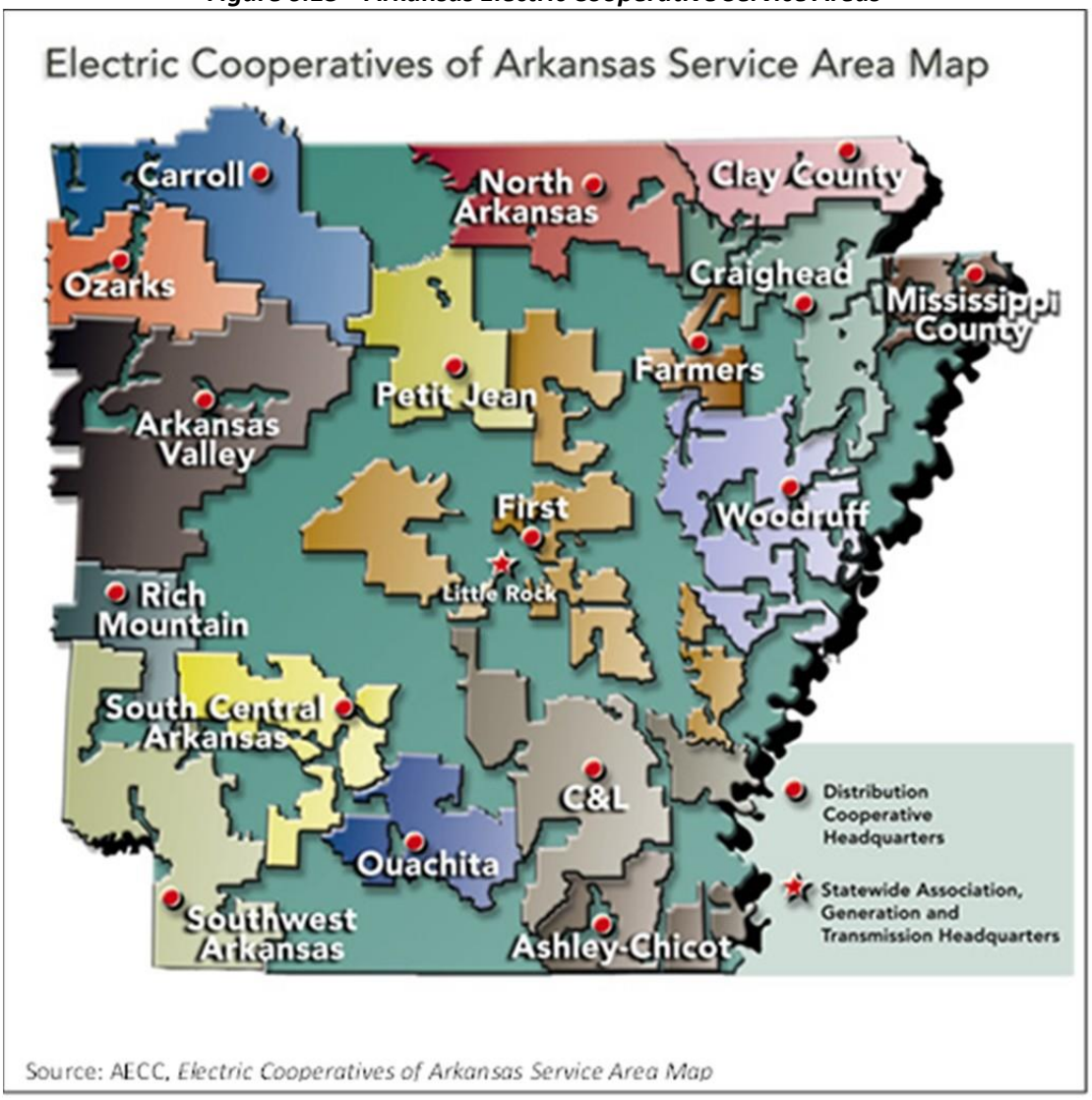
Capability: 32.4 megawatts
Plant Name: White Bluff Steam Electric Station **City:** Redfield, Arkansas **Operation:** Unit 1 - August 1980 / Unit 2 - July 1981 **Ownership:** AECC owns 35% of this plant **Fuel:** Low-sulfur coal mined near Gillette, Wyoming **Capability:** 1,659 megawatts
Plant Name: John L. McClellan Generating Station **City:** Camden, Arkansas **Operation:** Unit 1 - 1971 **Ownership:** AECC owns 100% of this plant **Fuel:** Primary-Natural Gas, Backup-#6 Fuel Oil **Capability:** 134 Megawatts
Plant Name: Electric Cooperatives of Arkansas Hydropower Generating Station **Plant Address:** Arkansas River Dam No. 2 **City:** Dumas, Arkansas **Operation:** 1999 **Ownership:** AECC owns 100% of this plant **Fuel:** Arkansas River **Capability:** 102.6 megawatts
Plant Name: Fulton CT1 Generating Station **City:** Fulton, Arkansas **Operation:** May 26, 2001 **Ownership:** AECC owns 100% of this plant **Fuel:** Natural gas **Capability:** 153 megawatts **City:** Fulton, Arkansas
Plant Name: Harry L. Oswald Generating Station at Wrightsville **City:** Wrightsville, Arkansas **Operation:** July 1, 2003 **Ownership:** AECC owns 100% of this plant **Fuel:** Natural gas **Capability:** 548 megawatts
Source: AECC, *Generation Facilities* http://www.aecc.com/about_us_generation_facilities.shtml

These plants represent a total capability of over 2,700 MW of electric capacity that serves primarily rural areas and towns in Arkansas. The highest firm load for this generation is about 2,100 MW during the winter and 1,900 MW in the summer. AECC works with American Electric Power, Entergy Arkansas, Empire, OG&E as well as the SPP on technical issues relating to system operation and scheduling with the high power transmission market. As can be seen in Figure 6.12, most of the fuel sources are domestic with coal from Wyoming, domestic natural gas (or equivalent) and hydro-power.

The Distribution Cooperatives (listed in Appendix E) are transmission-dependent and maintain their own delivery systems. This includes routine maintenance such as trees, new construction, load centers, pole management, inspection and electronic monitoring. Most have modernized distribution infrastructure that provides services beyond the basic capability of SCADA system controls with a few of the cooperatives able to monitor service up the customer's meter.

For energy assurance purposes, it should be understood that cooperatives are “transmission dependent.” This means that peaks are manageable from a generation perspective but the long distance distribution lines through rural areas result in a low customer density per line mile. This translates into higher costs per customer for maintenance and, when necessary, restoration. Further, the areas through which these lines traverse is more exposed to severe weather than lines in urban-suburban areas. Cooperative managers feel they can routinely manage relatively rare snow and tornado issues; ice is the greatest threat. Ice storms from 2000 to 2010 damaged more than 30,000 distribution poles in the Arkansas-Oklahoma region. Figure 6.13 shows the service area of the state’s distribution cooperatives.

Figure 6.13 – Arkansas Electric Cooperative Service Areas



6.3.2.1 Arkansas Electric Cooperatives, Inc. (AECI)

AECI, the umbrella organization that serves all of the 18 member cooperatives, has two primary functions. It represents the cooperatives before state and federal regulators and meets with elected and jurisdictional officials on matters pertaining to the electric cooperatives. As part of this effort, AECI works with communities and business to enhance business opportunities for its members.

AECI also maintains an extensive Utilities Division that supplies a wide variety of materials and expertise covering all aspects of utility maintenance, construction, repair and testing. The repair capability extends to crews that may supplement the efforts of individual cooperatives. The large equipment stores of this organization provide an extra margin of reliability to the entire cooperative system. AECI Utilities Division services are also available to other utilities. Appendix E is a contact list of the AECI association and its distribution cooperatives.

- Arkansas Valley Electric Cooperative
- Ashley-Chicot Electric Cooperative
- C & L Electric Cooperative
- Carroll Electric Cooperative
- Clay County Electric Cooperative
- Craighead Electric Cooperative
- Farmers Electric Cooperative
- First Electric Cooperative
- Mississippi County Electric Cooperative
- North Arkansas Electric Cooperative
- Ouachita Electric Cooperative
- Ozarks Electric Cooperative
- Petit Jean Electric Cooperative
- Rich Mountain Electric Cooperative
- South Central Arkansas Electric Cooperative
- Southwest Arkansas Electric Cooperative
- Woodruff Electric Cooperative

6.3.3 Municipal Electric Utilities

Municipal electric utilities are not regulated by the APSC. These companies may be departments of local government or stand-alone entities. They are governed by a city council or by a board of trustees. Because they work to provide lower rates than those posted by cooperatives and IOUs, municipals are popular with the local customers they serve.

Some municipals own power plants while others are part owners of generation co-owned with IOU or independent power producers. They work within either the Entergy or SPP transmission network. They operate under NAERC reliability standards. Some have extensive utility departments with engineering, design, line construction and field personnel. Others appear to operate with one professional who may also be responsible for more than one type of utility (e.g. gas, water). Apparently Arkansas municipal utilities do not have formal mutual aid agreements with other municipal utilities. Emergency response is managed by local company personnel, private sector contractors or, in some instances by arrangements with area IOUs. A list of Arkansas Municipal utility contacts is contained in Appendix F.

6.4 Arkansas's Electric Transmission System

The electric power transmission systems of SWEPCO, OG&E, and Empire are operated by SPP. Entergy's transmission system is coordinated by SPP as the ICT. SPP is a FERC-approved Regional Transmission Organization (RTO). RTO's were authorized by the U.S. Energy Policy Act of 1992 and created under Order 888, the open access tariff by the FERC. SPP covers most of the state both managing the area it covers and acting as the Independent Coordinator of Transmission (ICT) for those areas served by Entergy Arkansas. SPP's headquarters is located in Little Rock.

Entergy Arkansas, Inc. is a member of SERC, which is a member of the NAERC. SPP is also a reliability coordinator under NAERC. Participation in NAERC was designed to enhance energy assurance for transmission of power. The process is not entirely voluntary. FERC Regulations, Section 39.11 (b) states that:

> "…the ERO (Electric Reliability Organization) shall conduct periodic assessments of the reliability and adequacy of the Bulk-Power System and report its findings to the Commission, the Secretary of Energy, Regional Entities, and any Regional Advisory Bodies annually, or more frequently if directed by the Commission."

While this amounts to legal authority for setting reliability standards, § 215 of the Federal Power Act does not grant NAERC the ability to adopt "enforceable standards," or require compliance through the construction of additional infrastructure.

Both SPP and Entergy Arkansas are discussing, among a number of options being considered, a possible membership into one system after the current system agreement expires. APSC is also involved in this issue and is seeking more information on the cost/benefit of such a membership. The issue being considered under APSC Docket 10-011-U is whether or not Entergy Arkansas should be a stand-alone system, a successor agreement or a third party arrangement. Resolution of this issue would influence on-going evaluation of the state's electric transmission needs.

Electric cooperatives in Arkansas also work within the transmission systems of both SPP and Entergy Arkansas. Entergy Arkansas, SWEPCO, and OG&E have service territories in many of the same counties as the cooperatives. Arkansas Electric Cooperative Corporation (AECC) is the generation and transmission cooperative that provides electric generation for the seventeen distribution cooperatives. The distribution cooperatives operate in both the Entergy Arkansas and SPP systems. The municipal electric utilities are served by both the Entergy and SPP transmission systems.

Connected to, and influenced by, the statewide transmission systems, each utility also owns and maintains its own local area distribution system. Generally, consumers interact with a utility at the distribution level so these systems are the most visible to customers and disruption to them are most likely to generate complaints.

6.4.1 Transmission Growth

Expansion of transmission capacity anywhere in the regional power pool can benefit Arkansas by reducing congestion within the system. For instance, SPP approved an estimated $1.84 billion in new double circuit 345 kV lines and related equipment. Upgrades to distribution lines including improvements from 65kV to 161kV with multiple redundant circuits have been made in northwest

Arkansas. Other recent improvements were accomplished by IOUs SWEPCO and Oklahoma Gas and Electric.

SPP plans transmission growth in a three year cycle process of Integrated Transmission Planning. Each cycle contains three time periods: near term, 10 years, and 20 years. According to SPP, this technique will accompany its existing study processes including Extra High Voltage Overlay, Balanced Portfolio and SPP Transmission Expansion Plan Reliability Assessment. The RTO plans to integrate these analytical models with its stakeholder working groups at sub-regional planning meetings.[15]

Entergy Arkansas officials expressed concern in 2010 that current transmission was inadequate while distribution infrastructure is satisfactory. Entergy officials feel that bulk power transmission can sometimes hamper local needs by absorbing capacity that might otherwise be available for in-state consumers.[16] Entergy undertakes transmission planning on a regular basis and has on-going long-term transmission expansion scheduled to meet anticipated needs. Figure 6.14 lists 20 transmission line projects planned from 2009 to 2013 and beyond. The status of all these planned projects is subject to APSC approval.

[15] 132 FERC §61,042 Docket No. ER10-1269-000. *Order Conditionally Accepting Tariff Revisions,* July 15, 2010.
[16] Interview with Entergy officials, Little Rock, March 2010.

Figure 6.14 - Entergy Arkansas Planned Transmission Projects

2009	
1	Donaghey to Conway South: Upgrade Line
2010-2012	
2	Osage Creek – Grandview: New Line
3	Melbourne to Sage 161kV: Upgrade Line
4	Transmission Service – Aquila
5	Transmission Service - OG&E
6	Transmission Service – SMEPA
7	Jonesboro to Hergett: Upgrade 161kV Line
8	Holland Bottoms to Hamlet: Construct New 161 kV Line
9	Benton North to Benton South: Construct New 115 kV Line

2013 and Beyond	
10	Little Rock Re-Conductor 115 kV Transmission Lines
11	Norfork – Sage: Upgrade 161 kV Line
12	Bull Shoals to Midway: Upgrade 161 kV Line
13	Gum Springs to Amity: Construct 115 kV Line
14	Holland Bottoms to Ward: Construct 2nd 115 kV Line
15	Jim Hill to Datto: Convert 115 kV Line to 161 kV Or Construct a New 161 kV Line
16	Lake Village Bagby to Macon Lake: Upgrade 115 kV Line
17	Mayflower to Morgan: Upgrade 115 kV Line
18	Russellville East to Russellville North: Upgrade 161 kV Line
19	Camden North to Camden McGuire: Construct a 115 kV Line
20	El Dorado Upland to Texas Eastern F: Construct 115 kV Line
Entergy Arkansas, Inc., Proposed Transmission Projects, Entergy Transmission Planning Summit New Orleans, LA, August 11, 2009	

SWEPCO also has proposed transmission projects before the APSC. The projects proposed for location in Benton County are:

- Flint Creek to Shipe Road 345 kV transmission line originating at the Flint Creek Station, located on the premises of the Flint Creek Generation Facility, near Gentry in Benton County and terminating at the proposed Shipe Road Station west of Centerton
- Shipe Road to Centerton 161 kV transmission line originating at the proposed Shipe Road Station and continuing to a point south of the existing Centerton Station (approximately 5.4 miles) before connecting to an existing 69 kV transmission line. Infrastructure conductor work slated for the 69 kV line is also included in this application.[17]
- Rebuild the existing 69 kV Centerton to East Centerton transmission line and energize at 161 kV along two miles of existing right-of-way.

[17] Condensed from SWEPCO Web Site, *Benton County Project, https://www.swepco.com/info/projects/BentonCounty/*

6.4.2 Electricity Distribution in Arkansas

As noted above, local distribution of electricity is the responsibility of the EDCs. FERC and NAERC requirements must also be met by distribution companies but the primary regulatory agency at the distribution level is the APSC.

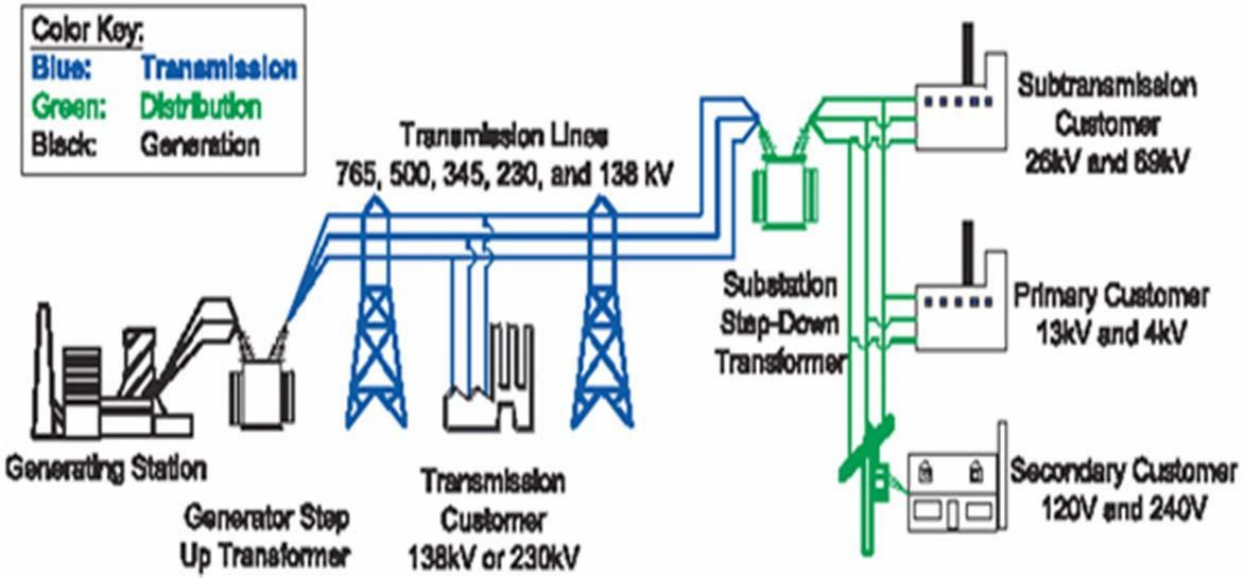
Figure 6.15 illustrates a typical electric distribution system. Like the generating and transmission systems, distribution is deceptively simple from the customer's perspective. After all, it is the consumption of electricity at the distribution level that provides the basic data required to plan for generation and transmission capacity. Behind the wall switch and meter are wires carrying several levels of kilovolts as power is stepped down by sub-station transformers from high voltage long-range transmission to voltage levels for various local distribution lines. Complex transformers also step-up power for long-range transmission as it leaves the generating plant. The local distribution system contains a network of infrastructure from poles to junction boxes to the wires and meter at the end-user's location. Utilities also operate complex communication networks for routine and emergency operations, control rooms to monitor network activity, maintenance and repair shops, equipment and trained personnel plus an accounting and billing operation to assure that electrons are accounted for when purchased.

The DOE, *Electricity 101* diagram in Figure 6.5 also illustrates an additional level of complexity that will help stakeholders unfamiliar with the electricity system understand potential issues in electricity distribution. Some industrial users receive power directly from high voltage transmission lines and maintain end-use transformation off-grid. The diagram also indicates end-use customers which include: small industry, commercial/institutional users, and municipals. These customers may obtain favorable bulk rates applicable to their size and demand. At the end of the distribution system are residential customers. Hence, a major electrical outage could create the appearance of discrimination and favoritism because it is expeditious and logical to first restore largest number of users whose distribution involves fewer utility components due to size and the ability to accept higher kV power.

The diagram can also be viewed as a template for the restoration of power. As will be noted below, companies generally restore power after a loss or interruption based on system-created priorities. This relates to energy assurance as the restoration of the larger (i.e., serving more accounts or customers) circuits occurs first, followed by smaller subsystems that serve diminishing groups of users.

EDCs assess outage location and scope after any disruption or incident. Incidents that occur in a smaller subsystem only, typically result in more rapid restoration than incidents that occur at or near the bulk power level. This is because it may take more time to repair complex large-scale components that must be restored before local distribution needs can be addressed.

Figure 6.15 – Electricity 101 - Electric System Diagram



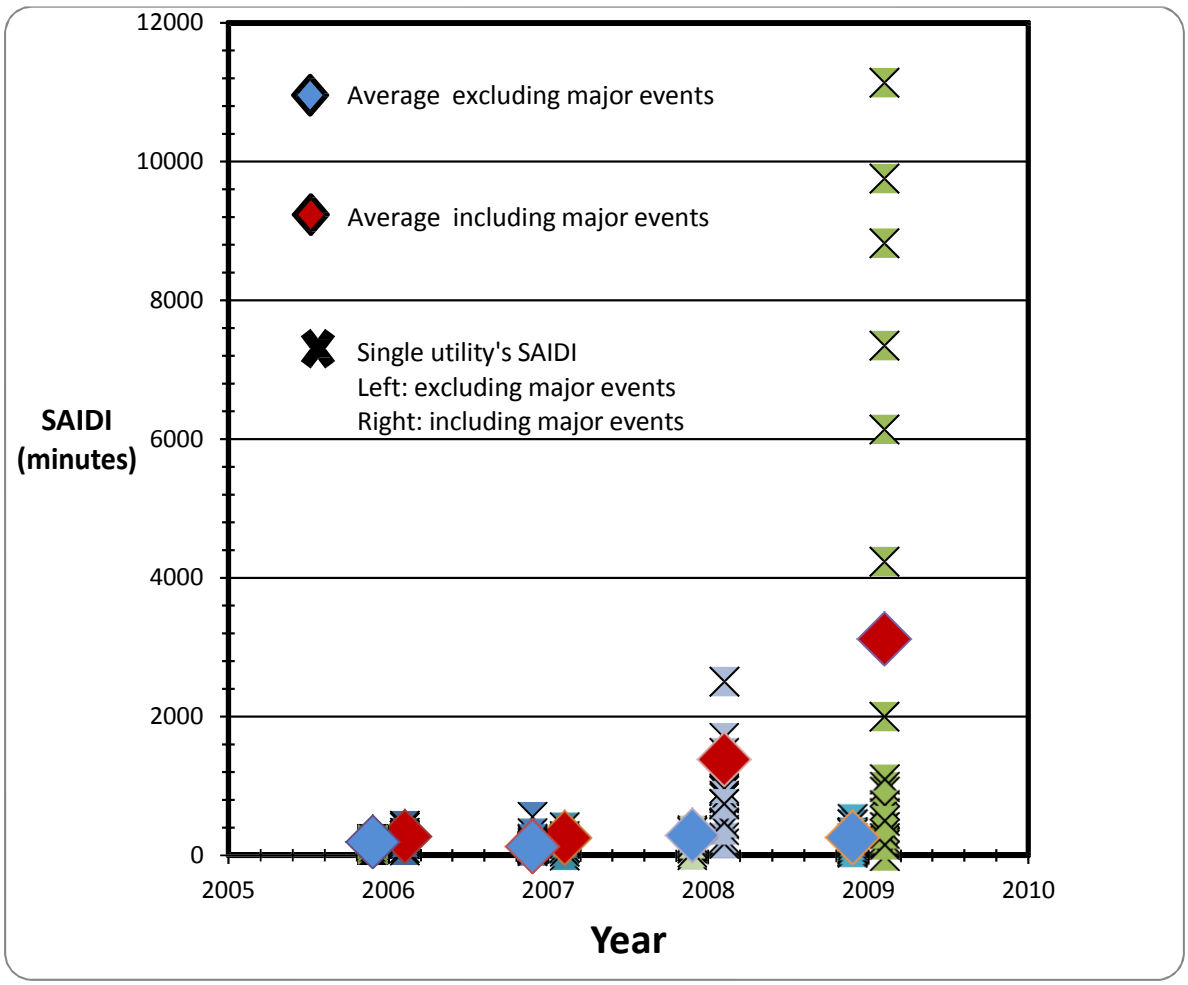
Source: U.S. DOE, OE, Electricity 101
http://www.oe.energy.gov/information_center/electricity101.htm

In the near future, the interface between distribution customers and the entire utility system may be automated all the way to the customer's appliance so that utility companies may monitor consumption remotely in real time and, eventually, be able to encourage and monitor conservation at the point of sale. Some communication equipment is currently in place which permits remote meter reading, service turn-on and turn-off, outage detection and service dispatch. Smart Grid systems may be a major element of this change and are discussed in Section 9 *Smart Grid and Energy Alternatives.*

6.4.3 Average Customer Outage (SAIDI)

The stability and hardiness of Arkansas's electrical infrastructure are measured in a variety of ways. One of these metrics, used by Arkansas's utilities, tracks the SAIDI - the average duration of an outage for each customer served. This statistic is often reported in two ways: one including major events and one excluding them. According to IEEE, a major event is one which exceeds reasonable design or operational limits of the electric power system and during which at least 10% of the customers within an operating area experience a sustained interruption during a 24-hour period. Figure 6.16 shows the yearly estimated average SAIDI for the utilities of Arkansas. The effects of the ice storm that devastated northwest Arkansas in January 2009 are clearly seen: major events added more than 40 hours to the statewide average SAIDI in 2009. The example from this single metric is an indicator of the importance of continued improvements to Arkansas's electrical power system.

Figure 6.16 – Yearly SAIDI data for Arkansas utilities.



6.5 Energy Assurance Procedures for Electric Utilities

While the primary state agency working with utilities is the APSC, this plan is designed to give all potential responders a picture of how the electric utilities and related entities manage emergency issues. Risk in an electricity system can be divided into two levels, just as it can for other energy systems – supply and distribution. Each level operates in reference to the other, but this division is a useful way to examine risk and describe what various components of the electric industry do to prevent, mitigate or recover from power problems. Arkansas EDCs and others address capacity and interstate marketplace issues on the supply side while being prepared to maintain and restore power on the distribution side. Procedures for analysis of the electric utility sector are well established at all levels of the supply chain. Comprehensive and precise information, including real time information on system conditions and impending problems, is available from the electric utilities and the APSC. The actions are well defined and do not require special additional analysis by state agencies.

As a part of its foundational responsibilities, the APSC regulates the jurisdictional electric utilities to ensure safe and reliable service at reasonable rates. The APSC has established quality of service standards and resource planning guidelines to ensure that the electric utilities have sufficient resources

and facilities to provide safe and reliable service. Further, as part of that regulation, the APSC ensures that the electric utilities are prepared to promptly restore service in the event of an outage, regardless of the cause of the outage.

Ensuring adequate generation, transmission, and distribution facilities is essential. In Arkansas and in the region, there are areas and times of transmission constraints. The APSC is addressing this issue through participation in proceedings involving SPP acting as the Independent Coordinator of Transmission (ICT) for Entergy Arkansas. The APSC participates in the Regional State Committee for SPP and in the Entergy Regional State Committee for the Entergy ICT. The APSC has also opened dockets to address the issue in Arkansas and actively participates in proceedings before FERC.

Specific resource planning guidelines ensure adequate supplies of capacity and energy to serve each utility's load. In the development and evaluation of resource plans, utilities and the APSC consider a number of factors, including but not limited to, load forecasts, generation and transmission capacity forecasts, peak usage, and weather data.

Further aspects of reliability management occur in metrics used by the APSC to measure the frequency and duration of outages. Using indices such as CAIDI (Customer Average Interruption Duration Index), SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index), the APSC looks for the frequency and duration of events as a routine part of its effort to understand the underlying cause of an incident. This activity is especially important in rural areas where circuits serve fewer customers per line mile.

The APSC has special rules that govern how jurisdictional electric utilities construct, operate, and maintain their facilities to ensure safe and reliable service and, consequently, to avoid outages and interruptions of service.

See the APSC's General Service Rules, Special Rules – Electric, Resource Planning Guidelines for Electric Utilities, Cogeneration Rules, and the resource plans of each jurisdictional electric utility filed with the APSC.

6.5.1 Restoration of Service

This section addresses procedures to restore service in the event of any disruption including an emergency. Each jurisdictional electric utility has established procedures to restore service in the event of an outage, regardless of the cause of the outage. The APSC has quality of service standards that are structured to ensure that all jurisdictional electric utilities provide safe and reliable service at a reasonable price. There are specific provisions that address restoration of service in the event of an outage. The jurisdictional electric utilities have executed those procedures on numerous occasions to restore service. Recent examples of responses to widespread outages would be the ice storms of 2009 that struck northern Arkansas and the tornadoes and hurricane remnants that passed through the state during 2008.

6.5.2 Response Procedures

The APSC Staff has established contacts with jurisdictional electric utilities to obtain outage information in the event of any service interruption. ESF #12 of the *Arkansas Emergency Operations Plan* identifies interaction with state and emergency officials, including ADEM, to share information. The APSC's

Consumer Services Section also interacts with individual customers to provide information and resolve questions during emergency or outage situations. When the EOC is activated, there is frequently APSC staff physically present.

6.5.2.1 Data to Monitor for Municipal Electric Utilities

Figures 6.17 and 6.18 list key information indicating current and near-future status of electricity supply that the AEO will monitor for municipal electric utilities in Arkansas. Figure 6.17 lists long-term information and Figure 6.18 lists short-term information. These tables are understood to be examples of the type of data the AEO will seek; these tables are not to be seen as requirements, but rather, as a beginning point for investigation. These data will aid the state in meeting its obligation under the Plan to assess post-issue performance.

Each table indicates the specific data items, a brief description of the data, the monitoring frequency and the indication from this data item that a stress condition is likely to occur, or exists.

Figure 6.17 – Municipal Electric Utility Long-Term Information

Examples of Information Description for Municipal Electric Utilities.	Comments	Frequency	Indication of Stress or Emergency
Municipal Electric Utility Emergency Plan	Identifies actions in event of emergency	As requested and quality of service inspection biennially, & seasonal planning	Based on evaluation of operational experience
Integrated Resource Plan (May not be available from all Municipals)	Indicates approach to meeting long- term demand requirements	As requested	Forecasted demand versus capacity
Annual Energy Outlook by EIA	Forecasts long-term energy supply perspective,	Early release, December. Full publication, March	Identifies long-term sources of supply, pricing, provides baseline
Generation and Transmission Capacity Requirements Forecasts	Reports published by SPP with near and long term forecasts of needs (especially pertaining to municipal EDCs)	Annually	Indicates new capacity needs
Load Forecast (Routinely used in addressing resource needs.)	Arkansas municipal electric utilities' power needs prediction	Annually	Load increases out of sequence w/ forecast
Mutual Aid Agreements (May not be available from all Municipals)	Shows how service restoration assistance will be provided by participating companies	As appropriate	Aid requested rendered

Figure 6.18 – Municipal Electric Utility Short-Term Information

Examples of Information Description for Municipal Electric Utilities	Comments	Frequency	Indication of Stress or Emergency
EIA Short-term Energy Outlook (Used in resource planning and daily dispatch decisions.)	Updates supply, storage and pricing information	Monthly	Identifies short-term supply, storage, pricing outlook, provides baseline information for comparison
Weather Data (This is used by all utilities for resource planning and daily dispatch decisions.)	Degree day information with comparisons to prior years and projections of long cold snaps, forecast of heat waves during summer	Daily	Weather forecast that in past led to supply/transportation problems
Seven Day Forecast (Used in resource planning and daily dispatch decisions.)	Forecasts weather, demand and capacity available	Daily	Severe weather or probable capacity deficiencies
Monitoring of Weather 4 Days in Advance (Used in resource planning and daily dispatch decisions.)	Weather service satellite-based forecasts make 4 day warning feasible	Daily	Severe weather forecasts
Morning Report (Used in daily dispatch decisions.)	Current weather and power system conditions	Daily	Severe weather or probable capacity deficiencies
Alerts (Used in daily dispatch decisions.)	Notice of abnormal conditions, operating restrictions	As required	Specific problems identified
Customer Calls (Routinely used to identify potential problems.)	Defines location of outage	As required	Specific customer outage identified

Communicate with municipal electric utilities, city councils, and city public utility commissions to obtain and verify information regarding each municipal electric utility's established procedures to restore service in the event of an outage, regardless of the cause of the outage.

6.5.2.2 Investor Owned Utilities (IOU)

Power restoration protocols can be explained at two levels. This subsection addresses the general concept of incident management. That is, what a typical EDC does to both prepare for, and react to, an incident that may or has caused a loss of electricity. Because Entergy Arkansas serves a majority of customers in Arkansas, a summary of the utility's response protocols is contained in Appendix G which provides illustrative excerpts of Entergy's Contingency Emergency Power Conservation and Curtailment Plan which is filed with the APSC. State and local responders may wish to use the guide contained below to explain an outage to the general public; APSC also address the detailed plan referenced in Appendix G as it deems necessary when assessing state options during an incident.

Figure 6.19 provides illustrative examples drawn from various response plans. This is not a definitive list of steps to be taken, but rather a listing of illustrative examples of the basic activity an EDC may take to mitigate and then restore power in the event of a storm or other problem affecting the delivery of electricity.

Figure 6.19 – Illustrative Examples of EDC Incident Mitigation and Response

Action	Explanation
Pre-Incident Preparation and Mitigation	
Planning, building, purchasing	• Continually assess electric capacity needs as customer base changes over time • Obtain generation capacity through building or purchase • Create and exercise protocols, working with regional entities (e.g., RTO), for emergency power acquisition • Acquire or identify sources of large and difficult to obtain equipment for rapid deployment in the event of component failure
Training	• Maintain staff readiness through on-going training and instruction
Protection	• Assure infrastructure integrity o Build to and maintain NAERC, SERC industry standards for quality and operation o Maintain and repair equipment, poles, and lines regularly o Create, maintain and exercise computer and electronic controls for system operation o Instruct and encourage customers on the efficient use of power o Maintain right-of-away (e.g. vegetation control) o Create and sustain mutual aid agreements among all utilities including municipal retail entities that purchase wholesale power for local distribution o Maintain financial integrity in order to sustain the company's responsibility to deliver power in compliance with state tariffs and rules o Ask customers with critical medical needs to notify the company
Awareness	• Monitor for conditions that may create shortage, interruptions or

	other incidents • Analyze system needs and capacity in relation to potential problem, threat, or other potential cause of power loss
Mobilize	• Pre-position repair and technical personnel in advance of known threat such as a weather emergency • Prepare in advance for post-incident logistic support
Post-Incident Actions	
Incident	• Assess o Damage and impact of incident, especially: ▪ Backbone feeders ▪ Major trunk lines ▪ Critical users with immediate public health and welfare responsibilities ▪ Medical needs as known o Adequacy of rapid response capability o Needs (e.g., personnel, repair equipment, replacement parts) for response support in terms of incident response time to completion o Range of response steps relating to the incident such as public appeal, on-site and in-company responder adequacy vs. need to call for mutual aid assistance o Coordination and collaboration with other utilities or operational entities, local and state government, and consuming public • Action o Begin action steps as appropriate (may occur prior to assessment) o Monitor progress of action taken and make necessary adjustments o Report action and restoration progress to APSC and ADEM as appropriate o Sustain efforts with logistics support to completion
Evaluation	• Review all aspects of performance in relation to pre-event planning and training • Review incident response in relation to frequency and location of incidents • Collaborate with other stakeholders to enhance future response capability • Make changes to plans and preparatory steps as indicated
Source: EDC Web sites and various response plans	

As noted above in relation to Figure 6.19, power restoration is basically dictated by the electricity delivery infrastructure and the location of a problem within each EDC's system. Again, given Entergy Arkansas's prominence within the state's electricity delivery system, Entergy Arkansas's on-line restoration diagram is used to illustrate the priorities that are generally applicable to all utilities. Figure 6.20 shows this information.

Figure 6.20 – Entergy (and Typical) Electrcity Restoration Priotities

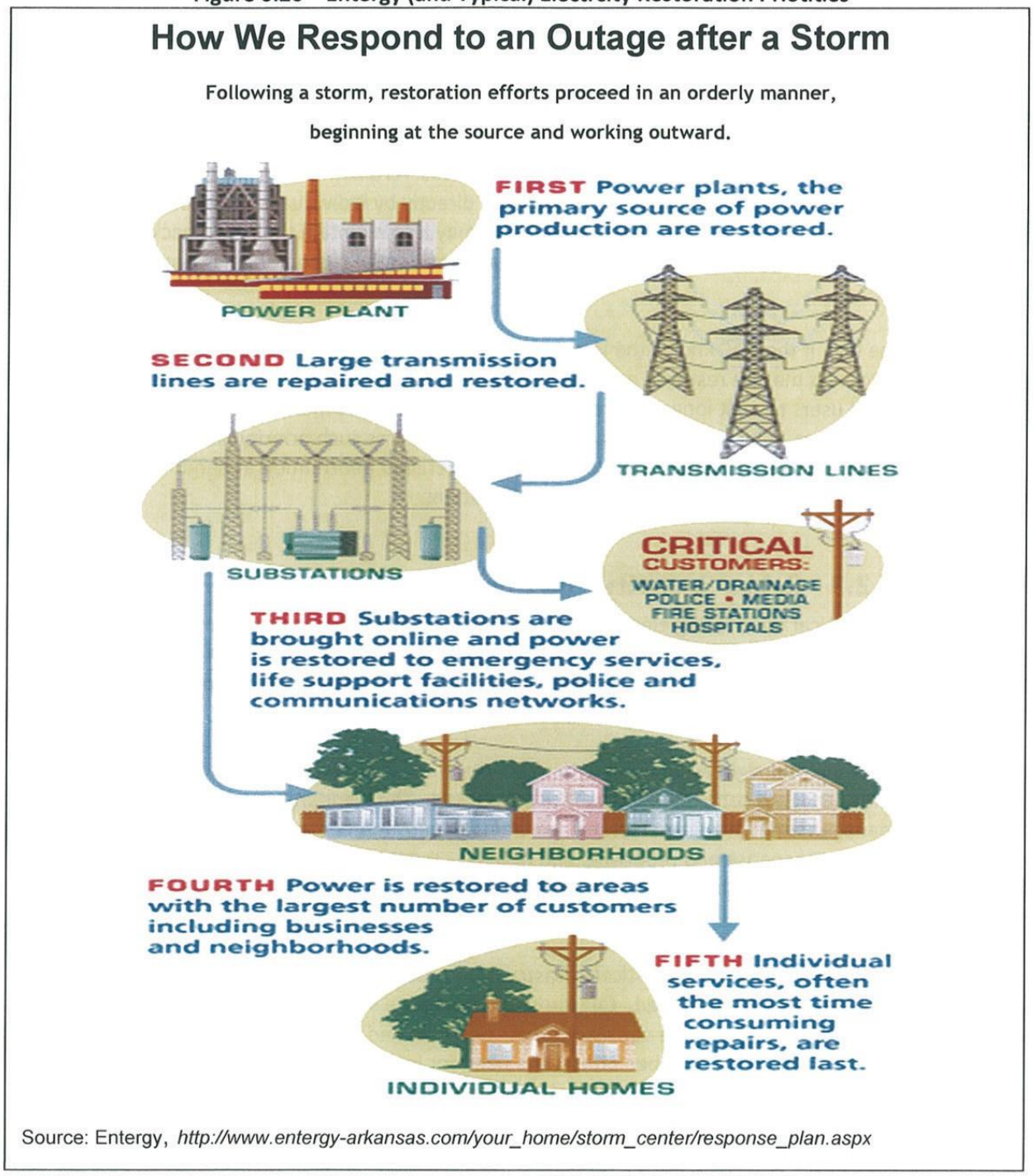


Figure 6.20 is based on the assumption that a state-wide major power interruption has occurred. In such a case, generation is the first priority for restoration. Second are the major transmission lines that feed the in-state distribution networks. This logical process then flows to the major equipment that reduces high voltage electricity to levels that can be safely sold and used by consumers. Industrial and some

large commercial/institutional users may draw higher voltage than is sold to the general commercial and residential sectors. Groups of customers may be served by intermediate sized equipment (smaller substations) and these are restored next. If an individual user happens to be hooked up directly to such lines, that customer enjoys power earlier than individual customers that are on single feeder lines. Feeder lines are restored based on system architecture. That means that some feeder lines attached to larger distribution systems (such as neighborhoods, or business locations) receive power before those are that farther away from the major sub-station equipment.

Exceptions may be made where the EDC knows of critical needs. As illustrated in the diagram, major critical systems such as water and sewer are probably fed directly by individual substations allowing for more rapid restoration. Many institutions and large users may also maintain their own back-up, or emergency power source. Individual business locations and residential customers may employ such devices as well.

Further down the line, if the EDC knows the location of critical home medical needs, neighborhoods feeding such customers may be restored earlier than others. Doing this is a public service and entails requiring other end users to wait longer for restoration. It is useful for responders to know about this and, in small towns some public officials may also know who requires such priority. In larger jurisdictions, it is highly unlikely that officials will have such detailed information at hand. Customers complaining about restoration time may be asked to be patient.

6.5.2.3 Cyber Security and Electric Utilities

Cyber security is a critical issue facing electric utilities. It has received additional attention as EDCs consider the enhanced monitoring capability of customer-located monitoring through new systems – particularly those labeled as "Smart Grid." A 2006 report by the DOE and the U.S. Department of Homeland Security notes several challenges in cyber security.

In 2008, the FERC approved eight mandatory cyber-security standards developed by NAERC, which extend to all entities that are connected to the U.S. power grid. The standards govern asset identification, management controls, personnel and training, perimeters, physical security, systems management, incident response and reporting, and disaster recovery. Through these standards, NAERC is responsible for assuring that the electric distribution system and control centers are protected from cyber-attack.

Among the 100 plus NAERC standards, critical infrastructure protection (CIP) standards concerning potential sabotage have been established. CIP standards 2 through 9 are aimed at control systems for critical assets. Challenges cited include consistent metrics within and across energy companies for measuring risk and vulnerabilities to cyber-attack; the need for information sharing on lessons-learned; and poorly designed connections between control systems and enterprise networks. Updated standards will feature a risk-based methodology to assess cyber impacts on components of the electric power system such as generation, transmission, distribution, and equipment. Responders will be trained to assess the impact of loss, compromise of information and misuse of systems.

The Arkansas Electric Cooperative Corporation has been especially active in working on state and regional cyber security issues. AECC has worked with local distribution cooperatives to enhance their systems. As of 2010, it has participated in national evaluation of proposed enhancements. Studies done

to date by AECC indicate that none of their substations could be considered critical assets for cyber security purposes. AECC continues to evaluate its systems looking at assets "from the bad guy's" point of view.

Entergy Arkansas too takes cyber security very seriously and has hired a cyber-security chief. The company has invested over $10 million in security assets including remote control buildings and is making all employees aware of the potential danger of cyber-attack. All of the state's utilities are required to comply with the NAERC requirements.

6.5.2.4 State Authorities

APSC is the state agency designated to work with electric utilities in managing energy emergencies. Arkansas utilities provide liaison with APSC and meet required filing and regulatory mandates. It is unlikely that AEO would become directly involved in electricity outage emergency management. However, its designated role in planning for, and coordinating among, stakeholders during energy emergencies does not rule out providing perspective as requested on electricity shortage matters. This background information is provided should such a request be made to APSC acting under its leadership for ESF #12.

7 Energy Assurance: Natural Gas

The transmission and distribution of natural gas is regulated in Arkansas. Thus the natural gas industry is governed by a mix of federal transportation and state operating and distribution regulations while also subject to unregulated market dynamics. Natural gas, like petroleum, is produced from underground resources. It is marketed differently because it is piped to where it is consumed. Government regulation ensures safety and prevents unfair pricing and restrained trade.

Natural gas is essentially methane, an odorless combustible gas with some minor additives (especially mercaptan to give it a distinctive odor). It is relatively abundant world-wide and reaches destinations for consumption via interstate and international pipelines and in the form of liquefied natural gas (LNG). Unlike petroleum, it does not receive much post-production processing and usually contains gas liquids. Such liquids are valuable commodities, but they are considered impurities if they remain in the gas. Natural gas is usually processed so that these liquids, like propane and butane, can be removed and sold separately.

This section discusses natural gas market components and its principal delivery system so that responders will have a basic idea of how this market operates. It also identifies energy assurance-related stakeholders in the natural gas market. Risks and vulnerabilities affecting the natural gas industry are noted so that observers understand how disruptive events can be managed.

7.1. National and Regional Infrastructure and Supply

FERC places Arkansas in the Midwest natural gas market. Some of what FERC says about this market applies to the state:

> Seasonal space heat requirements strongly influence the structure of the Midwest gas market. Total Midwest gas demand can be as low as 8 Bcf/d [billion cubic feet per day] on a mild spring or autumn day, or peak at over 21 Bcf/d during a prolonged cold snap due to robust heating demand. On an average annual basis, residential and commercial gas use accounts for about 60 percent of overall gas consumption.[18]

However, Arkansas is also adjacent to the Southeast natural gas market. The issues identified by FERC affect the Arkansas gas market because of the proximity of southeastern states and the fact that there are both company ties and pipeline connections between states in the southeastern market.

> Overall storage capacity is the lowest of any region in the U.S.; regional storage facilities are concentrated in Mississippi. The lack of market area storage means that pipeline companies must issue notices warning customers to closely match their scheduled gas volumes with actual gas usage at times and this can result in higher basis[19]. LNG and pipeline-related infrastructure improvements, however, have augmented regional supply diversification and altered traditional basis relationships. Over 6 Bcf/d of pipeline capacity was added between 2008 and first quarter 2009 to better link Texas and Oklahoma production with premium Southeast markets.[20]

7.2. Gas Supply Sources

Arkansas is a net importer of natural gas—more gas is consumed than produced in Arkansas. Several natural gas transmission lines traverse the state; however, Arkansas's customers do not take service from all of them. Arkansas Western Gas and Arkansas Oklahoma Gas continue to meet a portion of their supply needs with sources directly connected to their systems. About two-thirds of the in-state production comes from Fayetteville shale. The state Oil and Gas Commission expects production to be sustained at its current rate for 30 - 40 years.

Natural gas for consumption inside the state is provided primarily by pipeline from Oklahoma, Texas, and the Gulf of Mexico. Gas for consumption is also provided by Kansas and some in-state production. Figure 7.1 lists the major gas transmission lines serving Arkansas. Contact information for pipelines serving or transiting Arkansas is contained in Appendix N.

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[18] FERC, Natural Gas Markets: Midwest, http://www.ferc.gov/market-oversight/mkt-gas/midwest.asp

[19] Basis refers to "basis differential," or the difference in the value of a commodity based upon different market factors such as time-of-year, physical location and related transport charges or other factors that may influence the cost of the commodity. Basis is generally traded in the market as a form of commodity exchange, or swaps. Swapping the price of a commodity with one basis for the price of another with a different basis allows market participants, such as LDCs buying gas, to benefit from a favorable basis differential.

[20] FERC, Natural Gas Markets, Southeast, http://www.ferc.gov/market-oversight/mkt-gas/southeast.asp

Figure 7.1 - Arkansas Natural Gas Pipelines

Pipeline Company	Principal Supply from:	System Configuration (primary/secondary)	Enters Arkansas	Exits or Terminates
ANR Pipeline Co (A TransCanada Company)	Louisiana, Kansas, Texas, Gulf of Mexico	Trunk/Grid	Crosses at southeastern tip of state.	
CenterPoint Energy Pipeline Co	Kansas, Oklahoma, Texas	Trunk/Grid	Points in Louisiana, Oklahoma and Texas	Cross grids with Oklahoma and feeds into Mississippi and Missouri
CenterPoint Mississippi River Trans Co	Arkansas, Oklahoma	Trunk	See CenterPoint Energy Pipeline Co. above.	
Natural Gas PL Co of America (NGPL) (A Kinder-Morgan Company) Fayetteville Express Pipeline	Oklahoma, Louisiana, Texas, Gulf of Mexico	Trunk	• Fayetteville Express Pipeline under construction from Center Ridge, Conway County to NGPC line at Bald Knob and lines in Mississippi. • NGPL enters at southwest corner and runs diagonally to northeast into Missouri.	
Tennessee Gas Pipeline Co	Louisiana, Texas, Gulf of Mexico	Trunk	Crosses at southeastern tip of state.	
Texas Eastern Transmission Co (TETLP) (A Spectra Energy Partners LP Company) Ozark Gas Transmission	Louisiana, Texas, Gulf of Mexico	Trunk	• Southwest corner from Texas diagonally to Missouri. • Ozark from Oklahoma • North branch via Noark and Standing Rock connecting to Mississippi River and NGPL lines at Lawrence and TETLP at Green then to Missouri • Southern branch connecting to feeder line at Fayetteville and NGPL and TETLP at White.	
Texas Gas Transmission Co (A Williams Company)	Louisiana, Gulf of Mexico	Trunk	Southwest to southeastern edge of state	
Trunkline Gas Co (A Panhandle Energy Company)	Louisiana, Texas, Gulf of Mexico	Trunk	Southeast along Mississippi border area	Exits to southwestern Tennessee

Source: EIA *About U.S. Natural Gas Pipelines – Transporting Natural Gas – Natural Gas Pipelines in the Southwest Region. http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/southwest.html*

7.3. Storage and Consumption Pattern

As noted above, natural gas storage in the Arkansas region is relatively low (see Appendix J). According to EIA, the state does have two small, 15 Bcf, depleted resource (depleted gas production field) sites in northwest Arkansas. Arkansas gas utilities apparently do not utilize these "marginal" sites; but, they do exist and could be used if needed. Arkansas Western Gas owns a storage field that is directly connected to its system and is located in Arkansas. CenterPoint and Arkansas Oklahoma Gas purchase upstream storage service from interstate pipeline operators. Southwestern Energy owns and uses a storage field in Arkansas. Arkansas Western Gas has an above ground LNG facility in Blytheville to help meet its winter peaking needs. The bulk of near-by storage is in Louisiana and Oklahoma with some regional storage in southern Illinois, Indiana and Kentucky. Figure 7.2 lists the major natural gas storage in Arkansas's neighboring states, Louisiana and Oklahoma. Arkansas gas companies also purchase and inject gas into out-of-state storage facilities from April to October for use in the wintertime.

Figure 7.2 – Major Adjacent State Natural Gas Storage

Company	Field	County	Total Capacity in Bcf[21]	Working Gas Capacity in Bcf
Louisiana				
CenterPoint Mississippi	East Unionville	Lincoln	55.2	26.52
CenterPoint Mississippi	West Unionville	Lincoln	23.73	11.28
CenterPoint Gas Transmission*	Ruston	Lincoln	5.7	3
Gulf South Pipeline	Bistineau	Bossier, Bienville	141	85.74
Transcontinental	Washington	St. James	120	75
Trunkline Gas	Epps	Caroll	43	13
Oklahoma				
CenterPoint	Ada	Pontotoc	22.41	14
CenterPoint	Chiles Dome	Coal	26	15
National Gas Pipeline Company	Sayre	Beckham	84	50.83
Southern Star Central Pipeline	Webb	Grant	42.4	12
Southwest Gas Storage Company	North Hopeton	Woods	18.1	3.5

Source: EIA: *Jurisdictional Storage Fields in the United States by Location,* March, 2010.

- Not major, but part of key natural gas company system

[21] Total capacity refers to the physical measurement of how much gas a storage facility could hold. Working capacity is what is typically stored, on average determined by the owner/operator. In reality, it is generally too expensive to acquire and store gas that seasonal storage history reveals to be unnecessary.

Figure 7.3 - Natural Gas Storage Cycle in "Producing Region" (Including Arkansas): Updated, May 2010

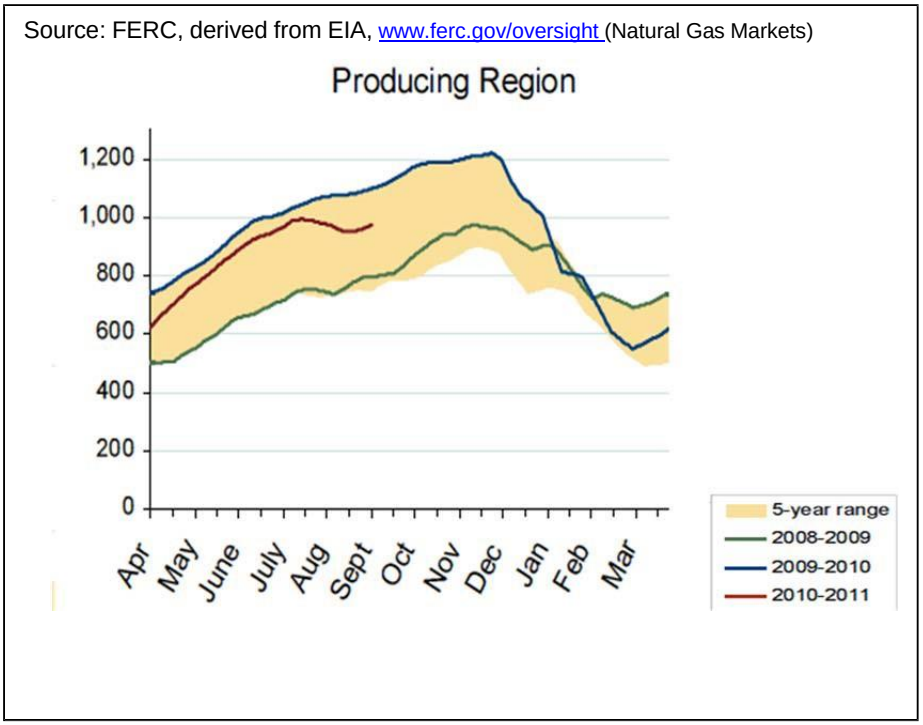


Figure 7.3 shows natural gas storage for the geographical region that includes Arkansas. The figure also shows that the natural gas supply for the region is seasonally-driven. Eventually this curve could change if enough gas-fired electric power plants were built to sustain a steady, year-round, demand profile. Natural gas-fired power plants provide great flexibility in electric generation and they pollute less than coal- or oil-fired plants.

The supply of natural gas in Arkansas became more robust during the past decade with the development of Fayetteville shale gas. As noted above, this source may continue for up to four decades. One of the advantages of this gas is its location, and there are commercial advantages as well, because of open access and because it has received sufficient investment to sustain it as a massive undertaking. Observers have called it more like a factory approach to resource development. The resource is proven and is not a reservoir to be measured by the same depletion calculations seen in more common gas field extraction.

7.3.1. The Arkansas Natural Gas Market

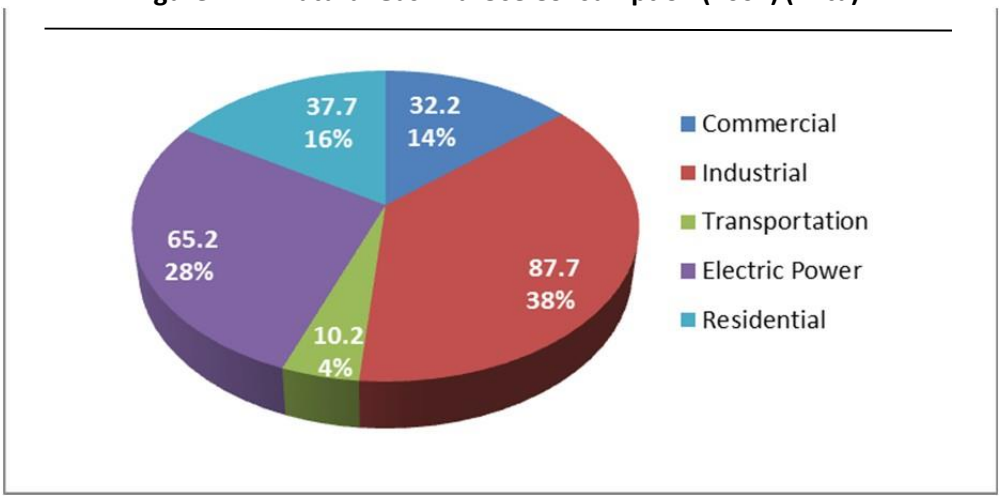
Natural gas is delivered by high pressure pipeline to “city gates” where the pressure is reduced for distribution within the community by one of the four regulated investor-owned LDCs -- Arkansas Oklahoma Gas Corporation, Arkansas Western Gas, CenterPoint Energy Arkla Division, and Logan Township Gas users Association as well as six municipal natural gas distribution utilities – Augusta Light, Water and Gas; Des Arc Municipal Gas System; DeValls Bluff Natural Gas System; Harrisburg Water and Gas Division; Hazen Natural Gas Company; Logan Township Gas Users Association; and North Crossett Natural Gas Company.

7.3.2 Consumption

Figure 7.4 shows the relative use of gas by consumption sectors in Arkansas. The largest individual sector is industrial at 54%, although EIA states this has declined slightly from the beginning of the decade. The commercial and residential sectors were approximately 20% each followed by transportation at 6%. In fact 10.2 TBtu of natural gas consumed as a fuel alternative to motor gasoline is considered a robust amount in comparison many other states.

The industrial sector includes gas for feedstock and manufacturing while residential and commercial sectors use gas primarily for space heating. These numbers give responders perspective on relative vulnerability to shortage among end-use sectors. See Appendix O for representative gas customer base and sales for several gas companies.

Figure 7.4 – Natural Gas End-Use Consumption (2007) (TBtu)



Source: U. S. Energy Information Administration

7.3.3 Design Day

Risk in the supply of natural gas is lessened by the fact that natural gas companies are generally required to have a seasonal supply sufficient to meet demand for a specified peak, or design day[22]. This requirement includes supply to customers who arrange for their own supply with transport through the distribution system. Arkansas's LDCs use different design days based on the area they serve. For example, CenterPoint uses a 59 heating degree day design day and injects gas into storage from April to October. The company is prepared to supply gas without interruption if the design day is reached. In addition, seasonal, "swing" and "no-notice" gas contracts are in place to supplement gas supply for winter use. According to state officials and gas company executives, Arkansas has not had to meet a design day since it was set in 1983.

As part of its responsibilities to assure an adequate annual supply of gas, the APSC requires regulated natural gas utilities to submit an annual gas supply portfolio plan that describes the specific plans it has to meet the gas supply needs of its customers. The plan also addresses the steps that the natural gas

[22] A heating degree day is defined as the difference between the average of a day's high and low temperatures and a base point of 65 degrees Fahrenheit. CenterPoint's design day of 59 degrees occurs when the average of high and low temperatures is 6 degrees (65-59). The system is designed to meet this average lower temperature.

utilities plan to take to stabilize the price of natural gas, including long-term contracts for natural gas supplies and physical and financial hedging transactions. These plans must "identify projected peak and annual gas supply requirements under various weather conditions" and show how this demand will be met. The estimate must also address gas supply and transportation capacity along with any associated, projected, resources.[23]

7.3.4 Inter-fuel Issues

The use of natural gas to fuel electricity generation creates a need for inter-fuel awareness in Arkansas. Natural gas for the generation of electricity is purchased and delivered directly from the interstate pipelines. Transportation of gas is sold as a "firm commitment" (an industry term for a supply contract); the gas supply is contracted between the generating plant and the third party supplier. Arkansas used approximately 12,293 MCf of natural gas to generate electricity in 2008. This number is included within the end-use sector numbers in the EIA data noted in Figure 2.[24]

An additional inter-fuel element of interest to Arkansas's emergency responders is the role of electric power for natural gas pipeline compressors. Although much natural gas compression is fueled by natural gas, a loss of electricity for any length of time has the potential to jeopardize the flow of natural gas. Pumping loss is minimized because losing pressure on any one of the major lines in Arkansas would only reduce delivery capability by a few percentage points. The risk that more than one line would be interrupted is minimal, but if that happened, the impact would also be minimized by the extensive grid lines supplementing major trunk lines.

7.3.5 Interruptible Service

Gas sold to firm customers, such as residential and commercial users, is an extremely high priority for LDCs. Industrial customers can obtain more favorable rates than residential and commercial customers by subscribing to an interruptible gas delivery tariff. Gas for such users, who possess, or have access to, an alternate fuel source, is temporarily cut-off when necessary.[25] Interrupted service may be invoked during any period that demand exceeds, or is expected to exceed, capacity. There is no precise temperature or point at which this might occur but it is most likely to happen in sub-zero (F) weather. A cut-off would apply to all interruptible customer uses including process, manufacturing or space conditioning.

7.3 Natural Gas Stakeholders

This subsection identifies the major natural gas industry stakeholders and others who have key roles in Arkansas's natural gas supply. Basic contact information is provided in Appendix I, but responders would ordinarily work through APSC in communicating with gas utilities during a supply shortage or disruption.

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[23] APSC, *Natural Gas Procurement Plan Rules,* Attachment A, pp 3 & 6.

[24] EIA addressed this issue. Basically EIA said that the numbers were adjusted for the double-counting of supplemental gaseous fuels, which are included in both natural gas and the other fossil fuels from which they are mostly derived, but should be counted only once in net energy and total.

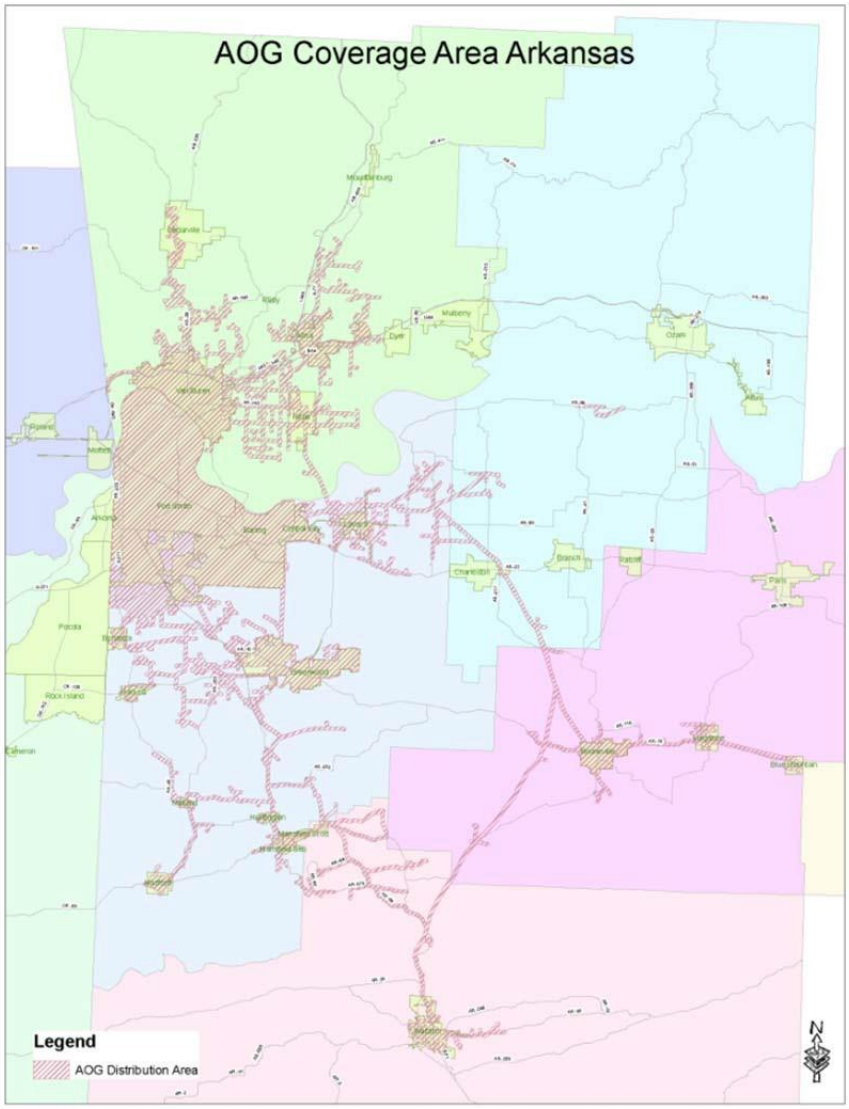
[25] The tariff is not available if no back-up system is in place. LDCs survey such customers annually to see that back-up is maintained; but LDCs do not "act as policemen." The company enjoying the tariff bears the risk. In some shortages service may be retained for a very high rate cost. In other situations, there may be no choice but shut down if back-up was not arranged.

7.4.1 Local Distribution Companies (LDC)

7.4.1.1. Arkansas Oklahoma Gas Corporation

Arkansas Oklahoma Gas serves about 60,000 customers in Western Arkansas and Oklahoma. In 2009 the company sold 5,014,940 MCf of natural gas to 45,792 customers.[26] The company's business office is located in Fort Smith.

Figure 7.5 – AOG Service Territory

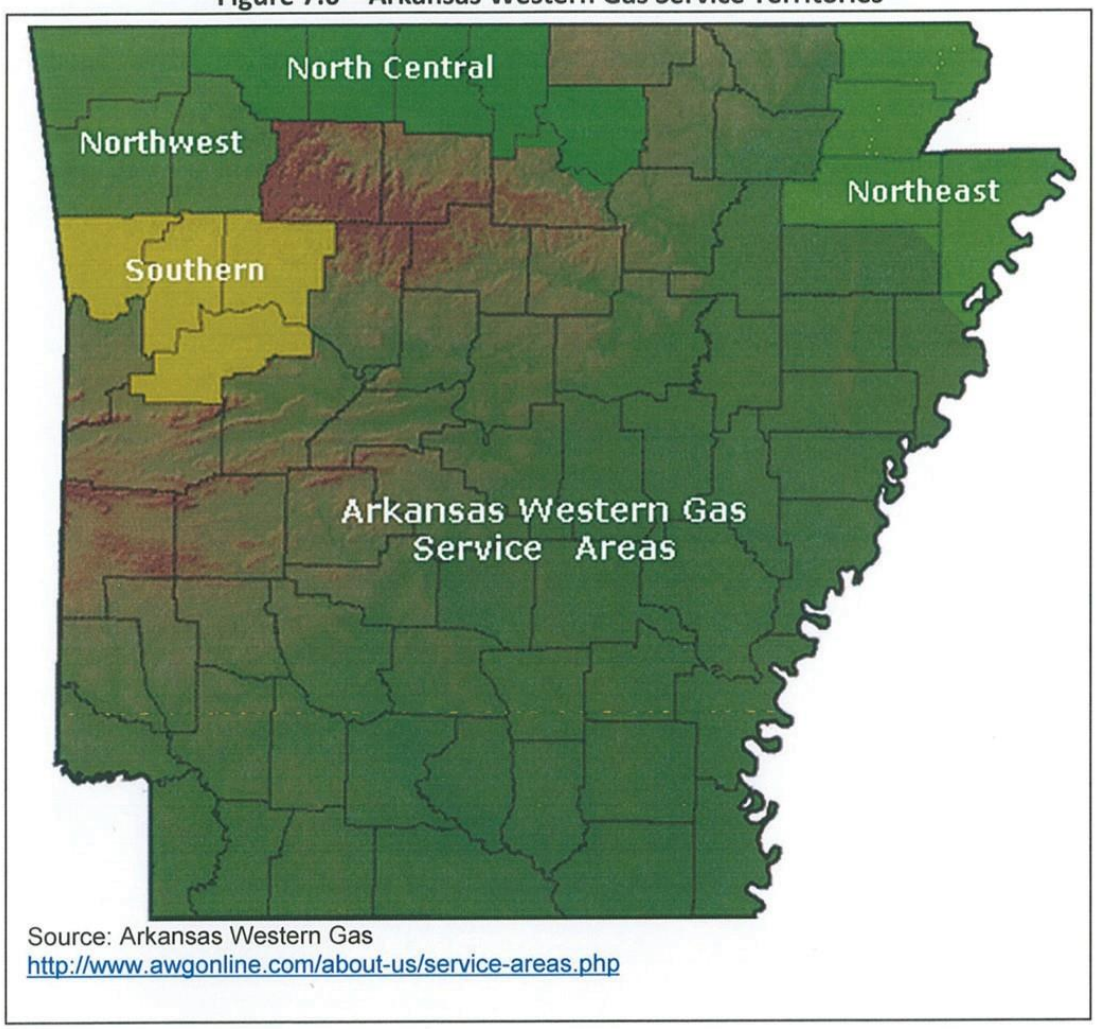


[26] See Appendix K

7.4.1.2. Arkansas Western Gas

Arkansas Western Gas (AWG) serves 160,000 customers in 90 communities in the northern tier of the state. The company is a subsidiary of SourceGas, headquartered in Lakewood, Colorado. The company has local offices in Blytheville, Fayetteville, Harrison and Ozark. In 2009, the company sold 15,121,692 MCf of natural gas to 151,969 customers. Figure 7.6 depicts the areas served by the company. Appendix K contains Customer data for AWG.

Figure 7.6 – Arkansas Western Gas Service Territories

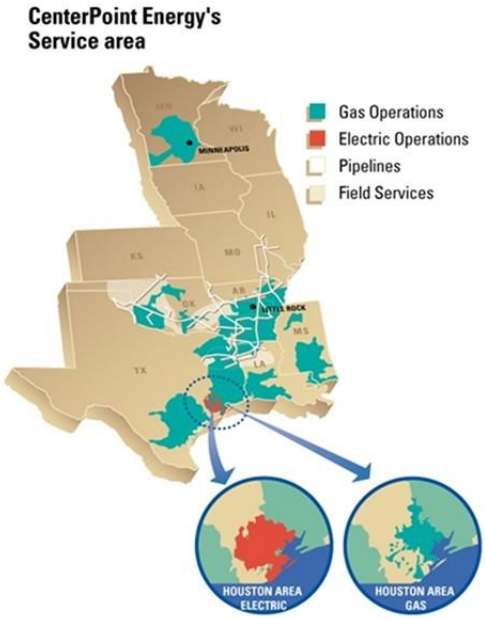


Source: Arkansas Western Gas
http://www.awgonline.com/about-us/service-areas.php

7.4.1.3. CenterPoint Energy

CenterPoint Energy is a company with over 3.2 million metered natural gas accounts in six states. Figure provides perspective on the scope of the company and also depicts both service territory and pipelines in Arkansas. As suggested by the map, the company is the principal supplier of natural gas in Arkansas. In 2009, the company sold 38,332,306 MCf of natural gas to 421,814 customers.

Figure 7.7 – CenterPoint Interstate Service Areas



Source: CenterPoint Energy,

7.4.1.4 Logan Township Gas Users Association

Logan Township Gas Users Association is a privately-owned local distribution company that serves approximately 74 customers in Logan County.

7.4.1.5 Other Natural Gas Utilities

As noted above, there are six municipal gas utilities in Arkansas - Augusta Light, Water and Gas; Des Arc Municipal Gas System; DeValls Bluff Natural Gas System; Harrisburg Water and Gas Division; Hazen Natural Gas Company; and North Crossett Natural Gas Company.

7.4.2. Regulatory Agencies

7.4.2.1. Natural Gas Pipeline Safety Regulation

The APSC Pipeline Safety Office routinely inspects all jurisdictional natural gas facilities in Arkansas to ensure compliance with the provisions of the federal and state pipeline codes. The provisions of the federal and state pipeline codes ensure that jurisdictional natural gas utilities and operators construct,

operate, and maintain their facilities to ensure safe and reliable service and, consequently, to avoid outages and interruptions of service.

In addition to the APSC's Pipeline Safety Office, the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), acting through the Office of Pipeline Safety (OPS), has a central role in U.S. and Arkansas pipeline safety regulations. The APSC's Pipeline Safety Office and PHMSA work cooperatively in the enforcement of state and federal pipeline safety codes. The APSC's Pipeline Safety Office and PHMSA work cooperatively in the enforcement of state and federal pipeline safety codes. These regulations pertain to the critical infrastructure components of the natural gas system as well as many other issues affecting location, construction and related matters.

7.4.2.2. Arkansas Pipeline Code

Pursuant to Arkansas Code Ann. §23-15-201 et seq., the APSC's Pipeline Safety Office routinely inspects all jurisdictional natural gas facilities in Arkansas to ensure compliance with the provisions of the federal and state pipeline codes. The provisions of the federal and state pipeline codes ensure that jurisdictional natural gas utilities and operators construct, operate, and maintain their facilities to ensure safe and reliable service and, consequently, to avoid outages and interruptions of service. The APSC's Pipeline Safety Office works closely with the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration to ensure the safe operation of natural gas facilities within Arkansas. The APSC adopts and maintains the Arkansas Pipeline Code.

7.4.2.2.1. U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS)

Public Law 90-481, the *Natural Gas Pipeline Safety Act of 1968,* forms the basis for federal pipeline safety rules. According the federal OPS official Web site,

> "The Department of Transportation's Pipeline and Hazardous Material Safety Administration (PHMSA) acting through the Office of Pipeline Safety (OPS), administers the Department's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Since 1986, the entire pipeline safety program has been funded by a user fee assessed on a per-mile basis on each pipeline operator OPS regulates."

Although FERC regulates natural gas pipelines, it does not have a significant pipeline safety function. The national natural gas market was radically changed by FERC's Order 636 in April 1992. Interstate natural gas pipelines became common carriers devoted to natural gas; they no longer bought and sold the gas. In the process of enforcing this Order, FERC governs several areas of the national natural gas market and thus directly affects distribution and sales in Arkansas. Samples of oversight undertaken by FERC include:

- Determining rate-setting methods for interstate gas pipelines.
- Developing rules for pipeline company business practices.
- Approving or disapproving the siting, construction and operations of interstate gas pipelines.

- Coordinating gas pipeline projects with applicable federal agencies.
- Effecting environmental, endangered species and historic preservation reviews.
- Cooperating with OPS.
- Examining pipeline mergers and acquisitions in coordination with other federal agencies and state authorities.

7.5. Energy Assurance Procedures for Natural Gas Utilities

Procedures for analysis of the natural gas utility sector are well established at all levels of the supply chain. Comprehensive and precise information, including real time information on system conditions and impending problems, is available from the jurisdictional natural gas utilities and the APSC. Hence, the natural gas utility related actions by the state are well defined and do not require special additional analysis by state agencies.

7.5.1. Resource Planning

As a part of its statutory responsibilities, the APSC regulates the jurisdictional natural gas utilities to ensure safe and reliable service at reasonable rates. The APSC's Natural Gas Procurement Plan Rules require each jurisdictional natural gas utility to submit annually a plan to meet its required supplies of natural gas to serve its customers. Those rules require the jurisdictional natural gas utilities to take steps to ensure adequate supplies and to reduce volatility in the price of natural gas supplies used to serve their customers. The jurisdictional natural gas utilities use various combinations of interstate pipeline services, storage services, on system supplies, long-term purchases, and spot purchases. In the development and evaluation of procurement plans, jurisdictional natural gas utilities and the APSC consider a number of factors, including but not limited to, load forecasts, natural gas commodity prices, peak usage, and weather data.

The APSC's Pipeline Safety Office routinely inspects all jurisdictional natural gas facilities in Arkansas to ensure compliance with the provisions of the federal and state pipeline codes. The provisions of the federal and state pipeline codes stipulate that jurisdictional natural gas utilities and operators construct, operate, and maintain their facilities to ensure safe and reliable service and, consequently, to avoid outages and interruptions of service.

See the APSC's General Service Rules, Special Rules – Gas, Natural Gas Procurement Plan Rules, the Arkansas Gas Pipeline Code, and the natural gas procurement plans of every jurisdictional natural gas utility filed with the APSC.

7.5.2. Restoration of Service

Each jurisdictional natural gas utility has established procedures to restore service in the event of an outage, regardless of the cause of the outage. The APSC has quality of service standards that are structured to ensure that all jurisdictional natural gas utilities provide safe and reliable service at a reasonable price. There are specific provisions that address restoration of service in the event of an outage. The jurisdictional natural gas utilities have executed those procedures on numerous occasions to restore service.

The APSC Staff has established contacts with natural gas utilities to obtain outage information in the event of any service interruption. Emergency Support Function 12 (ESF #12) of the State Emergency

Operations Plan identifies interaction with state and emergency officials, including ADEM, to share information. The APSC's Consumer Services Section also interacts with individual customers to provide information and resolve questions during emergency or outage situations. When the State Emergency Operations Center (SEOC) is activated, there frequently is APSC staff physically present in the SEOC.

7.5.3 Coordination between AEO and Other State Agencies

In the event of an extended natural gas disruption or shortage, the AEO will coordinate with other State Agencies to assist in public information related to the extended natural gas disruption or shortage Figure 7.8 lists examples of coordinating activities which may be helpful.

Figure 7.8: Examples of Possible Coordinating Activities Between the AEO and Other State Agencies

Phase	Possible Coordinating Activities for the AEO
Early Warning	• Review and reinforce communications within the state and ascertain that everyone understands their role, what can and cannot be said, and by whom • Work with APSC and ADEM to inform the governor's office • Keep governor's staff and legislative offices informed • Review/prepare graphic energy market presentations and other materials to explain consumption patterns and anomalies • Work with APSC to provide helpful conservation and mitigation advice to the public • Continue to acquire supply & demand data • Coordinate with ADEM on media contacts in order to help reporters (especially newly assigned) understand basic energy facts and issues • Review weather forecasts often
Pre-Emergency Declaration	• Maintain information actions per above • Coordinate with APSC, ADEM and LDCs to draft energy conservation recommendations if shortage is predicted to increase • Work with natural gas utilities on heating issues to provide media advisories on setting back thermostats, using cooking fuel wisely, checking heating equipment and conserving hot water • Consider public meetings and use of the Internet as appropriate • Share state energy data with other states, NASEO and DOE, as needed • The governor may make follow-up announcements to assure the public and to encourage continued cooperation and compliance • Estimate the probability and timing of greater shortage • Prepare briefings on possible supply and demand restraint measures should shortage intensify
Emergency Declared	• Maintain information actions per above • Assist APSC and ADEM with media briefings (sometimes in conjunction with energy stakeholder representatives) • Develop follow-up messages from governor to assure public and to maintain compliance • APSC and ADEM (in coordination/conjunction with the governor's office or others) announces enforcement actions, if any

7.5.4 Illustrative Examples of Possible Emergency Mitigation Measures

If a natural gas disruption or shortage were to continue for an extended time, the state may wish to propose energy emergency mitigation measures. Illustrative examples of possible measures are listed in Appendix M.

7.5.5 Municipal Natural Gas Utilities

Identify additional data sources beyond EIA such as: U.S. DOE, municipal natural gas associations, local jurisdictions, and municipal utility public Web sites. Communicate with municipal natural gas utilities, city councils, and city public utility commissions to obtain and verify information.

Communicate with municipal electric utilities, city councils, and city public utility commissions to obtain and verify information regarding each municipal natural gas utility's established procedures to restore service in the event of an outage, regardless of the cause of the outage.

It will be necessary to work directly with each municipal natural gas utility to establish information levels. Examples are: low storage status for either local or remote market, pipeline compressor station outages, pipeline delay or outages for other reasons, distribution system problems, and forecast of weather that will strain gas delivery capacity.

- For LDC's, Operational Flow Control Messages to customers.
  In addition to monitoring primary supplies from major pipelines, it is also necessary to know how much natural gas is in reserve (storage) for peak season use. This gas is generally stored underground in caverns or above ground in liquefied natural gas storage facilities.
- A description of the natural gas system in Arkansas is in this Energy Assurance Plan. This information will guide responders when gathering data pertinent to natural gas supply interruptions. The infrastructure, operator information and regulatory regime affecting natural gas are also contained in the Plan.

Figures 7.9 and 7.10 list key information indicating current and near-future status of natural gas supply for Arkansas that the AEO will monitor for municipal natural gas utilities. The figures focus on municipal natural gas utilities. Figure 7.9 lists long-term information and Figure 7.10 lists short-term information. These figures are understood to be examples of the type of data the AEO will seek; these Figures are not to be seen as requirements, but rather, as a beginning point for investigation.

Each figure indicates the specific data items, a brief description of the data, the monitoring frequency and the indication from this data item that a stress condition is likely to occur, or exists. These data will aid the state in meeting its obligation under the Plan to assess post-issue performance for municipal natural gas utilities.

Figure 7.9 – Municipal Natural Gas Utilities Long-Term Information

Examples of Information Description	Comments	Frequency	Indication of Stress or Emergency
Emergency Curtailment Plan (Some Municipal utilities may not have such a plan)	Provides sequence of actions in the event of a supply deficiency	2 times yearly in conjunction with training	Defines actions by LDC in event of supply deficiency
Annual Energy Outlook by EIA (Used in developing natural gas procurement plans.)	Forecasts long term energy supply perspective,	Early Release, December. Full Publication, March	Identifies long-term sources of supply, pricing, and provides baseline information for comparison
Mutual Aid Agreements (Municipal utilities may not have such agreements.)	Shows how personnel to restore gas service will be provided by participating gas companies	As appropriate	Aid requested rendered
Communication, Supply Delivery, Mutual Aid Drills (Working communications procedures exist.)	Shows readiness to implement plans	2 times yearly	Drill failure indicates plan deficiency
Pipeline Safety Audit (APSC, PSO conduct audits on schedule with additional inspections as needed.)	Shows pipeline deficiencies related to CFR 192 Transportation of Natural and other Gases by Pipeline; Minimum Federal Safety Unit audits	Every 18 months to APSC	Indicates pipeline deficiencies
Design Day (Used in natural gas procurement plan development.)	Included in annual procurement plan, generally based on 1983 model design day	Annually	Extreme cold temperature change
Procurement Plan	Portfolio/contract balancing to avoid supply and price volatility	Annually	Designed to avoid stress & emergency

In the event of an outage involving many customers, benchmarks are supplied for judging short-term forecasts and supply deficiency events. An in-state audit of pipeline safety approximately every 18 months complies with requirements of the Office of Pipeline Safety of U.S. DOT (CFR192) that establish the safety status of both transmission and distribution pipelines.

Figure 7.10 – Municipal Natural Gas Utility Short-Term Information

Examples of Information Description	Comments	Frequency	Indication of Stress or Emergency
EIA Short-Term Energy Outlook (Used in procurement plans and in dispatch decisions.)	Updates supply, storage and pricing information	Monthly	Identifies short-term supply, storage, pricing outlook, and baseline information for comparison
Weather Data National Oceanic & Atmospheric Admin. (NOAA), Local Weather reports (Used in procurement plans and in dispatch decisions.)	Heating degree day Information with comparisons to prior years and projections of long cold snaps	Daily	Weather forecasts that can fed into supply/transportation problem identification
Natural Gas Futures New York Mercantile Exchange (NYMEX) (Used in procurement plans and in dispatch decisions.)	Sensitive to integrated perspective of weather and supply prospects	Daily (Mon-Fri)	Rapid price increase indicates supply problems
Natural Gas Spot Prices (Daily: Bloomberg, & others; weekly: EIA) (Used in procurement plans and in dispatch decisions.)	Sensitive to integrated perspective of weather and supply prospects	Daily (Mon-Fri) or weekly	Rapid price increase indicates supply problems
Natural Gas Inventories (LDC) (Used in procurement plans and in dispatch decisions.)	Shows whether supply is adequate for time of year	See long-term planning	Decreased supplies below seasonal experience indicates problems
Notification of Flow Control Order (Used in daily dispatch decisions.)	Basis for customer curtailment, APSC is notified once threshold number of customers is exceeded	As required	Shows gas delivery is being curtailed
Customer Complaints	Shows a supply disruption has reached the customer	As required	Multiple complaints may indicate a significant problem

The monthly EIA Short-Term Energy Outlook provides recent data on supply, storage and pricing, and a short-term forecast that can be compared to the long-term outlook in order to determine whether a situation has deteriorated compared to earlier projections.

Shorter term indications of problems are provided by daily EIA information on futures and spot prices for natural gas, and weekly information on storage inventories. Pipeline status reports can provide an integrated view of the gas supply situation. Flow control orders issued by interstate natural gas pipelines will indicate that the supply situation has deteriorated and gas distribution customers are being

curtailed. Complaints from customers and media reports are another indication the supply disruption has reached end-users.

Once a supply deficiency occurs, the intensity and frequency of monitoring the information in Figure 7.11 should be increased; also the additional data identified in Figure 7.11 should be monitored. In this situation, the information will indicate whether the mitigation plans are effective, and provide the basis for forecasting the duration of an event or problem.

Figure 7.11 – Municipal Natural Gas Utility Information Monitored During Stress Conditions

Examples of Information Description	Comments	Frequency	Indication of Stress or Emergency
Updates of Supply Situation (Issued as required.)	Informal communication from LDCs	As required	Indicates changes in severity, and duration of supply deficiency
Restoration Plans (Issued as required.)	Shared with ADEM	As required	Defines process and expected timing of restoration
Numbers of Customers Without Gas (Issued as required.)	Reports from or inquires to LDC contacts	As required	Indicates status and progress

More frequent communication between the municipal natural gas utilities and the AEO will occur during a supply emergency. If curtailment for many customers occurs at the city gate, the municipal natural gas utility's general restoration plan will be used. During a severe shortage and subsequent restoration, municipal natural gas utilities maintain a count of customers without service that serves as an index of restoration progress and a basis for projecting the return to normal service. If a natural gas shortage were to continue for an extended time, the state may wish to invoke energy emergency mitigation measures. These potential measures are listed in Appendix H.

7.5.6 Data Analysis and Actions for Municipal Natural Gas Utilities

Long- and short-term data collected on a routine basis should be analyzed to develop historical references of price and stocks (inventories) related to seasons and weather. The specific conditions of weather, stocks and prices associated with supply problems that result in curtailment and necessitate requests for fuel supply driver hours of service waivers should be identified so they can be used to assess the severity of a problem or probability of an increasingly serious shortage.

- When an abnormal supply condition is projected, increased monitoring should be initiated. When the data indicates an emergency condition exists, the ability of the industry to solve the problem without government intervention should be accessed through discussions with the industry and a re-examination of industry restoration plans. If it becomes clear that industry actions are insufficient to resolve a shortage, and government action is indicated, an action specific to the problem affecting municipal natural gas utilities may be recommended to the Governor's office.

7.5.7 Cyber Security and Natural Gas

Cyber security for natural gas pipelines and LNG storage falls under the oversight of the US DOT, Office of Pipeline Safety. In general, LDCs are aware of cyber security but believe that the electric/mechanical safeguards employed in their systems accomplish the necessary protection.

SCADA systems for natural gas provide monitoring data and some limited ability to change settings of control valves. However, the gas system is essentially controlled by mechanical means with electronic communications involved only in data acquisition and changes to the set points of the mechanical controls. The mechanical controls have limits on adjustability, which prevent electronic signals from causing problems. If the natural gas SCADA system failed or was attacked, the utilities would lose visibility and would revert to mechanical recordings for system monitoring.

8. Energy Assurance: Petroleum

This section focuses on unregulated energy products. Three fuel types are emphasized because they are the most widely used in Arkansas. These are liquid energy products: motor gasoline, distillate; and propane (liquefied petroleum gas or LPG). Distillates include diesel fuel, kerosene, heating and bunker oils, and jet fuel. Relatively little heating oil and bunker fuel is used in Arkansas; however diesel and jet fuel supply significant customers in the transportation sector. Propane differs from motor gasoline and distillate because it enters the market either as a product of petroleum refining or a by-product of natural gas. It is not regulated and its distribution system is similar to that of other liquid petroleum products.

This section includes a discussion of petroleum and propane market components and their principal market delivery systems so that responders will understand how this market functions. Energy assurance-related stakeholders are noted in order to identify those affecting this market. Risks and vulnerabilities, industry issues, supply disruption, mitigation, response, and energy shortage identification are also noted to help identify how disruptive energy events can be managed. Certain agency response activities and suggested crisis response measures are discussed so that they may be considered for mitigating emergencies.

8.1. Market Description

The NASEO/NARUC State Energy Assurance Guidelines provide an excellent discussion about the petroleum market and energy assurance.[27] The details of this discussion should be examined carefully but many of them are summarized here.

Petroleum is an international commodity. While there are domestic laws pertaining to the integrity and safety of petroleum shipping and pipelines, as well as certain trade practices prohibited in the United States, crude oil and its products are bought and sold in an unregulated international marketplace. Petroleum is generally governed by the economic principles of supply and demand. However, essential elements of this marketplace can be obscure. That is, both sides of the supply and demand equation can be, and often are, adjusted to affect price.

[27] State Energy Assurance Guidelines, v. 3.1, NASEO/NARUC, September 2009, www.naseo.org

The ability of producers to increase or decrease extraction or to expand or contract product production, and of end-users to reduce consumption, adds risk to the petroleum market. Speculation in oil futures from participants who do not take actual (wet) barrels also affects price. Different components of this market may be more or less vulnerable depending on their need for petroleum products at any given moment and the ability of the market to "clear;" in other words, for supply to satisfy demand at a price that facilitates (even if reluctantly proffered) this exchange.

8.1.1 Essential Market Systems

Four essential "systems" affect petroleum: exploration/production of crude oil, transportation by pipeline and shipping, refining and local delivery. Each has its own supply and demand structure and these system structures further complicate the availability and price of petroleum products sold for consumption.

Exploration/Production

At the international and national levels, oil exploration and production are affected by a complex system of demand for crude oil (and natural gas because production wells often produce both); the cost of exploration including location and discovery of the resource; infrastructure; supplies; insurance; time; personnel; national and local laws and regulations; and luck.

Transportation

The transportation of crude oil is affected by many factors. Some of these are: shipping rates, vessel availability and location; alternative transport such as secure pipelines; insurance; personnel; weather; and international and national shipping and transportation rules and practices. In the United States, and for product from neighboring countries, crude oil can move from production to refinery via international and interstate pipelines, thus reducing risk and cost to the U.S. domestic market. But with over 60% of U.S. oil imported from abroad, ocean shipping is also an important component of the supply equation.

National Refining

In the late 1970's, the OPEC embargo of oil to the United States signaled the growing ability of economically emerging nations to affect oil supply. The major U.S. companies were losing control over significant oil fields as foreign countries nationalized assets and began to dictate crude oil prices. Major oil companies also were witnessing a growing spot (prompt) market that supplied a burgeoning off-brand retail sector. To increase economic efficiency and profits, major suppliers drastically reduced wholesale and retail oil product storage, creating the "just-in-time" oil market in the United States. They also worked to reinforce profits where they manufactured retail petroleum products - their refineries.

Even the-so called Seven Sisters, the seven largest international oil companies, could not compete effectively in a growing multi-faceted market with many national owners in a climate of diminishing U.S. domestic crude oil production. Further, monopolistic pricing mechanisms like the Texas Railway Commission gave way to transparent electronic-based pricing. Exploration, production, supply, refining and retail marketing became more fluid. Some of the majors merged; others shed components to concentrate on one or a few aspects of their formerly vertically integrated companies. Into the 1970's, independent local oil product distribution companies were closely tied to one major supplier. By the beginning of the 21st century, many of those same independent distributors had become major regional suppliers of distillate, motor gasoline and even propane, to a variety of branded and unbranded retail outlets.

Diminishing Refinery Capacity

Domestic and foreign consumption dropped during the U.S. economic recession of 2008. Until then, analysts had noted the risk to energy assurance resulting from the difficulty of expanding the refining industry. During this recession, several refineries shut down temporarily or simply closed. Not even on-site expansion was vigorously pursued. Many of the closures appear to have affected other parts of the country. As profitability in refining diminished, this segment of the industry may be reduced further. This could increase price volatility when demand increases thus accelerating supply risk along with price and economic vulnerability for consumers.

Although refinery capacity abroad has expanded in such countries as China, India and Saudi Arabia, the trend in the U.S. is currently for less refinery capacity, not more. This trend may add risk for consumers in Arkansas; however, the state is presently served by Gulf Coast, Oklahoma and Texas refineries and appears to be unaffected by the shut-in of older, more distant facilities. Figure 8.1 illustrates this recent trend. The net effect of this by January 1, 2010 was that the U.S. had 148 refineries with an operable capacity of just under 17.6 million bbl/day, or 87,760 fewer barrels than January 1, 2009. Note in Figure 8.1 that Valero was purchased by PFB Energy in June 2010 and the facility may reopen.

EIA has emphasized one more factor in the reduction of refinery capacity. EIA estimated that ethanol use from March through June, 2010 will increase about 400,000 barrels per day over the same period in 2007. The increase in ethanol use, plus lower consumption, suggests that 640,000 barrels per day less gasoline will be needed from refiners and importers during this same period of time. EIA estimates that the overall effect of ethanol blending has reduced U.S. refinery utilization rates to about 83% at the end of 2009, or about 9% less than its peak in early 2007.

Figure 8.1 – Recent Refinery Closures and Capacity Shutdowns

Company	Refinery	State	Type of Change	Announced Date of Change	Refinery Capacity Report Status 2010	Capacity Change (MMbbl/d)
Flying J	Big West, Bakersfield	CA	Idled Indefinitely	Jan 2009	Idled	-66
Valero	Delaware City	DE	Permanent Closed	Nov 2009	Shut down 01/01/2010	-182
Sunoco	Eagle Point, Westville	NJ	Idled Indefinitely	Oct 2009	N/A	--
			Permanently Closed	Feb 2010	Shut down 01/01/2010	-145
Western	Bloomfield	NM	Idled Indefinitely	Nov 2009	Idled	-17
Marathon	Garyville	LA	Expansion	Jan 2010	Expansion 01/01/2010	+180

Sources: News releases and information on company Web sites. *This Week In Petroleum*, Recent Changes to U.S. Refinery Capacity, Released March 31, 2010,
NA= not applicable. MMbbl/d = million barrels per day. A barrel of oil contains 42 gallons of product.

Refinery Products

The United States not only imports crude oil for domestic refineries, it also imports refined oil products and propane. It is easy to miss these activities because eventually they are resolved by the basic supply, demand and price-to-clear equation. However, long before any particular price has cleared on any given

day; it is possible to forecast the movement of that price by keeping track of the trends in the refining part of the petroleum system.

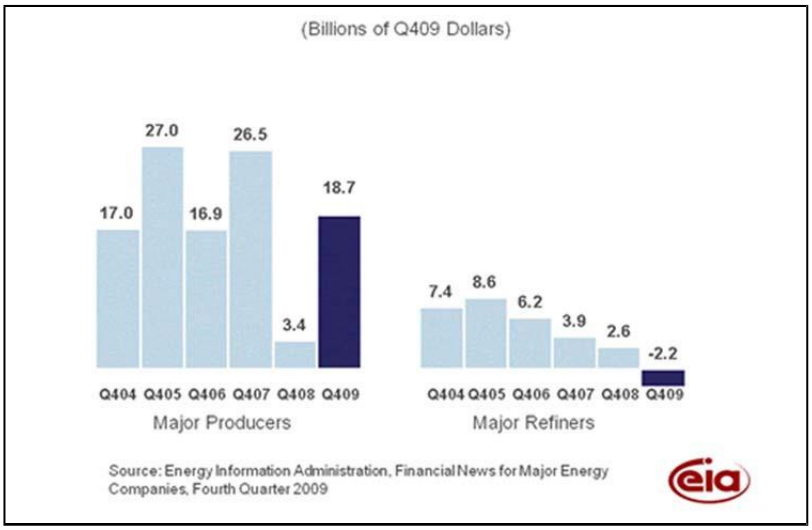
In the past, it was typical to observe seasonal production adjustments that varied the percentage of motor gasoline versus distillate (e.g., diesel and other distillates) "cracked" from crude oil. More gasoline was produced before the summer driving season and more distillate was produced before the winter heating season. But, refining has always been more complicated than that.

Other Factors Influencing Refinery Operations

The availability of crude oil at a price favorable for making a profit can no longer be assumed. Some refinery operators have found the purchase of crude oil versus comfortable refinery margins daunting. Some reasons for this are related to prices set by foreign producers and the Organization of Petroleum Exporting Countries (OPEC) or affected by commodity speculation. Other reasons are: domestic and international economies including rapid growth in demand; cost of infrastructure creation, availability and cost of raw materials including chemical components, technology, safety and insurance, trained personnel, heightened security, environmental rules, taxes and community opposition to expansion.

Figure 8.2 illustrates the disparity between production (exploration and producing oil from wells) and refining products. This profit squeeze also relates to the closure of refineries noted in Figure 8.2. The notation "Q409" refers to the fourth quarter of 2009.

Figure 8.2 – Producer and Refiner Earnings



Local delivery

The last of the four basic petroleum market elements is local delivery. This too is a complex subject. It is examined below beginning with The Arkansas Petroleum Market.

8.1.2. The Arkansas Petroleum Market

The distribution of petroleum products in Arkansas begins with major oil company suppliers. Depending on price and availability of supply, oil and propane products may be delivered to

Arkansas by many major petroleum companies including local area refineries. Major national product trading firms that buy from many suppliers also sell petroleum in Arkansas. Motor gasoline is supplied directly by the major companies or through independent petroleum companies, also known as jobbers. Most of the distillate and propane passes though jobbers as well. Arkansas consumers purchase distillate and propane through mostly independent retailers.

8.1.2.1. External Supply

Currently, Arkansas oil professionals do not see the reduction in national refining production as a problem for the state. However, the state is clearly dependent on the continuity of the interstate pipeline network for supply. Both the Enterprise Products Partners LP (Formerly TEPPCO (Texas Eastern)) and Gulf pipelines are laid from Arkansas into Missouri where areas associated with the New Madrid geologic fault exist. ADEM monitors this closely because a New Madrid fault earthquake could reduce state petroleum supplies significantly.

Product also enters the state from Memphis along a branch of the Enterprise Products Partners LP Pipeline. The Razorback Pipeline supplies northwest Arkansas from TransMontaigne facilities in Mt. Vernon, Missouri. Sunoco, Gulf and Enterprise Products Partners LP pipelines cross into the state from Mississippi carrying product from Texas and Louisiana. Lion operates a pipeline to supply product from its El Dorado refinery. Trucking to state jobbers is local except for one company, Dupree, based in Louisiana.

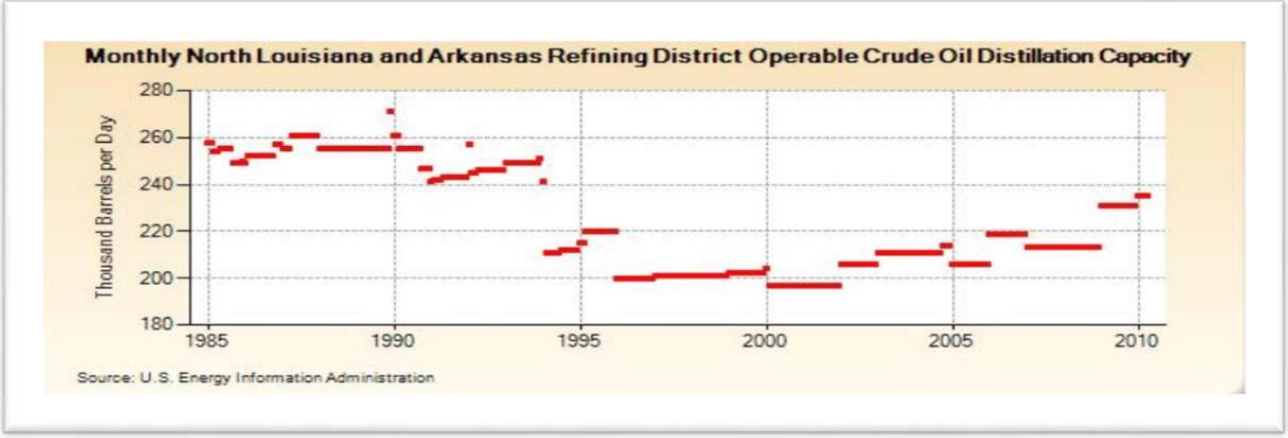
The state also receives petroleum products and crude oil by barge. In 2008, Lion Oil imported approximately 7.5 million barrels of crude oil from Saudi Arabia via ports in Louisiana for its refinery processing. However, there are also two river ports in the state that handle petroleum products. Both are owned and operated by Petroleum Fuel and Terminal Company. The facility in North Little Rock can off-load distillate, residual oil and other fuel oils, and various weights of lubricants. The facility in Pine Bluff off-loads diesel fuel. Both ports store product near-by; North Little Rock has capacity for 68,000 barrels of heavy fuel oil while Pine Bluff can store 75,000 barrels of diesel fuel.

8.1.2.2. Internal Supply

In addition to the refineries from areas noted above, product is supplied from two in-state refineries. Arkansas refineries receive crude oil from the Lion, Mid-Valley and Mobil pipelines. According to the EIA, the state's petroleum reserves constitute 2% of the nation's total of 30 million barrels (bbl). Crude oil is also produced in-state from stripper wells yielding less than 10 bbl/day. In 2009, 496,000 bbl of oil (3% of national production) were produced. The Lion Oil Company refinery at El Dorado produces approximately 70,000 bbl/day; and the small, Cross Oil Refining and Marketing Company refinery at Smackover produces approximately 7,500 bbl/day. The latter concentrates on production of lubricants and off-road diesel fuel.

The following figures illustrate the primary output of Arkansas's refineries as grouped by EIA. Figure 8.3 shows overall output capacity from 1985 to the present.

Figure 8.3 – North Louisiana and Arkansas Refining Crude Oil Distribution Capacity



Arkansas's two refineries produce a variety of products including alkylate, asphalt, road oil, sulfur and lubricants. Isomer products used primarily in manufacturing are also refined. They also produce volumes of distillate and motor gasoline as illustrated in Figure 8.4. These products find their way into the state petroleum market through co-located terminals.

Figure 8.4 – Production Capacity of Arkansas Petroleum Refineries (2009)

(Barrels per Stream Day, Except Where Noted)

Downstream Charge Capacity (Barrels per Stream Day)	2005	2006	2007	2008	2009	2010
Vacuum Distillation	32,000	32,000	32,000	32,000	32,000	48,500
Catalytic Cracking - Fresh Feed	19,900	19,900	19,900	19,900	19,900	21,000
Catalytic Cracking - Recycle Feed	0	0	0	0	0	0
Catalytic Hydro-Cracking		0	0	0	0	0
Catalytic Reforming	14,800	14,800	14,800	14,800	14,800	14,800
Low Pressure	14,800	14,800	14,800	14,800	14,800	14,800
Catalytic Hydro-treating/De-sulfurization	61,400	87,300	87,300	87,300	87,300	90,100
Naphtha/Reformer Feed	20,000	20,000	20,000	20,000	20,000	20,000
Gasoline	6,800	6,800	6,500	6,500	6,500	6,500
Heavy Gas Oil	21,000	21,000	21,000	21,000	21,000	21,000
Distillate Fuel Oil	8,600	28,000	28,000	28,000	28,000	30,800
Kerosene/Jet Fuel		0	0	0	0	0
Diesel Fuel	8,600	28,000	28,000	28,000	28,000	30,800
Other Distillate		0	0	0	0	0
Residual Fuel Oil/Other	5,000	11,500	11,800	11,800	11,800	11,800
Residual Fuel Oil		0	0	0	0	0
Other	5,000	11,500	11,800	11,800	11,800	11,800
Fuels Solvent De-asphalting	7,400	7,400	7,400	7,400	7,400	7,400

Source: Derived from EIA, *Number and Capacity of Petroleum Refineries – Arkansas, http://tonto.eia.doe.gov/dnav/pet/pet_pnp_cap1_dcu_SAR_a.htm*

8.1.2.2.1. Terminals Serving Arkansas

Petroleum product terminals are a key component of the state supply system. State terminals also handle product from the two oil refineries located in the southeastern part of the state. Propane is delivered to terminals serving Arkansas by a TEPPCO line. Large tanker truck rigs load the fuel from delivery racks. These rigs fill local dealer storage tanks from which product is loaded on smaller, retail delivery trucks. There are 10 terminals serving the state as shown in Figure 8.5.

Figure 8.5 – Arkansas Petroleum Terminals

Petroleum Terminals in Arkansas			
Name	**Address**	**Comments**	**Telephone**
EPCO North Little Rock (Enterprise Products Operating LLC)	2724 Central Airport Rd North Little Rock AR 72117		501-945-1421
HWRT Terminal – North Little Rock	2626 Central Airport Rd North Little Rock AR 72117		501-945-7115
JP Energy Partners Effective 11/2012	2207 Central Airport Rd. North Little Rock AR 72117	Formerly Arkansas Terminaling & Trading	501-945-4681
Lion Oil Company / Delek	1000 McHenry El Dorado, AR 71730		870-864-1350
Magellan Terminals Holdings LP	2725 Central Airport Rd. North Little Rock AR 72117		501-945-2991
Magellan Terminals Holdings LP	3222 Central Airport Rd. North Little Rock AR 72117		501-945-3291
Magellan Terminals Holdings LP	8107 Hwy 71S Fort Smith, AR 72908		479-646-1721
Martin Operating Partnership, L.P.	484 E. 6th Street Smackover AR 71762	AKA Cross Co-located with Cross Refinery	870-881-8700 x 1123
Murphy Oil USA, Inc. - Bono	15211 U.S. 63 North Bono AR 72416		870-268-0231
Petroleum Fuel & Terminal – North Little Rock	3206 Gribble Street North Little Rock AR 72114	Primarily biodiesel	501-945-7497
Razorback Terminaling - TransMontaigne	2801 West Hudson (Hwy 102) Rogers AR 72756		479-631-8098
TransMontaigne	Intercoastal Highway 4 East Arkansas City AR 78521	Primarily Chemicals	870-877-2404
Valero	South 8th Street West Memphis AR 72303	Formerly Premcor Refining Group	870-735-1610

Arkansas terminals are owned by both major oil companies and intermediate entities. For example, a major terminal operator in the state has sister companies that have wholesale and retail petroleum interests in Arkansas. And another terminal operator has wholesale operations in Arkansas and other states. There is one terminal operator who also operates a refinery and has both wholesale and retail sales in Arkansas.

Jobber and Retail Dealer Consolidation

The petroleum market in Arkansas has changed over the past two decades. Consolidation has taken place at the national, regional and local level. In 2010, there were 160 companies; down over 60% from the late 1990's. The basic distribution structure remains the same, therefore fewer companies supply the same volume of liquid petroleum products. Regional offices of supply companies consolidated as well, reducing the number of competitive contacts that state responders could reach in the event of a shortage. The impact on supply, however, is transparent.

Liquid Petroleum Fuel Acquisition - Prices

The most important factor in jobber product acquisition is price. Jobbers will seek the lowest cost per gallon of fuel required for their customers and send trucks to terminals (within a reasonable distance determined by their own calculations)[28] to supply their retail outlets. For example, the Truman Arnold terminal in North Little Rock may have a different price structure than the Magellan terminal in Ft. Smith. Contract secured accounts are served first; non-contract (so-called unbranded) customers follow. Many of the states unbranded dealers are combined with convenience, or "C," stores that are supplied with spot market product.

Ordering Product

Generally, retail dealers signal their jobbers in two ways. Either they send a regular (daily) posting to their jobber indicating how much product they anticipate selling, or the jobber obtains this information automatically via electronic sensors in the retailer's underground tanks. In the latter case, an automatic tank gauge (ATG) sends a morning reading and the jobber's tanker is dispatched. Under this system a retailer may never know if there is a shortage as long as sales proceed at a normal pace. However, if a shortage worsens, or is perceived by the public, the jobber is likely to inform the retailer because there is a chance that supply could run short before the end of the day.

While ATG is not prevalent in Arkansas, Wal-Mart in Bentonville is an example of how this system operates. ATGs at the Wal-Mart retail fuel outlets report a minimum of once daily, but possibly up to 10 times a day. The company, acting as its own jobber, checks all spot-market prices in the region and signals designated regional transport to move via computerized routing to pick up and deliver fuel to its retail outlets. When the motor gasoline is received at an outlet, the bill of lading is executed and the fuel is purchased electronically. This type of automation is still under development for other end-users. Some of the middlemen, such as Magellan, encourage it; major suppliers have been less enthusiastic about moving to automatic system electronic unification.

[28] The price spread varies and is affected by weather. In general, most Arkansas jobbers will not drive farther than 135 miles out of their area for fuel. As a rule of thumb, they will not make such an out-of-area pick up unless there is a 10 cent price spread or more. Source: Interview with Ann Hines, Arkansas Oil Marketers Association, Inc. March 2010.

Storage
Another piece of the fuel acquisition chain is storage. Local storage diminished significantly in Arkansas, as it did elsewhere in the United States, when major suppliers moved to just-in-time delivery. There are only 68 bulk facilities remaining in the state and most operate infrequently. The costs for environmental management requirements have also had an impact on reducing such storage.

8.1.2.3. Motor Gasoline and Diesel Vehicle Fuel Curtailment

Commercial, institutional (including governments) and industrial end-users may purchase fuel with long-term supply contracts. However, most motor fuel (diesel and motor gasoline) is sold through contracts with general retail outlets. Contractual arrangements may be altered during a significant supply shortage.

If crude oil supply is less than refiners anticipate, prices increase as refiners bid to obtain the reduced number of barrels available for sale. This means that the refiners' margins decrease unless they raise the cost of their outbound products. This is what happened when OPEC embargoed crude oil in the 1970's. A similar pattern occurred when Venezuela crude shipments diminished in 2002-2003 during a workers strike there.

In a weak economic market, when petroleum consumption is flat or regressing, refiners avoid "competing with themselves" by reducing production. This prevents supply from exceeding demand and helps maintains "refinery margins," (i.e., prices). Another way to explain this is to note that the response of the petroleum product industry is to reduce production in order to balance supply and demand.

If refinery production falls far enough, local jobbers may be notified (and it may not be by formal notice; sometimes volume is cut and jobbers must recognize it on their own) that the previously calculated volume for fulfilling contracts has been lowered, or curtailed. Because federal trade practice laws prevent discrimination in choosing or favoring buyers, jobbers will reduce the amount of contract specified available to all of their retail dealers. In such cases, the retail dealer is "put on allocation." Retail dealers may be curtailed by some percentage-from "100%-of-contract" on down. This means first that flexibility to serve non-contract customers is reduced. Second, should the curtailment continue (and the curtailment percentage drop), contract customers may receive less as well.

Local propane systems can manage a temporary supply reduction because the contracted customer base is filled in cycles; hence, most customers will have enough fuel on hand until normal supply is restored. If supply remains low, or diminishes further, customers become increasingly vulnerable to a fuel shortage risk.

If supply is short, dealers may adjust their hours of operation, but unless public authority authorizes them to do otherwise, they must allocate available supply in a fair and reasonable manner. This means that a supplier may not be able to discriminate within a class of accounts to give priority to one user over another. This is why some of the petroleum emergency mitigation measures may help to mitigate the impact of severe shortage. The least obtrusive of the suggested mandatory measures provide substitutes for rationing (e.g., tank topping prevention or odd-even day

purchases). The most stringent transfer the assignment of a percentage of product from private suppliers to the state government (the actual sale remains with the seller).

From about 2006 to 2008, reduced supplies of refined motor gasoline and other fuels resulted in increasingly high retail prices[29]. This indicates that for most petroleum product shortages, the market price will clear, or balance, the market. The economic burden of price as the mediator of energy shortage is that the consumer must reduce travel or pay more. Businesses with insufficient cash flow, weak market position, or other disadvantages are vulnerable. Institutions without alternative sources are also vulnerable. Homeowners may conserve up to a point beyond which their jobs, health or other needs demand fuel-or-food decisions.

The problem for energy assurance responders is that these anticipated outcomes vary significantly. According to the Congressional Budget Office, consumers did not significantly alter driving behavior from 2003 to 2006. However, CBO postulated that as prices reached the $3.00/gallon, weekday drivers in California with access to rail would reduce driving by 4%.[30] Higher prices appeared to have no effect on weekend motoring. Anecdotal experience from 2007 to 2008 indicates that around $4.00/gallon driver behavior began to change, especially for discretionary driving and highway speed. However, this reaction quickly coincided with an economic recession brought about by many market issues that may or may not have included fuel prices.

As prices dropped in response to the recession of 2008-2010, sales volumes remained low and anecdotal experience indicates that drivers resumed former driving patterns at highway speeds. One can argue that the increasing sales of hybrid vehicles reflects consumer concern for high fuel prices, but driving habits in relation to fuel prices continue to be shrouded by broader economic issues, so the metrics are murky at best. What is apparent is that lines seen at filling stations in the 1970's did not reappear in 2007-2008, indicating that price did, in fact, balance supply and demand at the retail end of the market.

8.1.2.4. Propane Delivery Profile

Propane, or liquefied petroleum gas (LPG), is stripped from natural gas by gas processing plants, or refined from petroleum. Most of the LPG is delivered into Arkansas via the TEPPCO pipeline; a small amount is received by rail. LPG is lifted from terminals at Kingsland, Rixie Road (North Little Rock) and West Memphis. Most of the LPG sold in Arkansas is purchased on contract and delivered to consumer tanks that are owned by the delivery company. Dealers generally contract with a propane gas transport company to have contract product delivered to their local bulk plant. From there it is loaded to smaller "bobtail" trucks for local delivery.

In 2010, there were 153 member companies belonging to the Arkansas Propane Gas Association. Four companies dominate the market with the highest numbers of outlets: Ferrillgas, Inc. has 24; Synergy Gas Corporation has 19, AmeriGas Propane, L.P. has 12, and Southern LP Gas has 8. Another 12 companies have 2 to 4 outlets. The remaining companies list only one retail location.

[29] High crude oil prices and speculation added to the cost.
[30] CBO, *Gasoline Prices and Driving Behavior* ***http:// www.cbo.gov/ftdocs/88xx/doc8893/Chapter1.5.1.shtml***

8.1.2.4.1. LP Gas Board

Act 31, Arkansas Acts of 1965, (§15-75-101., *et seq*) created the State Liquefied Petroleum Gas Board. The Board has authority over:

> "all persons, firms, or corporations who are engaged in the manufacture, sale, installation, or use of containers and equipment in the storage, transportation, dispensing, and utilization of Liquefied Petroleum Gases in the State of Arkansas."[31]

The organization formulates and promulgates rules for:

- Permits
- Fees
- Inspections
- Adding an odor agent to LPG
- Container definitions and specifications
- Use of unapproved containers and systems
- Unlawful use of containers
- Conformity with product specifications
- Areas of operation
- Safety and reports for installations
- Refrigerated or cryogenic storage
- Technical issues pertaining to LPG-related equipment and parts
- Specification for delivery vehicles and related equipment
- Servicing of equipment
- Storage
- Special markets such as farm equipment
- Appliance design and safety
- Filling rules and safety
- Safety training
- Liability re: rendering aid
- Reports
- Suspension of fees
- Acquisition of potable LP gas replacement cylinders
- Competency for delivering gas
- Penalties

The Act also specifies the membership and operation of the LP Gas Board (§15-75-201., *et seq*).

Two sections of this law apply to actions during a shortage of product. In particular the law addresses concerns for meeting customer needs during a shortage when normal, contract delivery may be interrupted. The first relates to Shortage Emergencies:

> "§15-75-322. Shortage emergencies
>
> (a) The Governor of the State of Arkansas may join with the Governor of any other state in declaring a liquefied petroleum gas shortage emergency.
>
> (b) When the declaration is issued, liquefied petroleum gas trucks and operators meeting all certification, permit, and licensing requirements of the federal government and their home

[31] *State Code*, *Liquefied Petroleum Gas Containers and Equipment, State of Arkansas*, July 1, 2009, Published and Authorized by the Liquefied Petroleum Gas Board

state shall be permitted to transport liquefied petroleum gas in and through Arkansas without obtaining any license, permit, or certification by an agency of the State of Arkansas.
(c) The waiver of Arkansas licensing, permitting, and certification laws and regulations regarding liquefied petroleum gas trucks and operators thereof shall be valid only during the time of the emergency."

The second section specifies delivery of product into non-contracted consumer tanks: "§15-75-406, Unlawful use of containers
(g) (1) The Director of the Liquefied Petroleum Gas Board may allow a liquefied petroleum gas company to fill or service another liquefied petroleum gas company's container during a declared state of emergency by the Governor if the liquefied petroleum gas company owning the container will not or cannot fill or service the container within twenty-four (24) hours after the request for service by a person or company.
(2) If the director determines that there is an immediate need to fill the liquefied petroleum gas container during the declared emergency, the director may authorize the filling of the container in less than the twenty-four-hour period if the company owning the container will not or cannot fill or service the container in less than the twenty-four-hour period.
(3) To expedite the delivery of liquefied petroleum gas, the required pressure testing by the seller is waived for any delivery of liquefied petroleum gas under this subsection during a declared emergency."

In theory, this law offers the potential for assistance to weather-challenged consumers. Formerly, the larger companies resisted this effort while smaller, locals supported it.[32] Responders will want to track the results to see if it provides the intended relief.

8.1.2.4.2. Other Propane Issues

It is important that the retail LPG dealer understand seasonal supply and customer consumption behavior because liquid propane is ordered each spring for winter shipment. If the order is inaccurate, customers may be vulnerable to insufficient supply and volatile prices. It is incumbent on local retailers to maintain sufficient bulk plant storage to meet short-term demand. This, added to economic efficiency considerations, is why most propane retailers insist on contracted, automated fuel delivery for space conditioning customers. With a known customer base and a record of usage rates, a knowledgeable LPG dealer will know how much "storage" remains in customers' tanks versus what is required to meet the demand for a refill.

Many of Arkansas LPG users reside in the rural sections of the state. Servicing such customers, plus excess time spent waiting at terminal racks, can cause delivery and tanker driver hours to exceed federal standards. Generally, the state propane dealers will learn about impending shortage from the terminal or a refinery. If allocations reducing available fuel for sale are invoked by major suppliers, word spreads quickly. Arkansas propane and petroleum industry officials consider relief from federal Hours of Service for supply and distribution drivers a vital tool for preventing, or mitigating a shortage.

[32] Interview with Ann Hines, AOMA, March 2010.

8.2. Arkansas Petroleum Stakeholders

This section describes a number of organizations that work with, or represent, petroleum energy companies. They include the major petroleum associations and other entities that work regularly with the petroleum system to enhance assurance. This listing does not include individual petroleum companies.

8.2.1. Arkansas Oil and Gas Commission (AOGC)

The mission of the AOGC is to oversee oil and gas production through the protection of ownership rights, preventing waste, encouraging resource conservation and protecting the natural environment. It accomplishes these by regulating:

- Well drilling permits
- Oversight of well completion, recompletions and production tests
- Compliance inspections
- Administration of USDOT natural gas gathering pipeline safety program
- Plugging of wells
- Management of Abandoned and Orphan Well Plugging Program
- Seismic operation permits
- Enhanced oil recovery injection operations permits
- Fluid disposal injection well permits
- Permitting of tank trucks transporting oilfield waste
- Monthly hearings to enforce state oil and gas regulations

The AOGC does not become directly involved in general petroleum shortages but it helps the state maintain its internal supply of oil and gas. The AOGC also produces maps of oil and gas critical assets that are extremely valuable for understanding the state's liquid and gas hydrocarbon infrastructure.

8.2.2. Arkansas Oil Marketers Association (AOMA)

AOMA is primarily a trade organization that coordinates communications among the organization's approximately 160 jobber and petroleum retail members. AOMA represents association members before government bodies on energy policy and regulatory matters. The organization understands the substance and pulse of the state petroleum supply and distribution systems. It provides a point of communications with petroleum suppliers, major companies and component organizations such as refineries, pipelines, terminals and distributors. The AOMA plays an important role during energy shortages by receiving notification from suppliers. The Executive Director has intervened directly with state officials during many supply shortage incidents in order to waive various environmental rules and restrictions on driver hours of service.

In the event of any distillate or motor gasoline shortage, state responders will want to be in contact with AOMA as soon as possible.

8.2.3. Arkansas Petroleum Council (APC)

The APC is essentially a local arm of the American Petroleum Institute (API), located in Washington, D.C. API represents all aspects of America's oil and natural gas industry, including producers, refiners,

suppliers pipeline operators and marine transporters, as well as service and supply companies that support all segments of industry. API conducts or sponsors research ranging from economic analyses to toxicological testing and collects, maintains and publishes statistics and data on all aspects of U.S. industry operations, including supply and demand for various products, imports and exports, drilling activities and costs, and well completions. API has led in the development of petroleum and petrochemical equipment and operating standards for over 75 years and maintains more than 500 standards and recommended practices.

The APC is the eyes and ears of the API and works closely with state and local petroleum entities to assure the continuity of supply and the maintenance of a viable petroleum industry. The local office is governed by a council of member companies and can, under certain circumstances, provide assistance and advice to state responders faced with petroleum product shortage or related issues.

8.2.4. Arkansas Propane Gas Association (APGA)

APGA is a trade organization that works with the state's LPG jobbers, retailers and stakeholders. In addition to representing the industry's interest before governing bodies, the organization sponsors extensive safety training and helps members understand and comply with state laws regulating certain aspects of the state LPG market (see LP Board).

Because propane has the potential to explode and is volatile in its gaseous state, APGA works closely with both local and national fire and safety officials to promote the safe use of LPG. In addition, APGA supports national LPG research efforts to protect consumers.

During a shortage, responders will want to be in touch with both the APGA Executive Director and the Director of the state's LP Gas Board to learn if waiver requests are forthcoming and coordinate information pertaining to any damage-causing events or shortages that might impact the health, welfare and vulnerability of customers.

8.2.5. Arkansas Waterways Commission

The mission of the Arkansas Waterways Commission is to oversee navigation issues, port development and the use and protection of navigable waterways in or affecting the state. The primary activity of the Commission is to promote commercial opportunities for the ports, but it would become concerned if products could not reach the ports for any reason. Since ice accumulation is unlikely, the Commission could be expected to be concerned about potential dredging issues as well as the safety and equipment pertaining to the waterways.

8.2.6. Liquefied Petroleum Gas Board (LP Gas Board)

As noted above, the LP Gas Board has responsibilities that include:

- Reviewing and approving of applications for permits and licenses
- Conducting of qualifying examinations
- Issuing and renewing of permits, licenses and certifications
- Inspecting liquefied petroleum gas equipment and facilities annually
- Monitoring mandatory education requirements and providing basic initial training for Class I permit holders

- Investigating complaints and accidents and holding disciplinary hearings

The LP Gas Board has a Director, four field inspectors and two additional support personnel. When anticipating or experiencing a supply shortage, the Board is in contact with the APGA and the AOMA in addition to responders at the Energy Office and ADEM. The Board does not become involved in restoration efforts but can invoke rules (noted above) to facilitate the cross filling of supply[33] in the event a local company cannot deliver LPG during a declared emergency. The Director monitors weather and transportation conditions pertaining to driver hours before and during a potential shortage event and assists the Governor in requesting federal HOS waivers as conditions warrant.

8.2.7. Association of Arkansas Counties (AAC)

The AAC provides a forum for county elected officials and staff to communicate and coordinate plans, programs and policies throughout the state. Nine affiliate associations of county and district officials are represented by the AAC as well. The organization represents 1327 elected county and district supporting a range of activities including issue research, legislative matters, professional training, and communications. In the area of energy assurance, as well as any other type of emergency, the AAC provides technical assistance to jurisdictions whose resources may be strained or inadequate to meet a special need. AAC also assists such jurisdictions in obtaining state government assistance and applying for federal relief as needed. In the event of a petroleum product shortage, or related energy assurance issue, the AAC can intervene on behalf of any requesting member jurisdiction and work with both state officials and energy stakeholders to mitigate the situation.

8.3. Energy Assurance Procedures for the Petroleum Market

Section 5, *Energy Market Risk and Vulnerability Assessment*, covers general risk to the state associated with energy assurance issues. This section focuses on two types of risk specific to the petroleum market. The first type of risk is fuel loss at the major supplier level, before shortage is felt by consumers. The second includes risks and vulnerabilities when loss of fuel threatens or affects end-use sectors within Arkansas. These risks, as discussed above, tend to mingle. Major international and national events such as the OPEC oil embargoes, the oil spill in Prince William Sound, Alaska (commonly referred to as the Exxon Valdez oil spill), massive hurricanes, the burning and collapse of the BP offshore platform, damage to an interstate pipeline , earthquakes and major refinery fires represent the worst sort of risks managed by petroleum companies. Lesser risks include the impact of refinery maintenance shutdown or occasional pipeline pump failure. Other, more localized, risks might be closed service stations or the temporary failure of an energy retailer to deliver product during a period of high demand.

Another aspect of the petroleum risk spectrum is the daily management of hazardous materials. Hazard events may not cause a shortage, but they will draw significant attention and raise supply-related questions. Arkansas officials may or may not visit the Emergency Operation Center in response to geographically distant petroleum risk events. But once an accident or other hazard-related emergency affecting the production and distribution of petroleum is reported, increased monitoring is indicated. If a petroleum hazard occurs inside the state, the need for hands-on activity is greater. State officials will undoubtedly respond robustly to safety and health issues that expose people, animals and property to hazardous materials released inside the state.

[33] See page 13—Delivery of product into non-contracted consumer tanks

Many issues threaten or interrupt routine petroleum operations and put supply at risk. These issues can occur at any point from exploration/production to distribution. In all cases, when state officials are informed (in whatever manner); it is important to monitor the situation actively in order to detect whether the problem increases energy risk for Arkansas end-users.

The petroleum industry generally does not disclose details about specific infrastructure damage, assessments, or repair. Because of competitive concerns, most petroleum companies are careful about discussing damage that is specifically related to an event. There are federal rules pertaining to safety and effective hazard management; but as the 2010 Gulf of Mexico disaster demonstrates, government lacks the expertise and tools for repair and restoration. Further, media and the public will focus on the dramatic portion of supply interruption events. For example, a refinery explosion or fire garners attention; the long, tedious job of repair and restoration – far more salient for returning supply to normal – is rarely reported.

With the sale of vertically-integrated petroleum company components, the sale of crude oil and finished products shifted from intra-company to inter-company thus increasing economic risk because single companies could no long control the entire supply-purchase chain. Large companies are perhaps better equipped to manage risk through both in-house commodities staff as well as contractors who sell Energy Tracking and Risk Management (ETRM) systems to manage commodity risk. The commodity futures market adds to price volatility as traders on the NYMEX invest in petroleum futures contracts. A disparity between the purchases of barrels for actual use versus buying futures (with no intent to accept delivery) further complicates supply risk. Supply risk is also compounded by financial market elements such as the availability of credit, growing competition for commodities from economically emerging nations and the overall economic health of national and international economic systems.

In most cases, state responders will find it easier to obtain details about supply issues and infrastructure problems from local jobbers and distributors than from major petroleum suppliers. For example, if there is a problem with the delivery of petroleum products because of remote pipeline or transportation problems, and AOMA learns about it, AOMA is more likely to inform state energy (AEO) officials than the production or refining company shipping the product. The organizations state officials should contact first are the AOMA, the APGA, LP Gas Board and the APC.

Some of the response activities suggested in Figure 8.6 are derived from common sense; but most of the measures are based on observation. For example, petroleum product distributors request HOS waivers during cold snaps. Suppliers have imposed fuel allocations in response to supply/demand imbalance. Companies have rerouted crude oil and petroleum products around major pipeline breaks where the infrastructure permits. Also, railroad or tanker truck capacity has been purchased following pipeline interruption, especially if demand is sufficient to pay for higher transportation costs.

Figure 8.6 – Examples of Supply Issues Affecting the Petroleum Industry

Issue	Petroleum Industry Response
Weather Forecast ❖ Temperature extreme ❖ Wind conditions ❖ Rain/flood conditions ❖ Ocean storms ❖ Snow/Ice	❖ Allocate contract supply, reduce release to spot market ❖ Add distribution capacity as price increases ❖ Prepare/protect distribution infrastructure ❖ Seek alternative routes and delivery means ❖ Reroute ships, seek alternative supply market ❖ Equip local delivery vehicles. Request HOS waivers
Geologic Events ❖ Earthquake	❖ Allocate contract supply, reduce release to spot market ❖ Assess damage, send repair as required, reroute supply
Electromagnetic Events ❖ Solar flares	❖ Electronic and computer systems may be vulnerable. It is unlikely that efforts to reduce this threat will be reported or discussed with state officials
Supply System Issues ❖ Embargo ❖ Production field exhaustion ❖ Environmental hazard ❖ Equipment failure ❖ Refinery fire or other outage ❖ Pipeline flow issues ❖ Storage tank failure o Regulations o Tank integrity ❖ Bottoms (shipping) o Tankers not available o Jones Act restrictions o Ocean storms	❖ Allocate contract supply, reduce release to spot market ❖ Seek assistance from federal authorities ❖ Explore and produce new locations – an ongoing activity ❖ Reduce hazard and adjust prices to cover cost or close facilities ❖ Assess, repair, replace or shutdown as economics indicate ❖ Maintenance, effect safety response, assess, and per above ❖ Assess, repair, replace, reroute, allocate ❖ Meet safety obligations as required, adjust prices to cover costs ❖ Maintenance, assess, repair, replace or shutdown ❖ Seek new ships as market permits ❖ Work with federal government to modify, eliminate ❖ Predict, effect safety measure, reroute
Regional Transportation Issues ❖ Highway interruption ❖ Port and River issues ❖ Weather conditions ❖ Insufficient trucking available ❖ Terminal queuing	❖ Seek assistance of affected state Departments of Transportation, man state and local EOCs, reroute ❖ Participate with port authorities, constantly assess and inform ❖ Pre-fill customers, maintain large contract customer base, locate alternate supply sources ❖ Seek HOS waivers if conditions warrant ❖ Seek HOS waivers if conditions warrant
Human Instigated Issues ❖ Worker strikes ❖ Lack of experienced workforce ❖ Terrorism ❖ Cyber-attack (IT risk) ❖ Workplace mistakes ❖ Training ❖ Commodities	❖ Work with unions, have back-up contractors to replace, allocate ❖ Expand and train as economics permit ❖ Harden infrastructure, supply information to U.S. DHS ❖ Assess, turn to IT and security professionals ❖ Train personnel, monitor, prepare media response ❖ Results are best barometer & seen at supply level. Refinery workers are highly trained and drilled regularly. Distributor organizations provide and encourage employee training ❖ Companies use a variety of in-house and Energy Tracking and Risk Management Systems (ETRM) consultants to evaluate and manage the sale and purchase of crude oil and petroleum products

The following bulleted list was developed in conversation with representatives of the petroleum industry. Not all participating companies do everything suggested in this list; however, the list in Figure

8.7 provides a useful starting point when state responders inquire about petroleum supply and distribution issues related to petroleum industry response.

Figure 8.7 – Summary of Issues and Potential Responses Taken by the Petroleum Industry

Issue	Potential Risk/Response
Spot-market purchase increase as major suppliers/refiners reduce direct retail ownership (i.e., "branded" outlets)	• Branded outlets are less vulnerable than spot-market fuel stations due to supply contracts reducing risk during shortage • Spot-market outlets enjoy price advantage while supply is abundant • The petroleum industry anticipates that higher prices will "clear" or re-balance the market
Reduction in storage for all petroleum fuels is related primarily to economics Industry views environmental regulations as a cost driver	• Reduced local storage increases customer risk when supply is tight • Major petroleum suppliers approve of storage reduction in order to manage demand signals and prices efficiently • State propane dealers see reduced secondary storage as a disadvantage
Federal law requires electronic and manual (every 30 days) tank integrity monitoring	• Some dealers complain, but all seem to understand safety implications • Attention to safety reduces insurance risk and potential legal exposure
Some gasoline retailers and large users increase automatic fill ordering via electronic equipment on tanks	Many retail dealers continue to enter orders into the system manually
The petroleum industry employs many contract protocols and cost plans that are reflected in retail pricing rather than reliability risk An example would be zone pricing (in which an area is priced as a unit to maximize profit)	• A dealer's ability to remain in business is a market/private sector decision • Overall, the loss of a dealer is quickly compensated by a purchase or expansion by another • Reliability does not appear to diminish
Product allocation applies to contract or branded outlets but affects spot-market outlets as well	• When supply diminishes, excess product supplying unbranded sellers is reduced • When supply is tight, spot buyers bid up the price to acquire fuel in a tight market
HOS waivers are granted by state and federal officials based on verification by product distribution associations or LP Gas Board	Associations ask many questions and work with retail dealers to find alternatives for HOS waivers requests
The TEPPCO gas line shipping propane to Arkansas also carries natural gas	Consistent planning and seasonal distribution contracts reduce customer vulnerability
Dealer consolidation is occurring in the retail propane industry	• Interstate companies such as: AmeriGas, Ferrillgas, Southern and Synergy Gas hold increasing market share • Reliability does not appear to diminish
Sources: Interviews with petroleum distribution association and industry representatives, March 2010.	

8.3.1. Procedures for Petroleum Disruptions

8.3.1.1. Shortage Identification

As supply risk shifts from the international/national petroleum industry to local jobbers and retail dealers, the state's role in reacting to shortage increases. The laws discussed in Section 3, *Legal Authorities and Stakeholders*, outline the responsibilities of essential state stakeholders and agency roles.

The Energy Supply and Data Tracking Plan developed in coordination with this Energy Assurance Plan, helps responders understand when to begin data tracking efforts related to a potential or actual shortage. Figure 8.8 expands the examination of disruption by focusing on some of the conditions that responders may observe before and during a fuel shortage. This list is not exhaustive; responders should rely also on their own training and experience. Attention to seasonal conditions, regular monitoring of supply and consumption, contact with industry and government representatives and open communications are essential to preparedness.

Figure 8.8 – Potential Shortage Conditions and Probable Impacts to Observe

I. Early Conditions (one or more may apply)	Probable Impacts Observed
Severe cold weather in any region affecting Arkansas may cause local supply problems	▪ Gasoline, propane prices may increase ▪ Natural gas prices may also rise in parallel with petroleum products
Reports of shortages in other parts of the U.S. or reports of natural disasters, terror or political difficulties in oil producing countries may affect petroleum and petroleum product prices on the New York Mercantile Exchange (NYMEX)	State jobbers and retailers may experience temporary supply difficulties evidenced by increased waiting time at terminal supply racks
Local prices may move up rapidly in response to spot market prices or speculation on commodity markets	If queried (especially during the summer driving season), some gasoline outlets will report greater than normal buying as motorists attempt to secure the current lowest price[34]
II. Tightening Conditions (in addition to previous phase; one or more may apply)	**Probable Impacts Observed**
The U.S. DOE, NYMEX, API, Oil Price Information Service (OPIS) reports reflect a decrease in the availability of product (e.g., from Middle East, South America, domestic refineries) Petroleum & propane associations hear from members that rack waiting time has increased	▪ Some jobbers report supply and delivery problems or related issues (e.g. extended rack wait time) ▪ Deliveries may be temporarily extended beyond routine hours ▪ Tighter market conditions indicated by upward pressure on prices or price volatility
Spot prices increase National and regional oil companies may begin to hold jobbers to contract allocation versus replenish-as-needed	Some retail dealers are uncertain about product availability and question information received from prime suppliers

[34] The term for this condition is "Cantango," meaning forward prices are moving higher. The opposite price movement is called "Backwardation."

Problems with energy delivery systems are observed such as refinery outages, transportation interruptions (including waterways) or rapid increases in consumer level storage	▪ State government assistance in suspending commercial driver HOS rules may be sought ▪ Arkansas Waterway Commission assistance may be required with marine and river issues.
Petroleum dealers report increased pressure on their ability to deliver fuel	▪ Some customers call dealers to top off home storage tanks ▪ Dealers complain to associations about increased cost of rack waiting time or other shortage-related delay
III. Serious to Severe Conditions (in addition to previous phase; one or more may apply)	**Probable Impacts Observed**
Regional and state fuel dislocation is brought on by large-scale storms; extended, widespread, winter cold; embargo; infrastructure failure or damage, accidents or other human initiated acts	▪ During peak driving seasons, gasoline stations may curtail operating hours and motorists may queue to purchase available fuel regardless of price ▪ Lack of courtesy in queues may produce altercations at service stations
Retail energy prices do not level off but continue to rise Some vendors may not be able to buy wholesale product regardless of price	▪ Customers (including government agencies) who contract with vendors for spot-market fuel may not be able to obtain product ▪ During winter months, will-call propane customers may have difficulty locating fuel regardless of price
Local product storage is extremely low or exhausted	Petroleum fuel hoarding may be observed
Major petroleum suppliers sharply reduce allocations to jobbers Spot-market fuel “dries up”	▪ Retail dealers are overwhelmed managing customer inquiries ▪ Retail dealers may curtail hours of operation or close to conserve fuel ▪ Jobbers may travel long distances to buy from terminals with supply ▪ Interstate driver HOS rule suspensions become routine
Shortages are generally regional in scope but possibly broader	▪ Requests for government assistance and relief increase rapidly ▪ State governments may speed efforts to coordinate interstate mitigation measures
Taxi and mass transit fares may increase to cover the rising fuel costs Existing assistance programs may be insufficient to help low-income families in distress	▪ If mass transit is available, ridership increases significantly ▪ Tourism and discretionary shopping suffers ▪ Economic dislocation occurs, especially for income challenged consumers.

Additional Data

Work with industry representatives to obtain updated data. Monitoring the flow of petroleum is an on-going job of the AEO. The major petroleum suppliers to Arkansas report their monthly deliveries to this office and the information is maintained in a secure database. This provides the AEO with current and historical information on the amount of petroleum products that are being delivered by each supplier.

Identify Other Involved Organizations

The AEO subscribes to and uses the U.S. DOE, OE, Infrastructure Security and Energy Restoration network (ISRnet). Also the AEO has direct contact with petroleum associations, distributors, pipelines, and retail outlets (e.g., service stations) organizations.

Identify Data to Monitor

Principal indicators to seek include international actions, refining outages, weather forecast, status of storage facilities throughout the supply system including abnormal road transportation situations, dealer restrictions on customer deliveries and requests for suspension of driver hours of service and load weight restrictions.

Identify Problem Indicators

Examples include: interruption of international petroleum supply or international or US refining capability, low storage status, severe weather or other issues hampering the ability to receive petroleum products by pipeline, barge, or transport it on highways.

8.3.1.2 Petroleum Data to Monitor

Figures 8.9 and 8.10 list key information indicating the current and near future status of the petroleum supply for Arkansas that is monitored routinely. Figure 8.9 lists long-term information to obtain and Figure 8.10 lists short-term data to obtain. Figure 8.10 identifies the primary government sources for long-term information on petroleum supply. In addition to the U.S. government sources, the International Energy Agency and industry organizations such as the American Petroleum Institute publish regular information on petroleum supply and pricing. Long-term information on petroleum is also discussed in business and financial publications. This information is useful for a baseline forecast and comparison to short-term data. Each table indicates the specific data items, a brief description of the data, the monitoring frequency, and the indication from this data item that a stress condition exists or is likely.

Figure 8.9 – Petroleum/Propane Long-Term Information

Information Description	Comments	Frequency	Indication of Stress or Emergency
Annual Energy Outlook by EIA	Forecasts long-term energy supply perspective	Annual - Early release, December Full publication, March	Identifies long-term sources of supply and pricing provides baseline
Pre-Heating Season Meeting with Propane Gas Association (APGA)	Discussion of current supply situation Projection for heating season	Annually	Expression of concern for supply adequacy
DOE Annual Winter Fuels Outlook conference	Forecasts heating season supply situation,	Annually	Forecast problem, pricing
Annual Energy Outlook	Projection of long-term outlook for demand and supply of energy--no specific information for propane, but oil and natural gas information affects propane situation	Annually in March with winter release date in December	Forecast problem, pricing

Figure 8.10 suggests data that should be obtained during appropriate seasons as well as when supply shows signs of becoming tight. For example, short-term data should be gathered for propane before winter and short-term data for motor gasoline should be emphasized before the summer driving season.

Figure 8.10 – Petroleum/Propane Short-Term Information

Information Description	Comments	Frequency	Indication of Stress or Emergency
EIA Short-Term Energy Outlook	Updates supply, storage and pricing information	Monthly	Identifies short-term supply, storage, pricing outlook, and baseline
Weekly State Heating Oil and Propane Program (SHOPP) teleconference	Attendance by regional state energy officials and DOE representatives	Weekly during heating season	Discusses any problems with supply system
Weather data	Heating degree day information with comparisons to prior years and projections of long cold snaps	Daily	Weather forecast, that suggests supply/transportation problems
Natural Gas customer curtailment as precursor to more propane & distillate consumption	APSC is notified	As required	Will increase demand for heating oil
Crude Oil, Gasoline and Heating Oil Futures	Data from NYMEX	Daily (Mon-Fri)	Indicates long-term supply problem
Crude Oil, Gasoline and Heating Oil Spot Prices	Data from Wall Street Journal, OPIS or other market sources	Daily (Mon-Fri)	Indicates short-term supply problem
Retail Gasoline and Heating Oil Prices	Query Arkansas Oil Marketers Association (AOMA), jobbers, terminals	Weekly	Increase indicates supply problem
Wholesale Gasoline and Heating Oil Prices	Query AOMA	Daily (Mon-Sat)	Increase indicates supply problem
Stocks of Crude Oil, Gasoline and Distillate at Various Points of the Distribution System	EIA data	Weekly (Wed)	Identifies inventory and compares with prior week and year data to indicate whether situation is normal
Request for Driver Hours of Service Waivers for Petroleum Tank Trucks	Caused by backups at terminals or difficult driving conditions	As required	Indicates delivery capacity problem

Once a problem is detected, more frequent monitoring of appropriate items in Figures 8.9 and 8.10 should be initiated and additional information listed in Figure 8.11 should be requested.

Figure 8.11 – Petroleum Information Monitored During Stress Conditions

Information Description	Comments	Frequency	Indication of Stress or Emergency
Customer Complaints, Media Reports on Supply Problems	Information may be identified through telephone, e-mail or broadcasts	As it happens	Indicates problem with supply or delivery
Inventory in Tanks	Inquiry by AEO	Monthly as requested by AEO	Can show level of problem, geographic variations
Applications for Driver Hour Waivers in Other States (AOMA)	Applications in state and in neighboring states indicate supply and transportation stress. Check with AOMA and APGA, Department of Environmental Quality	As appropriate	Waiver applications
Supply Status	Contacts with AOMA and APGA	As appropriate	Allocation status, inventory status
Allocation Status, Inventory Status	AOMA contact	As appropriate	Allocation status, inventory status

Customer complaints and media reports are an indication that customers are feeling the results of a supply problem. If all data indicates a significant supply problem is imminent or exists, AEO can request (on voluntary basis only) storage/terminal tank inventory data from petroleum product vendors. Similar information may also be available from Arkansas Oil Marketers Association and the Arkansas Department of Environmental Quality.

8.3.1.3 Data Analysis and Actions

Long-term and short-term data collected routinely should be analyzed to develop historical references of price and stocks (inventories) as related to season and weather. The specific conditions of weather, stocks and prices can create supply problems that result in a waiver by the Federal Motor Carrier Safety Administration (FMCSA) Hours of Service Regulations. Supply allocations or emergency measures, such as truck transport of supplies from remote locations or customer delivery restrictions, should be identified in order to assess the probability and severity of a problem.

When an abnormal supply condition is projected, increased monitoring should be initiated. When the data indicates an emergency condition exists, the ability of the industry to solve the problem without government intervention should be accessed through discussions with the industry. When it is clear that government action will be required to mitigate the problem, an action specific to the problem should be recommended.

8.2.1. Risk and Responsibility Addressed by State Stakeholders

At the state level, the risk shifts from supply to distribution. Distribution is what takes place between a terminal and the consumer. Figure 8.12 guides state energy authorities encountering distribution risk. Inevitably, new risks and attendant vulnerabilities will appear, and authorities will want to look for such events, not listed, that also threaten the reliability of fuel shipments into the state.

Figure 8.12 – State Loss-of Fuel—Risk and Vulnerability

Consumption Sector	Risk Due to Petroleum Product Loss	Economic and Related Vulnerability
Residential	▪ Price volatility adversely affects many users—especially low income ▪ Price escalates rapidly when supply is short, thus reducing consumption and lowering fuel risk ▪ Federal, state and local safety regulations mitigate risk ▪ Industry track record for in-state distribution is good, easing risk to state ▪ Oil Industry record on major external events is uneven. Risk is situation dependent ▪ Loss of fuel due to refinery closure increases risk to all liquid fuel consuming segments ▪ Port-related issues such as dredging may increase risk	▪ Loss of propane increases vulnerability of rural and suburban heating customers ▪ Loss due to price escalation increases vulnerability for low income and those burdened by recession ▪ Some reduction in vulnerability if high price reduces consumption, thus providing system self-correction ▪ Economically vulnerable citizens may have to make choice of fuel or foods ▪ Sales of other goods & services may suffer increasing economic vulnerability ▪ Insufficient propane for space heating increases vulnerability to disease and illness and consequent loss of productivity ▪ Loss of propane in winter is more dangerous to residents than loss of motor gasoline during peak driving season
Commercial	▪ Price volatility affects some users, especially business and institutions weakened by recession ▪ Price escalates rapidly when supply is short, thus reducing consumption and lowering fuel risk ▪ Industry track record for in-state distribution is good, thus easing risk to state ▪ Oil Industry record on major external events is uneven.- Risk is situation dependent ▪ Loss of fuel due to refinery closure increases risk to all liquid fuel consuming segments. Resulting high motor	▪ Price volatility is absorbed by most commerce ▪ Financially at-risk enterprises suffer more than others, especially small establishments ▪ High prices increase risk for all retail (commercial) areas in which shortage occurs because customer purchasing may decline and sales profitability may suffer ▪ Theoretically, higher price leads to lower consumption, providing self-correction and lowering risk ▪ Some commercial entities may not have sufficient cash or capital to endure a low consumption period

	fuel costs increases risk for retail merchants ▪ Port-related issues such as dredging increase risk for all sectors	▪ Higher fuel costs for institutions may lower services to clients, especially increasing vulnerability for challenged populations ▪ Higher fuel costs for government institutions may result in tax increase
Industrial	▪ Petroleum accounts for about 28%* of the fuel used by industry for both space conditioning and processes ▪ Loss of oil is a serious concern for industrial process ▪ Loss of petroleum in this sector appears to affect industrial process much more than space conditioning, lighting or fueling vehicles	▪ Industrial process-related fuel or feedstock losses increases economic vulnerability ▪ Price volatility in petroleum markets increases vulnerability as industrial, on-hand, process inventory drops ▪ Industry generally is less vulnerable in non-process fuel use if energy alternatives are on-site ▪ Industry may reduce vulnerability with certain alternative energy systems, especially CHP
Transportation	▪ Ability of the oil industry to obtain supply from alternate (e.g., out-of-state) terminals reduces risk ▪ Ever-increasing demand for motor gasoline increases risk in any loss ▪ Distillate market usually parallels motor gasoline market ▪ Shut-down of out-of-state refineries increases risk ▪ Delivery of motor gasoline in Arkansas appears to be basically stable over time, thereby lowering risk	▪ Price volatility increases economic vulnerability ▪ Increasing price of petroleum may slow demand, thus lowering vulnerability ▪ Price inelasticity shifts economic vulnerability to goods & services as discretionary dollars move from other sectors to petroleum ▪ 2008 anecdotal data suggests at $4.00/gal, fuel price may be more elastic than previously thought ▪ Very high crude oil costs appear to affect overall economic growth ▪ Serious volumetric loss could produce rationing by major suppliers, thus increasing economic vulnerability
Agriculture	▪ Diesel is the dominant petroleum fuel in this sector ▪ Loss of distillate would hinder operation of major farm machinery operating on diesel fuel ▪ Degree of risk depends on crop growth and harvest cycles ▪ Loss of propane would affect space heating for livestock increasing risk for farmers and consumers ▪ Farms can store fuel supply on site; this moderates risk.	▪ Greatest economic risk related to diesel is to crop harvesting when time management is critical ▪ Vulnerability is seasonally dependent ▪ Loss of propane would create greater economic vulnerability for livestock (especially poultry) than crops ▪ Loss of motor gasoline may create spot burdens but can be managed with relatively small amounts of on-site storage
	*Industrial estimate derived from Arkansas Industrial Energy Use, EIA, SEDS, Table #S6. Industrial Sector Energy Consumption Estimates, 2007, line losses excluded.	

8.2.1.1. State-Initiated Response Measures

While petroleum industry and federal government officials usually cooperate in responding to an energy emergency, state government may wish to take additional steps. Figure 8.11 summarizes initial steps that the various sectors may take to monitor when a shortage or other problem surfaces. During the initial, "early" condition of a problem, public relations and communications may be used to give market price signals and industry recovery efforts time to reduce or manage demand. Figure 8.12 summarizes these suggestions. When supply is tight, the petroleum industry will often call for hours of service (HOS) waivers and some of the mitigation measures contained in earlier Arkansas plans are similar to those suggested by the NASEO/NARUC *Energy Assurance Guidelines*, and are found in Figure 8.13 below.

Hours of Service waivers from federal driver safety rules[35] are requested often by propane distribution companies when supplies are tight. This occurs when propane dealers encounter extraordinary demand during the coldest periods of winter. The basic premise of HOS waivers is to permit professionally trained drivers to remain at the wheel longer than highway safety regulations allow. The LP Gas Board and AOMA are directly involved in ascertaining the need for HOS waivers and work with regional federal regulators to obtain waivers as conditions demand.

Figure 8.13 – Response Guidance Table

Response Initiation					
Response Sector	**Energy Sector**	**Local Sector**	**State Sector (AEO)**	**Federal Sectors**	**Observations**
Condition					
I. Early Conditions (one or more may apply)	• Monitor • Inform AEO • Check status of preparedness plans.	• Monitor • Communicate with energy sector	• Monitor • Notify ADEM • Communicate with state Petroleum associations	• Monitor on request from state	
II. Tightening	• All of the above • Prepare repair	• All of the above • Provide local	• All of the above • Consider public	• All of the above	• ADEM would begin to

[35] Arkansas abides by the federal HOS regulations: Federal Motor Carrier Safety Administration Regulations (FMCSA) (49 CFR 395) and FMCSA (49 CFR 390.23)

Conditions (in addition to previous phase; one or more may apply)	crews as needed • Activate repair & restoration actions as needed. • Assess delivery issues • Expand supply acquisition if possible.	repair & recovery assistance as requested.	information about conservation and energy efficiency management. • Discuss potential mandatory measures with ADEM and other state agencies according to time of year and general conditions • Evaluate HOS needs as requested • Initiate Public Information Actions	• Provide technical assistance as requested from OE	develop contingency options including use of EOC. • Energy industry asks out-of-area energy entities for assistance.
III. Serious to Severe Conditions (in addition to previous phase; one or more may apply)	• All of above • Repair and restore • Accelerated supply acquisition effort • Seek government assistance with HOS waivers • Seek government assistance with supply and equipment enhancement	• All of above • Assist State at EOC, and regional level and provide responders as needed.	• All of above • Evaluate/ Approve HOS Waivers • Ask ADEM to activate EOC as needed. • Work with other states to enhance supply as possible. • Initiate response measures from voluntary to mandatory depending upon success of successive measures	• All of above	• Local government response capacity exceeded. • Energy industry can no longer effect relief by itself.

8.2. Potential Petroleum Emergency Mitigation Measures

The measures suggested in Figure 8.14, progress from voluntary actions to mandatory rationing. Suggested timing is contained in the left-most column. Implementation steps are in the right column with other agencies or groups that may be involved. Measures such as the Arkansas Petroleum Set-Aside require a formal Declaration of Emergency but are included here so that responders can consider a range of options as events unfold. For most events, only the least stringent voluntary measures would be suggested. Mandatory measures involve process and political decisions that may be unrelated to energy assurance. Selecting appropriate measures is a matter of judgment.

Figure 8.14 – Potential Petroleum Emergency Response Mitigation Measures

Measure	What It Does	Recommended Steps for State Responders
Public Information for Energy Conservation **Voluntary Measure** Consider for Early Phase	Promotes voluntary reduction in energy use to aid recovery and restoration efforts, share limited energy supplies equitably and assure sufficient energy for priority customers. Gives the public specific guidance for type of energy shortage and may stimulate the use of alternatives.	**General** ▪ Use AEO & ADEM staff knowledge; obtain information from sister states, DOE, NASEO and others to develop conservation guidance **Administration** ▪ Coordinate with state fuel distribution associations working with their media and public relations professionals ▪ Develop brochures, handouts, video, audio, Internet and other dissemination materials ▪ Work with media and others to obtain low- cost or free airtime or print space ▪ Hold public meetings for concerned citizens ▪ Provide feedback to legislature and local jurisdictions
Compressed Work Week **Voluntary Measure** Consider for Tightening to Serious Phases	This is a form of flexible time management. It could reduce vehicle miles traveled (VMT) for workforce, but runs risk of increasing leisure driving instead. (*Many federal agencies already support a 10-hour, 4-day/week schedule for employees.)*	**General** ▪ Requires state and local government leadership ▪ Participation of major employers is highly desirable ▪ Certain businesses and agencies cannot participate due to the nature of their work **Administration** ▪ AEO works with state personnel management and private employers to enlist support ▪ Work with unions and other employee organizations to obtain support ▪ Ask affected local jurisdictions to help solicit participants. AEO coordinate with sister divisions within Arkansas Economic Development Commission (AEDC) and Arkansas Department of Labor (ADOL) ▪ Determine which businesses/agencies are capable of participating ▪ If mandatory, develop list of exemptions

		▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Assist participants in coordinating with out-of-state entities, if necessary ▪ Ascertain equity issues (including overtime pay) if measure is mandatory ▪ Coordinate with affected local jurisdictions
Variable Work Hours **Voluntary Measure** Consider for Tightening to Serious Phases	Reduces traffic congestion, fuel lost in idling and stop-and-go driving. May also encourage greater use of mass transit.	**General** ▪ Solicit business sectors to participate ▪ Needs assistance from AEDC, business associations, employee unions and groups **Administration** ▪ Publicize and explain ▪ Coordinate with ADOL ▪ Seek active help of unions ▪ Provide technical assistance to participants ▪ Encourage self-administration by participants ▪ Coordinate feedback with affected local jurisdictions ▪ Provide "success stories" to media
Telecommuting **Voluntary Measure** Consider for Tightening to Serious Phases	Reduces VMT and motor fuel consumption.	**General** ▪ Needs assistance from AEDC, business associations, employee unions and groups **Administration** ▪ Encourage all business sectors to participate ▪ Provide technical assistance ▪ Seek advice and operating procedure help from national and regional telecommuting organizations ▪ Publicize and explain ▪ Design this measure for self administration ▪ Consider publicized recognition or awards for participating employers ▪ Coordinate with affected local jurisdictions ▪ Provide "success stories" to media
Reducing Government Agency Hours of Operation **Voluntary Measure or** Mandatory Measure Consider or Tightening Phase	Creates a short workweek for state and local government in order to divert tight fuel supplies to critical and residential consumers.	**General** ▪ Approval and coordination required, as needed, for chief elected officials, (e.g., County Judges),cognizant agencies and other bodies; **Administration** ▪ Develop criteria to identify agencies/buildings to reduce hours or close ▪ Develop criteria for return to normal operations ▪ Coordinate with employee unions, if applicable ▪ Attend to employee issues, such as criteria for any wage/salary changes, impact on benefits, such as sick leave and vacation time ▪ Provide timely notice to employees
Hot Water Set Back **Voluntary Measure**	Recommended as a voluntary measure for	**General** ▪ Recommend a percentage reduction in temperature and

or Mandatory Measure Consider For Tightening Phase	residential and institutional users of distillate or propane for heating water.	consult with cross-section of user representatives ▪ Design this measure for building operator self-certification ▪ Use local inspectors for random verification **Administration** ▪ Notify the public ▪ Use standard testing procedures ▪ Arrange media coverage ▪ Enlist support and technical assistance from plumbing professionals ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Coordinate with local authorities as appropriate
School System Fuel Conservation **Voluntary Measure** or Mandatory Measure Consider for Serious Phase	Reduce VMT and motor gasoline consumption in the education sector. This is similar to other ride sharing measures.	**General** ▪ Requires approval and cooperation of local government and school boards **Administration** ▪ AEO coordinates with Arkansas Department of Education (ADE) to lay groundwork ▪ Consult with local government and school boards through appropriate associations and local school systems ▪ Assist school districts with planning as needed ▪ School officials to address scheduling, services, meals, extra-curricular activities and post-school day use of facilities ▪ School officials to coordinate with parent-teacher & related associations, if any and as appropriate ▪ School officials to determine rules for high school students who drive motor vehicles to school ▪ Coordinate enforcement at local level ▪ AEO provides technical support on vehicle use, alternative fuels and related issues ▪ AEO monitors in coordination with ADE
Employer-Based Travel Assistance **Voluntary Measure** or Mandatory Measure Consider for Serious Phase	Reduces consumption of motor gasoline by increasing average vehicle occupancy. Also reduces vehicles miles traveled (VMT) and queuing. This measure: Could be used in conjunction with high occupancy vehicle (HOV) lanes; May be coordinated with telecommuting measure.	**General** ▪ Requires cooperation of participating companies ▪ Company-based plan is essential whether a voluntary or mandatory measure **Administration** ▪ "Recruit" state agencies and companies over predetermined size (e.g., 100 employees) ▪ Coordinate with AEDC and ADOL ▪ AEO coordinates with Department of Highway &Transportation (ADHT) planners and companies to set up employee car, vanpool or busing arrangements, including schedules and access locations ▪ Employers determine applicability of staggered or flexible work hours, guaranteed ride home feature,

		preferred parking, company rewards, subsidy or other inducements ▪ Employers handle insurance questions and ADOL & AEO assists in obtaining government safety requirement information ▪ AEO monitors in coordination with business associations ▪ Coordinate with affected local jurisdictions ▪ Encourage self-enforcement in cooperation with associations ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures
Reduction in State Government Travel Mandatory Measure Consider For Tightening or Serious Phase	This measure sets an example for other entities by requiring state government officials to pay special attention to travel, schedule employee field visits and meetings so that trips can be combined and increase use of electronic communications.	**General** ▪ Governor instructs cabinet to take appropriate vehicle reduction measures ▪ Department of Administrative Services and Inter Agency Motor Pool is preferred **Administration** ▪ Most effective as a mixture of incentives and prohibitions ▪ Emphasis on use of alternative fuel vehicles helps to mitigate the effect of a motor gasoline shortage ▪ Agencies assist by selecting an in-house coordinator to work with Motor Pool ▪ AEO and ADEM help by providing assistance with area employee schedule coordination to encourage ride-sharing ▪ Vehicles should carry written logs for feedback on trips and other use for further curtailment and coordination ▪ State should invite media to see how the system works after implementation, as an example to private companies and to assure the public that state government is setting an example
Modified Fuel Purchase Times Mandatory Measure Consider for Serious Phase	Aids in the equitable distribution of motor gasoline and is designed to alleviate long lines at retail gasoline stations. This measure may be used in conjunction with the odd/even measures.	**General** ▪ Cooperation of AOMA, APC and service stations is vital ▪ Depends on retail gasoline outlets selling product in a prudent manner while pacing sales to avoid depleting supply until resupply occurs ▪ Encourage retail outlets within the same area to stagger hours in coordination with their associations ▪ Set retail outlet weekend operations with distribution association agreement (e.g., 1st or last digit of tax number designates day) **Administration** ▪ AEO coordinates with AOMA and APC to obtain agreement among participant organizations and dealers ▪ Obtain agreement about number of hours retail outlets will remain open (e.g., 4 to 6/day)

		▪ Determine if flag or other identification system is useful ▪ Determine appropriate enforcement measures ▪ If not self-enforcing, work with Attorney General to set up enforcement and appeal procedures ▪ AEO works with distribution industry associations to monitor ▪ Coordinate with affected local jurisdictions
Add Temporary HOV Lanes Mandatory Measure Consider for Serious Phase	Adds preferential lanes to existing state HOV lanes or on non-HOV highways and encourages additional ridesharing to reduce congestion and VMT. Measure may be mainly symbolic since Arkansas has relatively few HOV lanes.	**General** ▪ Identify HOV lanes and prepare protocols in coordination with ADHT ▪ Requires support of law-enforcement agencies ▪ Once political, public and administrative approval is obtained, publicize and explain to motoring public **Administration** ▪ AEO/ADEM to work with ADHT to develop signage and determine placement ▪ Determine hours of HOV lane operation ▪ Set number of required vehicle occupants ▪ Determine exemptions for use (e.g., public safety, law enforcement, emergency, medical, energy provider, and commercial vehicles) ▪ Establish procedure to monitor if traffic decreases in standard lanes while increasing in HOV — (If it does not, HOV lanes are probably not saving fuel) ▪ Develop explanatory material and deliver to motoring public through media, auto clubs, Internet and mailings ▪ Coordinate with Little Rock area jurisdictions
Enhanced Speed Limit Enforcement Mandatory Measure Consider for Serious Phase	Achieves maximum energy savings through increased compliance with existing speed limits to reduce motor gasoline/diesel fuel consumption.	**General** ▪ Requires approval by the state and local government law enforcement required ▪ Political approval is essential **Administration** ▪ Law enforcement could undertake this measure independently; however, coordination with all stakeholders is crucial for success ▪ ADEM, ADHT & AEO may work with law enforcement agencies to develop public education and information campaign ▪ Enhanced enforcement may require increased appropriations for labor needs ▪ ADEM & AEO work with law enforcement to monitor effectiveness of measure

Parking Management Mandatory Measure Consider for Serious Phase	Provides for parking preference to ride sharing vehicles Reduces VMT, use of motor gasoline/diesel fuel, and directs attention to voluntary ride sharing, employer assistance, work hour modifications and related VMT reducing measures.	**General** ▪ Needs cooperation of business, state and local government ▪ Gives parking preference to ride sharing **Administration** ▪ Work with appropriate business associations and local parking management on equity issues ▪ Coordinate with AEDC ▪ Stakeholders work with AEO to determine appropriate restrictions and pricing issues ▪ Local jurisdictions assist in determining equity issues related to increased fees and disposition of fees ▪ Local governments to determine status of on-street parking and rules for off-street parking ▪ Stakeholders help determine exemptions ▪ Unions and related organizations to be consulted ▪ ADEM coordinates public information ▪ AEO works with local jurisdictions to coordinate with parking management agencies for monitoring effectiveness
Prevention of Tank Topping Mandatory Measure Consider for Serious Phase	Prevents panic buying by propane customers. This measure is similar to minimum and maximum purchase measure (see odd/even).	**General** ▪ Requires active cooperation of jobbers and propane dealers ▪ Needs APGA promotion and oversight for success **Administration** ▪ AEO coordinates with jobbers and dealers to set procedures ▪ AEO and associations prepare media material to inform the public ▪ Attorney General needed to set up enforcement and appeals procedures ▪ AEO coordinates with local jurisdictions and law enforcement
Increased Motor Gasoline Tax Mandatory Measure Consider for Serious Phase	A temporary increase in the gasoline tax could further reduce the use of motor vehicles. This is a highly controversial measure likely to face significant opposition. Higher prices due to shortage may be sufficient to achieve results; and added tax should be considered only as an option for the most extreme shortage.	**General** ▪ Requires approval by the General Assembly ▪ To be used only if high fuel prices do not discourage fuel use during a severe shortage ▪ Entails serious political risk for state officials **Administration** ▪ Coordination of the Governor's office, the AEO, AEDC and the Arkansas Department Finance and Administration (ADFA) and local government ▪ ADFA may also wish to coordinate with the distribution associations and others in the petroleum industry to effect tax collection ▪ Media assistance is highly desirable in order to explain such a measure to the public and enlist their continuing cooperation during the temporary levy of the tax

		▪ Careful recordkeeping of sales and VMT in the state is needed to demonstrate if the tax is effective ▪ Could involve additional state expense to pay for real-time traffic surveys
Odd/Even, Carless Day & Minimum/Maximum Purchase Mandatory Measure Consider for Serious Phase	Discourages panic fuel purchases and risk of increasing local shortage due to topping off motor fuel tanks. Note: • Attorney General's assistance is required to work outside of state and federal anti-trust laws. — Attorney General needs to obtain federal permission to allow its representatives to monitor and keep discussions focused on measure management • Retail outlets may not have sufficient, capable, or trained personnel to enforce. If local law enforcement does not enforce, measure should not be considered.	**General** ▪ Requires support from AOMA, APC and petroleum retail outlets plus coordination with local government ▪ Public acceptance is crucial **Administration** ▪ Develop detailed implementation plan in coordination with retail outlets and petroleum associations ▪ Determine minimum/maximum purchase levels if minimum/maximum option is added ▪ Coordinate with Arkansas Department of Motor Vehicles (ADMV) ▪ Set license plate or other protocol for identifying status of vehicles ▪ Determine days of operation (e.g., workweek only, set number of days, rotating weekend control) ▪ Prepare reference materials for use by retail outlets and for state agency staff when answering inquires ▪ Set up extra telephone or computer response banks to answer questions ▪ Secure emergency funding for staff time, if necessary ▪ Coordinate with law enforcement for random checks and follow-up ▪ Determine exemptions such as: – agriculture vehicles, – common carriers, – energy company vehicles, – medical emergency – "Personal" vehicles (motorcycles, mopeds, etc.) – public safety vehicles, – rental vehicles, – sanitation vehicles, – telecommunications vehicles, ▪ Carefully weigh potential rules for dealing with motorists identifying other motorists as violators ▪ Work with Attorney General to set up enforcement and appeals procedures ▪ Notify the public; explain to the media ▪ Monitor and follow up ▪ Coordinate with affected local jurisdictions ▪ Seek continuing media coverage to encourage public cooperation ▪ Provide data to the public illustrating fuel savings

State Petroleum Fuel Set-Aside Consider for shortage beyond serious only when public would accept full scale vehicle (or other) fuel rationing Mandatory Measure	Assists petroleum product suppliers in providing product to designated priority end-users in circumvention of federal non-discriminatory marketing rules and assure that priority end-users have fuel available for vital public services. This measure also can be used to establish fueling priorities for guiding retail dealers in selling fuel to specified users.	**General** **See Section 3, *Legal Authorities and State Stakeholders* and Appendix A for Copy of State Set Aside Procedures.** **Administration** • AEO monitors imported fuel supply using state, federal and private sector data • AEO notifies major petroleum companies • ADEM provides EOC or works with AEO to develop alternate site if EOC is not available • ADEM and AEO coordinate with petroleum stakeholders to generate information for media including press releases • Finalize and provide application and other forms • AEO determines where applications can be picked up (e.g., local government offices or via the Internet) • Determine how application is returned for investigation, verification and evaluation (e.g., facsimile, E-mail, hand delivery, regular mail) ▪ Provide access and operation information to potential applicants using services of distribution associations, media and Internet • Establish processing order (e.g., first come, first served) • Establish protocol for releasing remaining set aside volumes if conditions dictate/permit • Maintain coordination and communications with petroleum stakeholders, ADHT, AEDC, law enforcement and participating local jurisdictions • Attorney General's assistance is required to work outside of state and federal anti-trust laws. — Attorney General needs to obtain federal permission to allow its representatives to monitor and keep discussions focused on measure management

9. Smart Grid and Energy Alternatives

The 2009 ARRA Energy Assurance Grant asked that states include a discussion of Smart Grid as well as new and emerging technologies that may increase energy resilience and reliance. ARRA also funded the largest energy grid modernization investment in U.S. history. The DOE funding of ARRA included over $3.4 billion specifically for Smart Grid technology investment.

The idea that such technologies may enhance assurance by offering alternatives to the consumption of conventional energy forms –electricity (including coal and nuclear), natural gas, and petroleum – emerged from states that have invested heavily in energy efficiency, renewable energy, and similar programs over the past four decades. It was logical to expand upon the original efficiency and renewable energy efforts that encouraged this discussion and add even newer systems that are only beginning to find their way into the market.

One of the relatively new technologies states are asked to discuss is the effort to increase automated communications between electric companies and consumers (Smart Grid). This section examines several of these technologies, including Smart Grid, as they pertain to Arkansas. No attempts have been made to quantify the costs and benefits of implementing a Smart Grid system, how much of the system to deploy, and when is the best time to roll it out. Rather, the focus of this discussion is on Smart Grid's potential role for enhancing energy reliability as it pertains to energy assurance.

9.1. New Technologies

A number of new and emerging technologies already affect energy assurance planning in the state. Some of these may enhance energy reliability in the next several years. Others are still gaining market share and may or may not increase resiliency. These technologies are summarized in Figure 9.1 as an introduction to an analysis of such technologies as they affect energy resiliency in Arkansas. They briefly summarize the concept and indicate the possible influence of such technologies on the three energy forms discussed in this report. The list begins with Smart Grid, then technologies that may enhance the reliability of energy delivery.

In addition to the new technologies listed in Figure 9.1, there are other technologies, emerging, or already in the market place, that serve to reduce demand. These generally focus on building energy management or design and include condensing furnaces and boilers, compact fluorescent lighting, LED lighting, and demand-response approaches. It is the understanding of the AEO that this discussion was requested in order to examine potential supply and distribution-affecting technologies; not to evaluate existing and ongoing (although often valuable) conservation and efficiency measures.

Figure 9.1 – Relationship of Principal Emerging Technologies to Energy Supply

New item	Description	Influence on Petroleum (including Propane-LPG)	Influence on Natural Gas	Influence on Electricity
Smart Grid				
Smart Grid	A number of approaches which improve system control and/or reduce demand	Negligible	Could be used to minimize heating peak demand	Improved operating effectiveness, reduced consumption, rapid problem identification and potential reduction in restoration time
Renewable Energy Technologies				
Wind, Solar, Fuel Cells	Substitutes sustainable energy for current electric power plant fuels	Negligible	Reduced market, except for fuel cell portion	More complex system operation, may reduce or stabilize demand
Solid and Liquid Waste	Substitutes sustainable energy for current natural gas or propane fuels	Could substitute for liquid fuels, especially in rural areas where the industrial nature of farming provides greater fuel use flexibility	Could be significant if used to reduce gas use	Negligible
Combined Heat and Power (CHP)	Uses heat normally rejected in power plants	Negligible	Could reduce the use of gas for space and process heating	Potential for back-up power and buying time to restore during outage. Maybe especially use for location at emergency responder control and related locations
Other Interesting (primarily space conditioning) Technologies				
Ground Source Heat Pump	Pumps heat to (summer) and from (winter) underground which has stable year-round temperature	Could reduce market for propane	Reduce natural gas sales thus lowering potential peak load risk	Reduced summer day-time peak, increased winter night load
Solar Thermal	Collectors on rooftops to collect solar	Reduced market for propane	Reduce market natural gas sales thus lowering	Reduced load but competes with ground source heat pumps

	heat energy		potential peak load risk	
Green Building Design	Changes to building design to reduce energy demand	Reduced demand in buildings so equipped	Reduce market natural gas sales thus lowering potential peak load risk	Reduce market for electric heating thus lowering potential peak load risk
Transportation Technologies				
New item	**Description**	**Influence on Petroleum (including Propane-LPG)**	**Influence on Natural Gas**	**Influence on Electricity**
Plug-in Hybrid and Electric Vehicles	Electric drive vehicles	Reduced motor gasoline & diesel market; negligible for LPG	Could lower use of natural gas for alternative vehicles	Increased night time demand
Renewable Vehicle Fuels	Ethanol and Biodiesel	Reduced motor gasoline & diesel market; negligible for LPG	Could lower use of natural gas for alternative vehicles	Negligible
Natural Gas Fueled Vehicles	Substitutes natural gas for petroleum	Reduced motor gasoline & diesel market; competition in lift truck market	Increases market for natural gas sales. Impact remains relatively small, however	Competition for electric drive vehicles
Hydrogen-Fueled Vehicles	Substitutes hydrogen for petroleum fuels; often with fuel cell power plants	Reduced motor gasoline & diesel market; negligible for LPG	Possible increased market for hydrogen generation	Competition for electric drive vehicles but also be used as adjunct fuel

Other technologies have passed the emerging stage in terms of market acceptance. Some of the more prominent are: fleet fuel economy and emissions devices, idle truck power packs, smart routing for truck fleets, hydro power from rivers, and a variety of timers and automatic thermostats. While these

technologies are laudable they are not actually “new and emerging” in their nature. Indeed, some have already enhanced overall energy system reliability by reducing demand.

9.1.1. Issues Facing New Technologies

When consumers and advocates state that newer technologies should increase energy reliability, they reflect hopes for achieving two goals. The first goal is to turn the nation away from carbon-based fuels that have been associated with climate change. The second is to reduce the nation’s exposure to energy supply from the international market because that market can lead to undesirable outcomes, including highly volatile energy prices and political actions often felt to be incompatible with American policy interests.

Notwithstanding the relative attractiveness of new and emerging technologies, these innovative concepts are subject to economic markets and the reality of economic market fundamentals. In other words, it is assumed here that all the new items, such as those in Figure 9.1, involve substantial investment to develop, test and market while competing with previously acquired and publically accepted technologies with proven reliability and long operational lifetimes. For example, in energy consumption areas of high visibility and impact:

- Motor gasoline and diesel-powered engines are extremely reliable systems that have been incrementally improved for over a century. Efficiency, emissions, reliability and operability improvements over the past half-century have been dramatic, driven in part by government regulations as well as the driving public’s desire for electronic and other devices that increase comfort, entertain, monitor road conditions and increase safety.
- Properly maintained automobiles are now capable of a 10 year service life or more and the longevity of heavy duty vehicles is even longer.
- Heating and air conditioning systems are built to last for 15 to 20 years and even though incremental improvements in efficiency are continually offered, dramatic improvement in a particular technology does not always create a viable investment opportunity.
- Utility power plants last for 40 years or more. As plants age, energy providers must weigh incremental improvements against very high replacement costs in an atmosphere of extreme competition for investment dollars.
- Many buildings last for more than a century and some are protected for historical reasons. Refitting such structures is often more cost effective than building new ones. This may result in a adaption of new technologies; but on an incremental and cost effective basis, that does not take full advantage of new technology design.
- Other buildings are constructed in speculation for various classes of clients by builders whose goals are to minimize investment while maximizing profit. Such buildings are typically built to minimum levels of the energy code, building codes are not generally written to advance technology beyond a financially comfortable range that assures safety for users and profitability for builders.

Consequently, even after these new products are successful in meeting the performance and economic requirements of the market, and when related standards and regulations for them are in place, diffusion into the market takes a long time, perhaps decades. This means that significant energy efficiency resulting from these new products will be experienced well into the future. The U.S. DOE believes, however, that understanding those effects now, and preparing for them, can result in better implementation that may enhance present and future energy assurance.

9.2. Smart Grid

The DOE has highlighted Smart Grid as a major, relatively new, technology with the potential for greatly enhancing energy reliability. The Smart Grid is made up of a set of distinct yet entirely interdependent elements and concepts. Smart monitoring elements at the generation, transmission and distribution levels create a real-time view into the status of the grid; this information informs the decisions of both utilities and consumers and allows for increased automated control of the grid. The precise adaptability of this sort of grid facilitates the further expansion of distributed generation and generation from renewable sources, so these topics are often included in discussions of the Smart Grid.

The Smart Grid is a paradigm shift in the way electricity is controlled, delivered, and monitored in order to realize a more efficient system as well as to achieve a more autonomous responsiveness to events that would impact the electrical grid such as an outage. The Smart Grid is postulated to deliver electricity to consumers while employing active two-way digital communication. This is made possible by integrating sensing, measurement, and control devices with the capability of real-time communication to all levels of the electrical grid including generation, transmission, distribution, and consumption. The immediate information made available by such active communication is conceived to permit a dynamic response to changes in grid condition. A corollary to this would be the ability to identify and isolate outages beyond the supply and distribution levels already monitored by utilities and system operators. As a preventative measure, insight into the status of the grid at and beyond the consumer interface would allow for more understanding of consumption patterns and barriers to efficiency, while predicting for enhanced system management and better maintenance to avoid outages.

9.2.1. Proposed Aspects

One of the proposed aspects of Smart Grid is the ability to control home appliances to reduce peak energy requirements. That in turn would improve the overall reliability of the electrical grid. One of the goals of Smart Grid is to enable customers to allow the utility control over certain home appliances in order to reduce expensive peak energy demands. This is planned to be done in a way that would be transparent to the customer. The system could also include a voltage reduction technique that is transparent to the customer. In addition, Smart Grid might provide residential and commercial customers a form of electric service that, currently, is available mainly to industries with contracts that permit load reduction during critical peak consumption periods.

9.2.2. Smart Grid and Renewables

The development of a Smart Grid infrastructure may also improve the integration of renewable-based energy (wind, solar, hydro, biomass, etc.) into the power grid. Power production from renewable sources could supplement, but not replace, base load generation by offering a substitute “fuel” for these loads. In 2010, renewable energy still faces the issue of continuous availability. That is, in order to be reliable, base-load fuels should support power production on a continuing and reliable basis. Because the sun does not always shine, the wind does not always blow, and water does not always flow, these renewable forms of energy are not entirely continuous. In order for them to become consistently reliable, the energy they produce needs to be stored for when the physical driving force is not present. Techniques and technologies for storing that intermittent renewable energy are in the development stage and will enable an even smoother integration into the electric power grid. While the implementation of energy storage is not a prerequisite for the integration of renewables, it would

improve the economics for such power and gain further advocates among those who are responsible for providing reliable power.

If a utility is to utilize renewables they need to be "dispatchable" – a Smart Grid needs to be able to communicate with the renewable energy source. The Smart Grid is an enabler for the efficient utilization of renewables to augment a utility's base load. All of these elements working in conjunction with each other will realize a comprehensive Smart Grid which will enable the electricity markets to flourish. The Smart Grid will increase efficiency and provide higher quality, reliable power which will reduce outages and vulnerability while holding prices in check and allowing customers to participate in the process.

9.2.3. "Intelligent" Features and Challenges for Smart Grid

There are varying degrees of "intelligence" required of electrical grids depending on where they are, how congested they are, and how vulnerable they are to adverse conditions. A single definition does not cover all of the possibilities. Transmission is already highly automated and supports such automation - related features as real-time pricing for wholesale markets (for example, the Arkansas electric system is sampled every 5 minutes for operational integrity according to SPP). Although there is automation available at the wholesale, supply level of the power delivery system, this is not the case for the retail, distribution sector. This is where developments in the Smart Grid will generate improvements in the reliability of service.

Present thinking about electricity distribution holds that the elements of automation that could support "intelligence" are best managed on interconnected, redundant or circular circuits. Hence, in communities with high customer density, there are a number of paths through which electricity can be routed and these form an interconnected network that can be used to circumvent or even abet the restoration of electricity during and outage.

Conventional wisdom among some electricity providers is that smaller jurisdictions, with a customer density as small as 20,000, cannot benefit from the multi-path circuitry that enables multi-directional communication. Such systems are called radial systems because they tend to resemble radiating lines with discrete termini. However, the most recent thinking on Smart Grid contends that such radial configurations may also benefit from Smart Grid installation.

Proponents of Smart Grid point out that distributed generation may be a key to supporting Smart Grid in a low customer density area. The degree of distribution automation is what must be managed to supply a cost/benefit analysis favorable to Smart Grid implementation in such areas. For example in case of contingencies, a radial feeder (typically found in rural areas) with potential feed from another substation, can benefit from distribution automation. A rural radial feeder, with no potential feed from another substation, may still benefit from distribution automation in certain cases if the local energy network (or community energy system) can be implemented with load shedding at customer premises. Such shedding could improve the resiliency of the system upon a disruption in the main source of power (i.e., islanded operation).

According to the U.S. DOE's *Modern Grid Initiative* report, a modern Smart Grid must:

- Be able to heal itself
- Motivate consumers to actively participate in operations of the grid
- Resist attack

- Provide higher quality power that will save money wasted from outages
- Accommodate all generation and storage options
- Enable electricity markets to flourish
- Run more efficiently
- Enable higher penetration of intermittent power generation sources

9.2.4. Benefits

Smart Grid already exists at the supply level where systems are monitored regularly. Other benefits of a Smart Grid are said to include the following: improved operation and maintenance of the electricity grid, better demand side management for abetting distribution, improved information to manage overall grid resources, more informational gathering options for real-time system monitoring, timely identification of outage occurrences, and both increased protection and security of the system. All of these are driving factors behind a smarter grid. Greater reliability can reduce costly mistakes and outages and thus lead to holding the line on electricity prices because the delivery of electricity will be more secure, and hence, more cost effective.

9.2.5. Elements

A comprehensive Smart Grid would be made up of the following conceptual and resulting physical elements.

9.2.5.1. Accompanying Communications Network

An extensive two-way communications network is the foundation of all of the Smart Grid's monitoring and control. An integrated communications system is needed in order to achieve optimal control of the Smart Grid system at all levels of the electrical grid (generation, transmission, and distribution). Integrating the communications network with the sensing and measurement equipment discussed below is the foundation of the Smart Grid along with its control architecture and scheme. This also assures that at the transmission and distribution level, the utility will have a real time view into the status of the grid to which it can send commands and receive simultaneous feedback from the system. This two-way communication between the electric utility and consumer or controlled equipment along the transmission or distribution system is an essential part of the Smart Grid's definition.

9.2.5.2. Phasor Measurement Units (PMU)

Phasor measurement units (PMU) take snapshots of the voltage and current at key points in the transmission and distribution system. In the distribution system, low cost measures of voltage magnitude and phase, current magnitude and phase, and real and reactive power flow direction, give utilities the ability to optimally manage distribution resources and support autonomous control. PMUs collect data up to 30 times a second, compared to even the fastest Supervisory Control and Data Acquisition (SCADA) systems, which collect data only once every 4 seconds. SCADA systems no longer provide enough information for contemporary system needs and do not have two-way communication capability.

PMUs are currently available on the transmission level and can accurately detect phase relationships. PMUs would greatly improve synchronization within the distribution system. Prior to the development of PMUs, there was no way to accurately determine the phase difference between transmission and distribution lines that leads to system inefficiency and loss of power. These units have proven to be a very useful tool in analyzing the performance of the grid. Unfortunately, at the current level of production, these devices are too costly for the distribution level, thus, continued research is crucial.

Under the encouragement of the North American Synchrophasor Initiative, utilities across the nation have already proven the effectiveness of PMUs; their increased use is an important element of the Smart Grid.

9.2.5.3. Advanced Metering

Advanced Metering at every point of delivery creates the opportunity of time-of-use pricing and direct load control. One of the goals at the heart of the Smart Grid initiative is a shift in energy usage. This shift is impossible without a better view of how customers are using energy. The Advanced Metering Infrastructure (AMI) would eliminate the simple electromechanical meters at the points of electricity delivery. The meters of the AMI boast two-way digital communication with the utility to send customer usage data and receive control data. An advanced meter records and reports the amount of power consumed for every customer, when it was consumed, and how much it costs to generate at the time of consumption. This time-specific usage data allows the utility to create time-of-use billing schemes. The advanced meter also connects to a local control network that allows the grid, within the customer's guidelines, to send on/off control signals to some of the customer's appliances and devices. This ability allows the utility to create direct load control and time-of-use billing programs discussed below. The active communication that AMI enables will allow customers to use electricity more efficiently, enabling utilities to operate more efficiently and detect potential problems in real time. Giving the grid visibility into the most urgent needs allows for a more dynamic load management that also minimizes the need for ever-expanding peak capacity.

9.2.5.4. Time-of-Use Pricing

Time-of-Use Pricing is a utility rate structure where customers are charged a premium for energy consumption during peak hours. The theory is that if customers are well informed of the cost of their energy consumption, they might be more likely to shift their usage to a less costly period which would lessen peak demand.

A unique and problematic characteristic of electricity is that it must be consumed the moment it is produced. In practice, the highest demand for power from an electric utility is far from constant but rather is heavily centered on certain seasons and peak hours of the day. Peak loads are measured in real time, but predicting future peak loads are estimations which are naturally probabilistic. It is during those hours that electricity is most expensive to generate. In a method called load following, utilities use their most cost-effective generation methods at all times and add more expensive auxiliary methods, when needed, to supply peak demand. During the peak time, the grid is encountering the most strain and therefore runs the highest risk of not being able to meet demand. Even if total daily demand is not reduced, shifting usage away from peak hours, and flattening the daily demand curve, lessens that risk.

One method of achieving this usage redistribution is a time-of-use billing program. A customer under this program is not charged a constant rate for electricity, but is charged a rate that varies based on how much the electricity costs to produce at the time of consumption. Charging customers more during the peak hours (and conversely – less during off-peak hours) is thought to encourage reduced energy usage during peak hours, thus flattening the curve.

While simple time-of-use billing programs have been used for many years, an hour-to-hour time-of-use deployment is made practical only after a fully functional AMI is in place that allows consumers to monitor and respond to pricing changes. Utilities must know their customer's time-specific power consumption in order to bill accordingly, and they need an AMI to gather that information. Further, the customers must also be able to access their time-specific power consumption, so this data can be passed on from the utility or supplied to customers directly from their meters.

9.2.5.5. Direct Load Control

Direct Load Control is the ability of the utility to directly turn on and off high-energy consuming appliances, even in residences. Direct Load Control allows the distribution grid to shift power consumption away from the peak hours. With a comprehensive view of customer usage provided by the AMI, PMUs and other monitoring devices can contain algorithms in the Smart Grid's control system that could carefully schedule some the customers' most load demanding activities and execute that schedule through direct, on/off control of certain appliances. Based on predetermined customer preferences, the Smart Grid could seamlessly arrange the operation times of participating appliances into the least expensive schedule. This would be seen in the industrial, commercial, agricultural, and even residential domains from irrigation systems to washers and driers and HVAC systems.

AMI is not a prerequisite for such a program. Utilities have used load control methods on air conditioner compressors and hot water heaters for peak load shaving for over a decade. The current implementation of these approaches has been on a voluntary basis by customers in return for a fixed credit on their monthly bill (e.g., $5-$10). However, for more efficient and widespread use of load control, the utilities would gain even more efficiency by utilizing the two-way communications offered by AMI.

9.2.5.6. Energy Storage

Energy storage units can relieve peak demand or provide energy during an outage. Energy storage techniques and technologies seek to level the demand curve by mitigating a central characteristic of electricity – that it must be consumed the moment it is produced. Storage devices can charge during off-peak hours and back-feed during peak hours to help reduce peak demand. These can be put in place centrally at the generation source, distribution substations, or even on a community level. Types of storage in existence at this time include chemical, flywheel, electric double layer capacitor, or superconducting magnetic energy storage. As it pertains to energy assurance, distributed energy storage units have the further potential of supplying all of the power to their immediate area for a short time in the case of an outage in the supply from central generation.

Utility scale energy storage at the hundreds of megawatts level is currently only available as pumped hydro storage. At the scale of a single megawatt or two, sodium sulfide (NaS) batteries have been developed for substation applications and potential use in wind farms. This level of energy storage has

the capability of augmenting the intermittent energy supply of solar and wind sources to provide a degree of ride-through capability needed for utilities.

9.2.5.7. Automated Adaptability

Automated Adaptability is the grid's use of automation to heal itself following damage. Today's grid's redundancy and protective relaying features allow it to adapt to a wide array of system failures. A properly designed Smart Grid will have a control system that analyzes its performance using distributed, autonomous controllers that "learn" grid governing strategies in the face of ever-changing conditions such as equipment failures. The volume of real-time information provided by Smart Grid monitoring technologies allows for such automation. Such systems would have the ability to recognize failures immediately and forecast the strain on the system; its direct load control programs would allow it to shape that forecast. The control system can then take automatic corrective action using switching, throttling, modulating, and fault-limiting power electronics to alter grid patterns to isolate failures.

9.2.5.8. Embedded Sensors

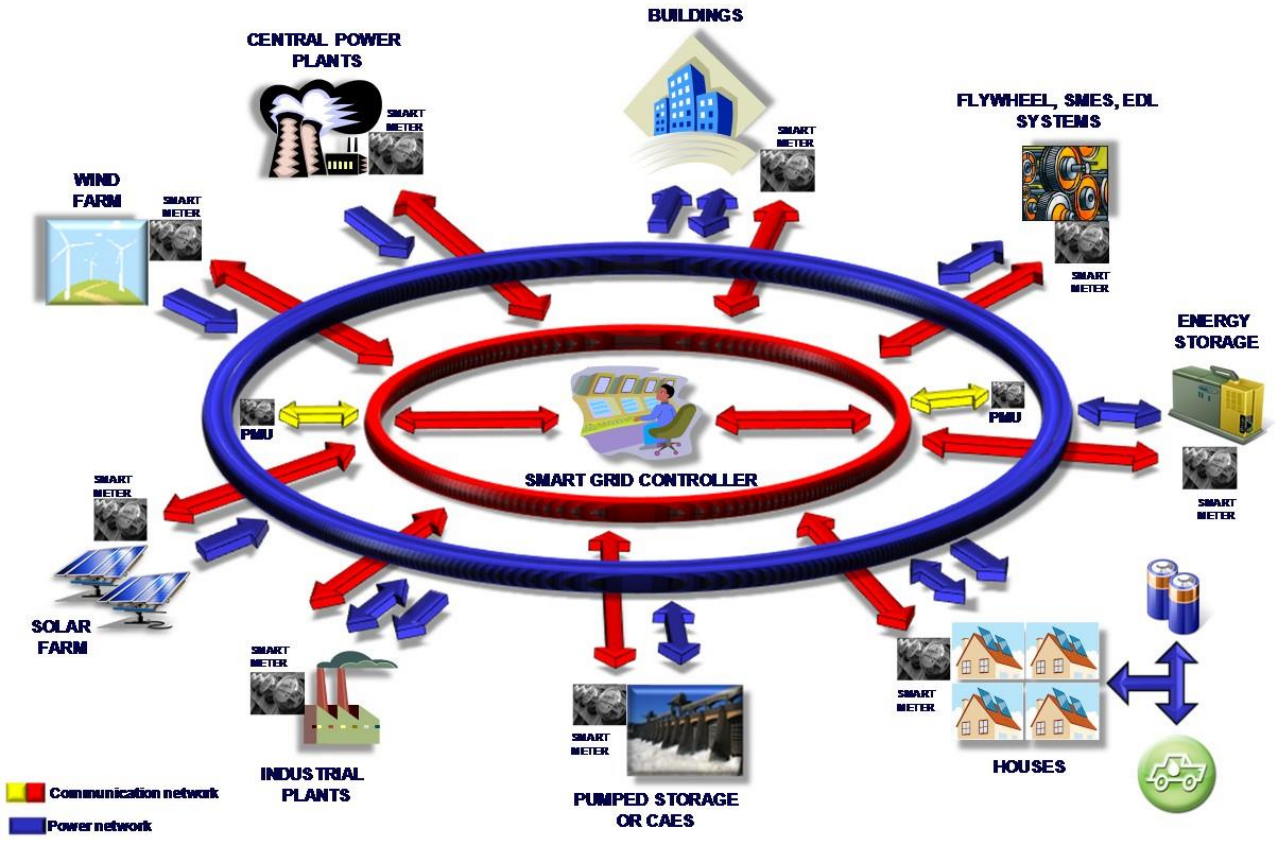
Low cost embedded sensors in components can support a more reliable grid as well as prolong the life of components by prognostic health management (PHM). There is a two-part basic setup up to PHM.

1. By using a set of technologies that sense impending failure in components by way of temperature analysis, frequency analysis, acoustic signatures, and infrared imagery, the strain on that piece of equipment, or component, can be reduced in order to optimize its service lifetime.

2. The sensed information is used to dynamically change the operating points of a component to help avoid a condition that would otherwise prove fatal to that component. For example, temperature sensing that analyzes heat content as opposed to heat rating could be used to determine the status of a distribution transformer. According to the eight degree Celsius rule, which is a common rule used in determining a transformer's life, a transformer that is operated consistently eight degrees Celsius above its rated operating temperature will reduce its life by half. This clearly is affected by many things such as season of the year, and region of operation, so these things must be taken into account by the control structure.

The elements of the Smart Grid are represented in Figure 9.3. In this diagram, the outer loop represents the power infrastructure, with bidirectional arrows emphasizing the connections that allow the two-way flow of power. The inner loop represents the communication network with bidirectional operation. Infrastructural items of the Smart Grid include power electronics for smart power routing, protection, and conversion between alternating current and direct current as needed. These power electronic interfaces become the platform for controllability and observability when describing a "digitally-driven" grid.

Figure 9.3 – Elements and Operation of the Smart Grid



In summary, Smart Grid technology has great potential to reduce the risk associated with fault conditions, sudden peaks, and unexpected weather related failures. Its sophisticated control structure could help isolate problems on the distribution system especially at the "micro" grid management level. From an energy assurance perspective, this would streamline the redistribution of power to essential services while normal operations are being restored.

9.2.6. The Potential for Smart Grid in Arkansas

Arkansas has demonstrated its suitability for Smart Grid technologies, but has several barriers to overcome in order to achieve widespread, full-functioning implementation. Electricity transmission in Arkansas is already fairly automated with real-time pricing for wholesale markets. Distribution, however, is not automated. Towns with a population of at least 20,000 can benefit from distribution automation and especially distributed generation. The degree of distribution automation must be managed using a cost/benefit analysis.

The state of Arkansas has demonstrated its suitability for Smart Grid technologies through its widespread implementation of partial-featured smart technologies and its small-scale implementation of full-featured smart technologies. Widespread use of partial-functioning smart technologies and concepts include:

- Automated Meter Reading (AMR) is a technology that exhibits one-way communication of basic usage data from the customer to the utility, but falls short of the definition of AMI because it reports far less data and lacks the second direction of communication. Arkansas utilities make

extensive use of AMR with cooperatives covering 70.4% of their residential service area and 58.9% of their commercial service area with AMR. Utilities often use high-functioning AMR that can monitor voltage, ping to detect an outage and count “blinks” in power through one-way communication. A “ping” is a computer network administration utility used to check if a device is reachable and is on.

- Some Arkansas utilities create direct load control programs for selected high-impact applications. For example, one uses direct load control via cellular two-way communication for its customers' agricultural irrigation systems.
- Time-of-use billing programs are rarely mandated, but are commonly available across the state for customer volunteers.

Selected use of full-functioning smart technologies and concepts include:

- The ARRA 2009 provided $3.4 billion in grants for Smart Grid pilot programs, two of which went to utilities with service areas in Arkansas. These grants will provide funding for the installation of AMI throughout the utilities' entire service areas so that they can begin a time-of-use billing program. OG&E received $130 million to install 771,000 advanced meters to cover 100% of its customers, including those in its Arkansas service area. OG&E plans to complete this task by December 2012. Woodruff Electric Cooperative received $2.4 million to provide advanced meters for 13,000 of its customers.
- Several Smart Grid initiatives have been implemented throughout the U.S. with encouraging results. Arkansas utilities can also observe the Smart Grid initiatives put in place in their out-of -state operations or by their out-of-state parent companies to help determine the Smart Grid's suitability in Arkansas.

9.2.6.1. Smart Grid Developments in Arkansas

Issues pertaining to regulated electric and natural gas utilities are within the APSC’s jurisdiction and are the subject of ongoing proceedings. The APSC has several proceedings addressing Smart Grid, smart meters, alternative energy resources and related subjects as they pertain to the electric and natural gas utilities that are jurisdictional to the APSC. The deployment of these technologies by the jurisdictional electric and natural gas utilities will be addressed in proceedings before the APSC. Currently those proceedings before the APSC include Docket Nos. 08-144-U, 10-102-U, 10-103-U, 10-104-U, 10-109-U, 10-067-U and several other open proceedings. Additionally, there are specific statutes addressing renewable resources for electric and natural gas utilities regulated by the APSC including Arkansas Code Ann. §23-18-701 et seq., §23-18-601 et seq., and §23-3-401 et seq.

9.2.7. Barriers and New Considerations

Smart Grid technologies introduce a new set of safety, security, and technical concerns, which must be addressed by developing technologies.

9.2.7.1. Safety

The advanced functionality of some elements of the Smart Grid creates the need for new safety considerations.

- The two-way flow of power that is characteristic of a Smart Grid presents a considerable risk for the safety of workers who work on the power lines directly following an outage. When repair is necessary on a power line, there must be a system that enables the utility to disable back feeding. This system would be most suitably attached to the AMI. This increased functionality of the AMI adds to the complexity of the system, but is absolutely necessary.

- The protective gear that rapidly analyzes the system should provide automated assistance, but must also keep the utility informed. Informing the utility can help prevent unintended consequences, such as uncontrolled load shedding that causes a domino effect through neighboring utilities. This protective gear can also help minimize the number of affected customers and the area that is affected during an outage in the case of a fault condition. This is a major component of distribution system protection.

9.2.7.2. Security: General and Cyber

The necessary advancements that are taking place in the modernization of the current U.S. power grid will include advanced digital communication that is inherently susceptible to cyber-security threats. The technologies available today are numerous including wireless and power line communications in the distribution systems and optical communications in the transmission field. There is existing public infrastructure such as cellular and internet communications that could be used. However, as standards associated with the communication of information are still largely in development, more comprehensive security protocols need to be developed to protect the privacy of consumers as well as the security of utilities.

Increased remote control puts more power in the hands of a cyber-attacker. Encryption and authentication measures are already available, but are typically limited to smart meters and other critical components. Smart meters contain potentially sensitive information on the consumer's billing and usage. In addition to these available measures, new technologies must be developed in order to detect threats and limit their effects. One of the main goals in developing an effective Smart Grid is building sufficient security barriers within the system to protect against sabotage. These technologies will eventually enable a Smart Grid to become "self-healing" as it will be able to detect possible threats, secure the compromised system, and use redundant, uncompromised systems to control its decisions. The development of security protocols has also been charged to the National Institute of Standards and Technology (NIST), which cites its experience from developing the SCADA protocol.

- A measure of resolve for all infrastructures within the U.S., Objective 3.1 of the US Department of Homeland Security (DHS) states that it aims to *"Protect and Strengthen the Resilience of the Nation's Critical Infrastructure and Key Resources."*
- With the increased amount of information that will be communicated, there is a much larger need for a sound cyber-defense system. More nodes on a system create more openings by which hackers can infiltrate the system and sabotage it.
- In a recent brief to the DHS, researchers from IOActive, a security services firm, announced they had "created a computer worm that could quickly spread among Smart Grid devices, many of which use wireless technology to communicate." According to the *Journal of Energy Security*, IOActive performed an experiment in which a hacker with a fundamental understanding of electronic systems and a $500 set of equipment could hack into Smart Grid meters lacking proper security protocols and cause disorder. IOActive states that several studies were performed testing these smart meters and that the damages from leaving the Smart Grid unprotected go far beyond the fines any government could impose.[17]

9.2.7.2.1 Training on Cyber Security

The Federal Emergency Management Agency (FEMA) has teamed with the University of Arkansas to create a cyber-terrorism Defense Analysis Center (CDAC) within the Criminal Justice Institute at the University. The national Cyber terrorism Defense Initiative is a tuition free program available to technical personnel and managers who work with critical infrastructure affecting the public. Public utilities are

included within the scope of this training. Information about programs in Little Rock can be obtained from:

Criminal Justice Institute
7723 Colonel Glenn Road
Little Rock, AR 72204
Phone: 800-635-6310 or 501-570-8000

9.2.7.3. Cost Recovery

The EIA Updated Annual Energy Outlook in 2009 cited the Electric Power Research Institute's (EPRI's) 2004 conclusion that full deployment of Smart Grid technologies nationwide would cost $165 billion. The financial risk for undertaking bold Smart Grid initiatives now rests heavily on the utilities, and strategies for dispersing this risk must be developed. Utilities require assurance that their investments will see a return. As demonstrated by a 2010 Maryland Public Service Commission rejection of a Baltimore Gas & Electric Smart Grid proposal calling for customers to bear 100% of the anticipated financial risk, this issue requires careful consideration.[36]

- The federal grants designed to stimulate the development of the Smart Grid were not intended to fund it fully. Rather, these funds were intended to provide initiatives for the development of a smarter grid.
- There are short- and long-term savings to the utility inherent in the peak reduction afforded by the Smart Grid. In the short-term, peak reduction reduces their use of the more costly auxiliary generation methods; in the long-term, peak reduction reduces the capital cost of generation equipment. However, returns on Smart Grid investments come with fewer guarantees than most Arkansas utilities anticipate. So, legislative reinforcement at the state and municipal level may be necessary for the continued implementation of Smart Grid technologies in Arkansas.

9.2.7.4. Customer Education

The success of Smart Grid technologies demands a higher level of involvement from the customers, and customers must be informed of new responsibilities associated with it. An uninformed customer might impute personal financial, physical and privacy risks that are more imagined than real. It is important to define these perceptions for greater clarity.

First, if adoption of a new technology costs customers more than the perceived benefit, they may reject it. So, utilities must provide detailed information about initial investment as well as short- and long-term financial benefits. Second, if the adoption of a new technology posed any potential threat to customers' personal safety, acceptance would be highly unlikely. Third, the same can be said for a perceived loss of privacy. In response to such concerns, advocates of Smart Grid have noted the following:

- A March 2010 survey conducted by General Electric found that only 4% of U.S. consumers have an understanding of how a Smart Grid could affect them. 69% of U.S. consumers are not sure if they are already connected to a Smart Grid. [18]

[36] *Shamila Janakiraman, TMCnet Contributor, Maryland PSB Rejects Baltimore Gas and Electric Company's Smart Grid Initiative, Smart Grid, TMCNET.COM, June 23, 2010.*

- For customers to welcome time-of-use billing, they must be convinced that it is, in fact, worthwhile to shift their energy usage. Simple education programs on the basic benefits of Smart Grid need to be developed in order for some of the essential components of Smart Grid implementation to be successful.
- Privacy concerns are perhaps even more difficult to manage and may in fact require legislation to create rules that will assuage suspicion.

9.2.7.5. Technical Challenges

While there are many power electronics subcomponents, power modeling tools, communications improvements, and integrated systems being developed for a Smart Grid; there are serious considerations that need to be carefully addressed in order to realize the potential of Smart Grid. The main focus of research and development (R&D) activities is geared toward the distribution system, but the benefits will propagate throughout the grid to the supply system as well. The short-term goals of developing new technologies would be to demonstrate the superiority of Smart Grid concepts and to gain acceptance by increased customer participation. The long-term goals could be focused on increased sustainability, reliability, and automation of the electrical grid with decreased maintenance.

9.2.7.6. Unclear Definition of System Architecture

Electric system architecture can be defined as the topology in which the power and communications networks operate and the control strategies that govern them. Smart Grid is still in its earliest stages of pilot programs and hence it is too early in its development to strictly define the technology requirements that may be required.

9.2.7.7. Integration with Intergenerational Infrastructure

The American electric power grid, from generation to transmission to distribution, is an enormous interconnected system that involves thousands of generation sources and service providers, hundreds of thousands of transmission and distribution lines, and hundreds of millions of customers. It is possible that the implementation of Smart Grid will have a revolutionary impact on the current electrical grid; however, its advocates hold that it is imperative to keep in mind that the deployment of a comprehensive Smart Grid will need to be accomplished incrementally to ensure a reliable system. New technologies being integrated into an intergenerational legacy infrastructure, with potentially brand new distribution system topologies, presents a significant challenge.

9.2.7.8. Expected Service Longevity

The current electrical grid has been developed to have an extremely long service life for most components. Many years of research have been put in to the development of a useful, fully functional system. One may argue that many more years are needed to ensure the robust and versatile operation of in light of potential demand growth in an increasingly electronics-driven environment. Growth creates pressure to reduce the demand on energy and operate the electrical grid more efficiently. Hence, while one can argue that Smart Grid is the right answer for the issue of growth while maintaining efficiency, a full deployment of the Smart Grid, presents a significant challenge from the technology development perspective. To date, the existing system has successfully survived many problems, continues to delivery highly reliable power to customers and operates transparently most of the time.

From the perspective of an average electricity customer, the system works well. Hence the task of obtaining public acceptance may require special attention to highlighting the future, versus the present, benefits of Smart Grid.

9.2.8. Steps Toward Implementation of a Comprehensive Smart Grid

Government and industry entities are rapidly developing Smart Grid technologies and standards. As these developments allow, the utilities of Arkansas may wish to take the steps noted in this section to take advantage of the opportunities promised in Smart Grid technologies. These advantages are broken into two categories: communication and power.

- Communication network
  - Today controllable loads and appliances that respond to price signals are available, but penetration into the market is quite low. Generally speaking the active communication that is required for these devices to work is lacking. In addition, intelligent, low cost controllers with increased intelligence are needed to respond quickly in order to operate efficiently.
  - Fully deploy AMI with two-way communication network. Most other Smart Grid functionality depends on this infrastructure for information about customer usage.
  - Further deployment of PMUs at the transmission and distribution level.
  - Develop expansive software to integrate Smart Grid elements. This software must receive and interpret the wealth of information being communicated to it from the AMIs, PMUs, and the protective technologies into a comprehensive view of the grid.
  - Inherit nationally developed cyber security protocols and outline of basic standards

- Power network
  - Utilize modeling and simulation techniques of distribution networks to assess the impacts of new Smart Grid assets, evaluate the current distribution system for low-cost operational improvements, and feed usage data into a near real-time analysis for proactive demand management.
  - Deploy two-way power flow capable distribution and transmission technology including active power control circuitry to disable back feeding as mentioned in Section 9.2.7.1 as developments allow.
  - Deploy advanced storage mechanisms necessary for renewable energy sources as developments allow.

9.2.9. Savings from Demand Management

The financial benefit of demand management provides electric utilities with an opportunity to offset Smart Grid investment. However, the most significant of these benefits may only be evident in the long-term. Some considerations pertaining to short- and long-term benefits are:

- Short-term
  - As energy output rises towards a peak, the cost of generation does not rise linearly. Utilities use their cheapest generation first. Thus, even if total energy output is not changed, moving some output away from the peak lowers relative generation costs.
  - Restructuring billing plans into a time-of-use framework provides an immediate opportunity to pass along costs to the customers in the form of rate increases or fixed fees. However, a drastic increase may spark objections from utility customers who see added costs associated with a “strange” or “untried” technology.

- As indicated above, improved operational efficiency that would result from improved analysis of the distribution feeders translates into real savings for the utility and thus a lower cost of delivery to the customer
- Long term
  - Many power generation facilities are built to accommodate peak load. Therefore, even a small decrease in the peak load can create a significant decrease in capital needed to produce new generation facilities.

9.2.10. Rate Decoupling and Lost Revenue Recovery

Rate decoupling and lost revenue recovery are inevitably proposed during any discussion of energy efficiency programs; however, these topics have less pertinence to Smart Grid than they have to energy efficiency programs outside of the strict set included in the Smart Grid definition. A dilemma arises because Arkansas utility revenue is tied to volumetric sales. Thus, if a utility program successfully increases energy efficiency, its revenue is lowered. Two rate methods can mitigate this financial disincentive:

- Rate decoupling disconnects utility revenue from volumetric sales by fixing revenue.
- Lost revenue recovery estimates how much revenue the utility lost due to its efficiency programs and refunds that amount to the utility.

The disincentive is less of a concern with Smart Grid programs because the demand response programs at the heart of Smart Grid seek to reduce peak demand by shifting volumetric sales levels, not necessarily reducing them.

9.2.11. Operational Standards Development

The DOE has been working diligently with NIST to create common interoperability principles spanning the entire electrical delivery chain for the Smart Grid. The Institute of Electrical and Electronics Engineers (IEEE) and other organizations have been developing some Smart Grids that readily accept new innovations and inventions that produce a better energy delivery system. NIST has a $15 million budget to develop a comprehensive framework for a nationwide, interoperable Smart Grid as called for by the EISA Title XIII, Section 1305.

NIST created Domain Expert Working Groups in partnership with the DOE. This partnership will address such issues as:

- Transmission and Distribution
- Building (Commercial) to Grid
- Industry to Grid
- Home to Grid
- Business and Policy

NIST contracted with EPRI in July 2009 to gather information from stakeholders in order to assess standardization needs and create guidance for future project. NIST plans to release an initial set of standards early fall 2010, as well as a Smart Grid Interoperability Standards Panel to facilitate further development and plan for Smart Grid testing and certification.

9.2.12. Smart Grid's Added Potential for Energy Assurance

Smart Grid technologies may provide an added benefit for the reliability of electric power. Used in conjunction with other reliability-enhancing technology, Smart Grid may provide an integrated structure for identifying alternative power sources and enhancing the dispatch of such resources to compliment conventional power sources. Some examples of these are examined here and include: distributed generation, diversified power generation, dispatchability, load control and adaptability.

9.2.12.1. Distributed Generation

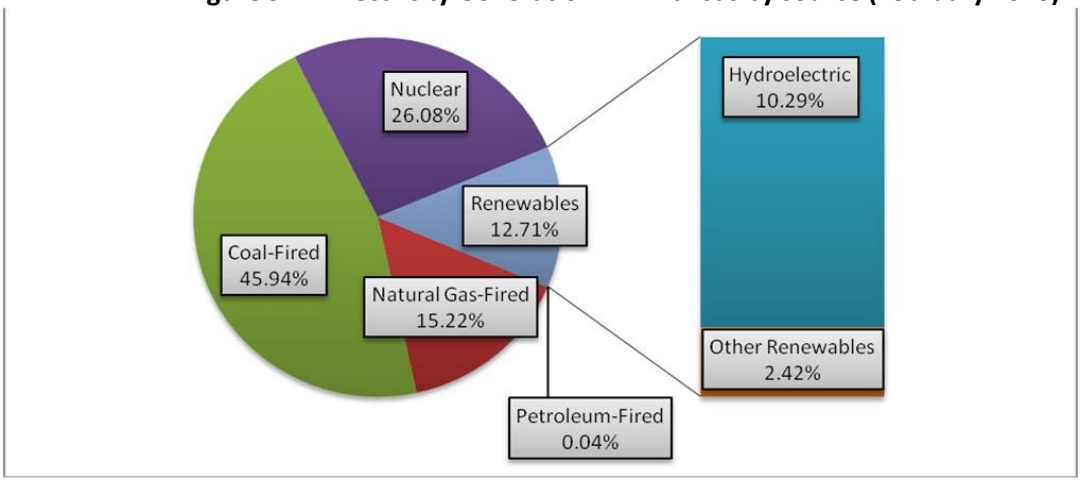
Distributed generation (DG) inherently addresses energy assurance because it adds resiliency to the electric system through geographical disbursement. DG is the use of small-scale power generation technologies located nearby the load they serve, often in the form of microturbines, reciprocating engines, fuel cells, photovoltaics or wind turbines. In order for a grid to use these varied and dispersed generation sources effectively, it must be adaptable and aware.

- DG provides an opportunity to localize an outage because only the customers whose equipment is damaged will experience the outage. Other utility customers, who would otherwise be supplied by a path through the damaged equipment, are instead supplied locally. This strengthens the resiliency of the grid because power can be rerouted through these smaller generation facilities to supply necessary infrastructure with power.
- Excess locally generated power, usually sold back to the utility, could also be stored locally. With small storage units in neighborhoods, houses within a single community could back feed power during non-peak times. This would reduce transmission distance which, in turn, could reduce line loss.

9.2.12.2. Diversification of Generation Resources

Figure 9.4 shows the electrical power generation in Arkansas by source as of February 2010. The increased use of renewable energy sources depends on a more adaptable grid.

Figure 9.4 – Electricity Generation in Arkansas by source (February 2010)



Source: EIA, http://www.eia.doe.gov/state/state_energy_profiles.cfm?sid=AR

- Diversified generation lessens dependence on a single fuel source such as coal. This means that a shortage of one source would have less effect on electricity generation. For example a heavy

dependence on coal production had serious consequences in May 2005 when two trains derailed while bringing coal out of the Powder River Basin. Forty percent of the coal used for electricity production in the United States comes from the Powder River Basin and this shortage curtailed production and delivery for months, increasing the strain on the grid and forcing utilities to rely heavily on much more expensive fuel such as natural gas or expensive electricity from other providers.

- Because most renewable sources are intermittent in nature, their effect on energy assurance and reliability is minimal. However, if the renewable energy provider is able to store energy (in so-called dispatchable reserves) problems with intermittency are mitigated and the diversity they bring to Arkansas's generation portfolio can enhance energy assurance and reliability. The control of such dispatchable storage can be integrated into the Smart Grid infrastructure, ensuring the effective release of the stored energy.

9.2.12.3. Increased Load Control

Smart Grid may also improve the ability of both utilities and consumers to adjust energy usage to decrease peak demand.

- The data gathered by the Smart Grid should be sufficiently robust to help utilities make more thoroughly-informed load-shedding decisions. Rapidly acquired knowledge about electric system status can be used to quickly identify and isolate failures that, if left alone or remedied too slowly, could turn into regional catastrophes due to the domino-like consequences of shedding load. Smart Grid forecasting technologies will be able to warn utilities of these consequences and quickly (automatically) effect, or suggest, appropriate action.
- Smart Grid technologies will reduce the strain of the peak demand by automating demand management and helping consumers shift usage by a pre-arranged agreement and/or by delivering pricing information. This will reduce the number of outages caused by a utility's struggle to meet demand during a severe peak. In June 2008, the EPRI estimated that Smart Grid technologies could reduce peak demand by 5% by 2030.[19] Load growth, as discussed above, continues to have the potential for strain. This is evident as three of the last five major U.S. blackouts over the past 40 years occurred since 2001.

9.2.12.4. Increased Adaptability

Smart Grid technologies also have the potential to automate and inform the existing failure recovery procedures. The precise, automated control of switching, throttling, modulating, and fault-limiting power electronics, informed by the real-time data and system forecasts, should quickly isolate damaged equipment and prevent malfunctions from causing further damage. Today’s system of circuit breakers, relays, reclosers, and disconnect switches can be enhanced or replaced by solid state power electronics. These advanced components also provide a unique opportunity in that many of them feature automated controls, increased operational flexibility, higher efficiency and higher reliability and could replace current mechanical common devices still used in 2010. Advances in silicon carbide (SiC) devices, along with advances in reliable power electronics, promises to further abet the long-term deployment of Smart Grid. Such devices would provide an added advantage because maintenance on mechanical mechanisms should be reduced. An example would be where reliable power electronic subsystems could regulate a fault condition until it was resolved.

9.3. New and Emerging Technologies: Highest Priority Applications

The listed renewable resources include solar thermal and solar electric power, wind power, low - emission biomass, methane gas generated from solid and liquid waste, water power, combined heat and power (CHP) meeting certain efficiency thresholds and fuel cells. The AEO published a *Consumer's Guide to Renewable Energy in Arkansas,* October 2005; it is incorporated into the Arkansas Energy Assurance Plan by reference. It includes many diagrams, explanations and data for calculating the acquisition and installation of alternative energy systems. It can be found at: *www.arkansasenergy.org/media/170965/consumers_guide.pdf.* Additional information is contained in this evaluation.

9.3.1. Solar Photovoltaic Power

Solar photovoltaic (PV) power generation uses a solid-state process to convert sunlight to electricity. The amount of power generated is determined by the strength of sunlight (insolation) incident on the solar cells built into panels. The number of connected cells in an array, or panel, determines total output as does the type of cell employed.

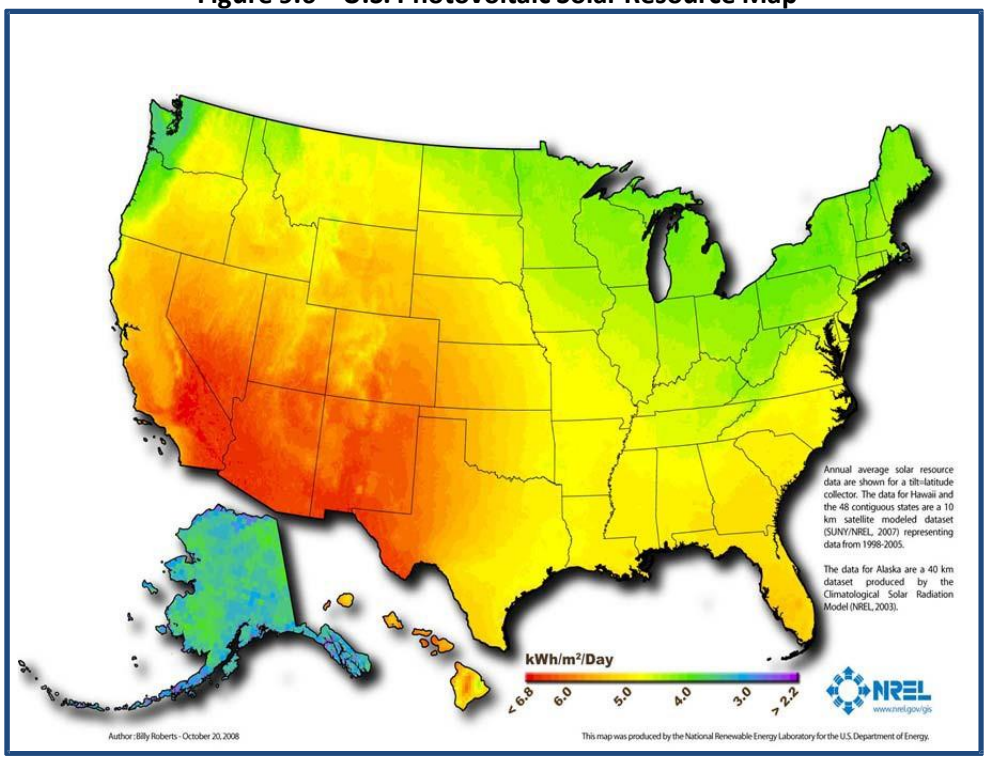
Figure 9.5 – Characteristics of Three Primary Types of Solar Cells

Type	Efficiency (Lab % with highest meaning most output)	Production Efficiency (%)	Advantages/Disadvantages
Monocrystalline or single crystal silicon	24	14-17	• Relatively high level of efficiency in production, lower cost to produce • Durable roof-top installation with highest electric output • Vulnerability to hail storms
Polycrystalline silicon	18	13-15	• Lower production cost offset by edge defects in crystal development, thus lower output • Low cost production but limited use • Vulnerability to hail storms
Amorphous silicon	13	5-7	• Relatively easy to produce, but produce less output • Attractive integration into homes • Dual purpose—serves also as roofing material • Durability • Vulnerability to hail storms

Sources: DOE, *Energy Efficiency & Renewable Energy, Energy Savers, Types of Solar Cells,* **http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10791** *and, The Encyclopedia of Alternative Energy & Sustainable Living,* **http://www.daviddarling.info/encyclopedia/S/AE_solar_cell.html**

Sunlight varies with distance from the equator, season, time of day and cloud cover, reaching its maximum at the summer solstice (nominally June 21 at noon). Solar panel ratings are based on the summer solstice and power output is less during the rest of the day and year and, of course, zero at night.

Figure 9.6 – U.S. Photovoltaic Solar Resource Map



Source: National Renewable Energy Laboratory, DOE

As Figure 9.6 illustrates, Arkansas lies below the peak locations, but above the midpoint for receiving the least intense solar radiation. The state has an extensive solar power program including national solar events, about two dozen businesses selling solar products and a DOE-sponsored Regional Solar Instructor Training program. Solar-related research is conducted at the University of Arkansas, Fayetteville, at the National Center for Reliable Electric Power Transmission (NCREPT) and two recent statewide solar electric research centers funded by the National Science Foundation headquartered at University of Arkansas, Fayetteville.

The state has also enacted policies that impact the development of solar power. Foremost among these is a net metering policy that was established by the legislature in 2001 and amended in 2007. The rules for this policy are promulgated by APSC. According to the AEO, "systems must meet certain criteria to participate, such as size criteria of 25 kW or smaller for residential systems and 300 kW or smaller for commercial systems. Any utility under the PSC's jurisdiction must allow customers who meet the criteria to net meter. Any excess generation created by the system will be fed onto the electric grid, earning the customer credits (at the retail rate) toward future energy use. These credits may be carried from month-to-month over the course of a year and are zeroed out at the end of the year. Customers also retain control of their Renewable Energy Credits, which have an additional monetary value."

As one of the ARRA programs that will expire in 2012, Arkansas also has a Renewable Technology Rebate Fund – this fund of nearly $2 million provides rebates to individuals and organizations that install solar and wind equipment providing electricity to the electric power grid. Installations need to be grid - connected under the net metering regulations. The fund also is available for PV and solar domestic hot water systems equipment.

9.3.1.1. Large Scale Solar Systems

An alternative to solar panels is to concentrate solar insolation with mirrors at one or more reception points through which a heat conducting liquid flows and creates pressurized steam to generate electricity. These concentrated solar units are more effective in western U.S. climates found in California, Arizona and New Mexico where solar insolation is high. There are various types of concentrating systems in use from large fields of parabolic arrays to dish-mounted systems. These latter systems can also be used as CHP systems. Dish-mounted units typically produce from 66% to 75% of their output as heat and the remainder as electric power. These are especially suited for commercial, industrial and stand-alone applications such as emergency management and high priority installations including health facilities and other critical service providers.

Presently, electricity output from large parabolic array systems is limited due to insufficient cross - country power transmission line capacity. A build-out of electric transmission capacity from New Mexico and California would entail billions of dollars in new infrastructure in addition to significant issues related to environmental impacts and potential power line routes.

9.3.1.2. Market Penetration

Figure 9.7 illustrates solar sales in the U.S. from 1999 to 2008. The table also shows that there has been a recent increase in domestic solar shipments (supported by federal programs). However, solar power remains a relatively small portion of the U.S. and state energy market (see Section 5, *Energy Market Risk and Vulnerability Assessment*).

Figure 9.7: Annual Sales Solar of Photovoltaic Cells and Module in USA 1999-2008

Year	Photovoltaic Cells and Modules
1999	21,201
2000	19,838
2001	36,310
2002	45,313
2003	48,664
2004	78,346
2005	134,465
2006	206,511
2007	280,475
2008	524,252
U.S. Total	**1,395,376**

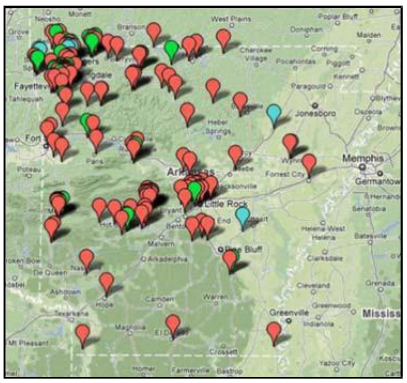
*Total shipments minus export shipments.
Notes: Totals may not equal sum of components due to independent rounding. Total shipments include those made in or shipped to U.S. Territories.
Source: EIA, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

The AEO has documented that in 2010 the state had 51 solar systems with 151 kilowatts installed solar capacity. The state government has employed a 27.3 kW solar array for net metering at the site of one of its newest buildings housing four state agencies in Little Rock. The building is currently registered to be LEED Silver certified through the U.S. Green Building Council and features aspects such as charging stations for electric vehicles. Figure 5 illustrates the activity of the Renewable Technology Rebate Fund (RTRF).

Figure 9.8 – Arkansas RTRF Fund

RTRF Applicants Statistics (Source: AEO, *Renewable Energy Arkansas, July 2012)*

- 143 Installs (151 Applications)
  - 3 Wind
  - 113 Solar
  - 27 Solar Hot Water Systems
- 853 kW Capacity
  - Wind-64 kW
  - Solar – 792 kW
- Solar Hot Water Systems – 2,753 SF
- $5,429,878 Total Applicant Investment
- $1,771,165 ARRA Rebate Investment
- Net metering was established in 2001. As of March 2010, according to dockets filed with the APSC, the installed capacity for small scale solar energy in the state was 214 kW via 37 installations.



The red flags on the map at right represent solar RTRF applicants. The green flags represent solar thermal RTRF Applicants.

- In just over a year, this rebate program increased renewable energy installations in the his state by well over 400% of what was installed over the course of a decade through net metering.

RFRF Quick Facts

- Average Size: 6.7 kW
- Largest Size: 50 kw (Wind)
- Largest Solar: 25 kW
- Average production of system: 8,716 kWh
  - Average annual energy use in Ark. Home: 14,532 kWh (Natl. avg: 12,000)

In spite of subsidy and improved technology, PV is still an “early adopter” product purchased by users who wish to enjoy partial freedom from the power grid and who, patriotically, wish to hasten independence from carbon fuels. In addition to cost, PV faces issues of availability due to weather and, for the off-grid consumer, the cost of battery storage. There is the promise, however, that widespread use of solar power could reduce carbon-based electric generation by a significant margin if implemented at millions of locations. This form of alternative energy may receive significant additional subsidy to increase the nation’s electric reliability, so it cannot be judged entirely as a long-range energy source until such time as the solar industry reaches grid parity or, in other words, costs no more than

traditional sources of energy. There have been relatively large price reductions for solar components over the past several years, which in addition to short-term federal subsidies provided through the state energy office should enhance PV growth.

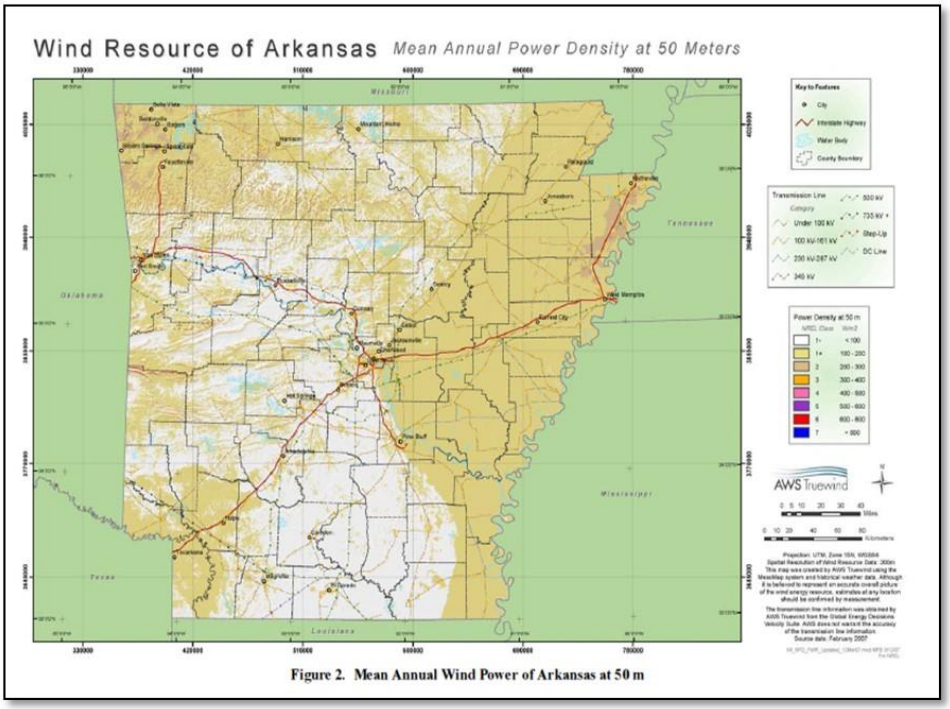
As noted above, large scale solar power installations have even greater promise for supplying vast amounts of electric power. Until agreements are made to construct transmission infrastructure adequate to reach larger pools of customers, this form of alternative power is likely to remain limited.

9.3.2. Wind Power

Wind can generate power using tall pole mounted turbines where a strong, steady wind resource exists. The AEO notes that Arkansas has good wind capability in the northwest corner of the state, on Ozark Mountain ridges and mountain tops, and in the west central part of the state along the Ouachita Mountains. Mean winds along Ouachita ridges can reach wind speeds of 7 to 9 meters/second at 50 meter heights. This translates into wind power densities of 400 to 800 W/m^2 (or NREL Class 4-6). More than adequate wind density can be found in nearby areas. Greater speeds are attainable at the 80 to 100 meter height of modern wind turbines.

Figure 9.9 shows a National Renewable Energy Laboratory (NREL) wind resource map for Arkansas

Figure 9.9 – NREL Wind Resource Map



Source: AWS Truewind, *Wind Resource Maps of Arkansas,* prepared for NREL, March 23, 2007.

The greatest wind density is, as noted above, found in the northwest corner of the state as well as along the eastern third of the state. Some of that resource is near the state's largest population center, Little Rock. Delivery of this resource to all areas of the state may require additional investment in transmission if wind installations were to expand significantly.

Arkansas has also taken steps to expand the use of wind resources. In addition to the renewable energy initiatives for solar power noted above, the state is supporting wind-related development through the following efforts

- An income tax credit for windmill blade and component manufacturers.
- The Arkansas Anemometer Loan Program designed to allow land owners in Arkansas to measure wind energy potential.
- A Tall Tower Wind Measurement Study that will involve the installation of anemometry on approximately five to ten existing tall towers in the western, northwestern, northern, and northeastern portions of the state.
- The Industrial Energy Technology Loan Fund of $10 million in low-interest revolving loans to encourage investment in clean technology.
- The Sustainable Building Design Revolving Loan Fund with $12 million in revolving loans to encourage energy efficiency and use of renewable resources in state buildings.
- The Clean Tech Fund of $2.7 million in one-time grants targeted to support clean technology companies in Arkansas that make or sell renewable energy products for storage, energy efficiency or result in an overall reduction in energy use in the state economy.

9.3.2.1. Market Penetration

In 2010, Arkansas had 14 wind-powered systems with 153 kilowatts of installed capacity. The state's net metering rules apply to wind as well as solar power. The state has three major original manufacturing companies branches located or planned; representing a $350 million investment. There are two large wind energy component suppliers in the state and another one planning to locate there. A map of Arkansas wind installations as of October 2010 can be found at: *http://www.arkansasenergy.org/solar-wind-bioenergy/wind.aspx*.

9.3.2.2. Implications of Implementation

There are advantages and cautions regarding wind as power resource. Variability in wind makes it necessary to have sufficient conventional sources of power. A benefit of wind power is that it can reduce dependence on carbon-based fuels. Wind power increases overall electric system reliability because it reduces exposure to the coal, oil and natural gas commodity markets. Wind is being used increasingly across the country which makes system components easier and cheaper to obtain. However, the decreasing cost of shale-based natural gas could be a disincentive for expanded wind development.

9.3.3. Power from Solid and Liquid Wastes (Biomass)

Both solid and liquid municipal wastes are sources of energy that can be used to generate electric power. Solid waste can be shredded and burned to generate steam for use in turbines. As biomass gasification processes improve, solid waste can be gasified for use in high efficiency gas turbine/steam turbine combined cycle systems[37]. Anaerobic digestion in landfills and waste water treatment plants produces a gas that is rich in methane which can be used for power generation. Another form of waste

[37] D.S Liscinsky and J.J Sangiovanni, ASME IGTI Paper - GT2003-38295 *Advanced Technology Biomass-Fueled Combined Cycle*, , United Technologies Research Center; R.S. Tuthill Pratt & Whitney Power Systems; A.G. Foyt, Arkansas Resource Recovery Agency; F.L. Robson KraftWork Systems, Inc.; M. Swanson, University of North Dakota Energy and Environmental Engineering Research Center, June, 2003

stream gas is created by water treatment systems; this production is steady and has high methane content. Figure 9.10 depicts the various uses of land fill (and bio-gas) in the U.S.

Figure 9.10 – Land Fill Gas Consumption (2007)

(Trillion Btu)					
Type	Sector				
	Commercial	Industrial	Electric Power		Total
			Electric Utilities	Independent Power Producers	
Total	31	162	16	221	430
Landfill Gas	3	93	9	69	173
MSW Biogenic[1]	21	6	5	134	165
Other Biomass[2]	7	63	3	19	92

[1]Includes paper and paper board, wood, food leather, textiles and yard trimmings
[2]Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.
MSW = Municipal Solid waste.

Note: Totals may not equal some of components due to independent rounding.

Sources: Source: EIA: *Land Fill Gas*, Table 1.7, *Waste Energy Consumption by Type of Waste and Energy Use Sector*. EIA, Form EIA-906, *Power Plant Report*, Form EIA-920, *Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report;* Government Advisory Associates, *Resource Recovery Yearbook and Methane Recovery Yearbook;* and U.S. Environmental Protection Agency, *Landfill Methane Outreach Program Estimates.*

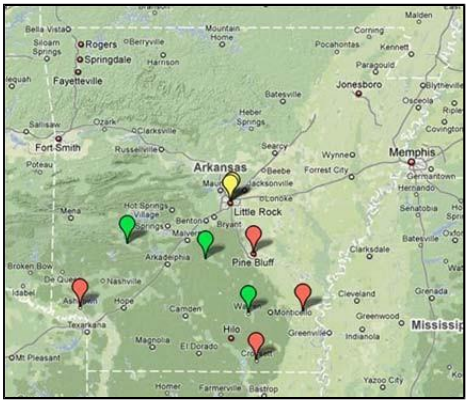
9.3.3.1. Market Penetration

AEO reports that Arkansas has nine co-generation plants that use biomass. Biomass has been used to generate power in the state since 1968. Figure 9.11 lists the biofuels used in the state as well as electricity generation capacity in megawatts.

Figure 9.11 - Arkansas Biomass Fuel Use (2010)

- **4 – Waste Fuel – Paper byproducts**
  - Potlatch –24 MW Capacity
  - Crossett Pulp & Paper Mill – 34 MW Capacity
  - International Paper - 213 MW Capacity
  - Ashdown Mill- 156.5 MW Capacity
- **3 – Wood Fuel**
  - Bean Lumber – 9.5 MW Capacity
  - Leola Lumber Mill – 7.5 MW Capacity
  - Southern & Bradley Plant – 15 MW Capacity
- **2 – Biomass Fuel**
  - Fourche Creek Wastewater – 1.7 MW Capacity
  - Two Pines Landfill – 4.8 MW Capacity
  - Eco-Vista Landfill -4 MW (Development)

(Source: AEO, *Renewable Energy Arkansas,* July 29, 2010)



Red flags represent waste fuel (process gas, waste, MSW, petroleum coke, etc.) Green flags represent wood waste. Yellow flags represent biomass fuel (e.g.,: biomass, LFG, digester gas)

As indicated in Figure 9.11, landfill gas appears to enjoy growing popularity in Arkansas. AEO reports that Arkansas currently has three landfills that collect their methane gas for energy production:

- Since September 2006, Two Pine Landfill in North Little Rock (Waste Management) has been directly generating electricity from their gas and selling it to the North Little Rock municipality where it powers approximately 4,500 homes. It generates 4.8 MW.
- The Eco-Vista Landfill (Waste Management) in Tontitown is building a 4 megawatt plant that will generate electricity from gas that will be sold to Ozarks Electric Cooperative. It will be enough to power about 4,000 homes.
- The Little Rock Municipal Landfill collects and sells their landfill gas directly to Geo Specialty Chemicals via a pipeline. The company uses the gas to power a kiln and has purchased the gas via a 15-year contract. (The City of Fort Smith Sanitary Landfill has a similar arrangement with a local business.)

9.3.3.2. Implications of Implementation

Power from these waste streams reduces the amount of coal, petroleum and natural gas used for power generation. The cost of removing impurities from the gas is less than the cost of buying conventional fuel. The use of landfill and bio-gas lowers risk for the commercial, industrial and utility sectors thus decreasing the vulnerability of these use sectors to energy shortage or interruption.

9.3.4. Combined Heat and Power (CHP)

CHP, or co-generation power plants, combine a heating source or power station to simultaneously generate both electricity and useful heat. CHP plants have the potential to make significant reductions

in energy consumption because they recycle waste heat from power generation to space conditioning or industrial process.

CHP installations in Arkansas are also considered distributed generation within the overall state electric system (see Section 9.2.12.1 above). They use a variety of fuels including: biomass, coal, natural/propane and wood waste as fuel. If a CHP system also powers cooling, it displaces electricity used for air conditioning and reduces summer peak demand for electric power.

9.3.4.1. Market Penetration

EIA indicates that there are 16 CHP facilities in the state with a total of approximately 497,325 kW of electricity capacity. Figure 9.12 shows that the majority of these units use biomass and wood; but the bulk of fuel used is either biomass or coal. These plants serve pulp and paper manufacturing, solid waste and waste water facilities, wood products manufacturing, food processing and two, relatively small, institutions.

Figure 9.12 – CHP in Arkansas (as of 2006)

Primary Fuel Source	Number of Sites	Capacity in kW
Biomass	7	252,000
Coal	1	213,000
Natural gas (or propane)	1	5,200
Wood waste	7	27,125
Total	16	497,325

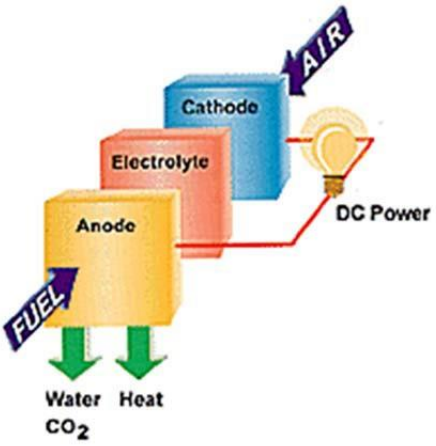
9.3.4.2. Implications of Implementation

Additional benefits for the CHP process are:

- Use of fossil fuel power plant exhaust to grow algae could generate biofuels that could then supplant transportation fuel used in Arkansas with attendant reductions in carbon dioxide emissions.
- Reduced air emissions, including carbon dioxide and nitrogen oxides, are abetted by burning less fossil fuel.
- Increased national security by reducing dependence on imported fossil fuels.
- Reduced peak electricity demand when used for chilled water loops.
- CHP units are also suitable for reducing government and private sector emergency management facility dependence on external power. If the CHP units are combined with alternative energy sources, such as PV, wind or biomass, they can reduce recovery time for power restoration (see Passive Survivability Design discussed below).

9.3.5. Fuel Cells

Figure 9.13 – Fuel Cell Diagram



Source: US DOE, *Future Fuel Cells R&D*

Fuel cells involve a processor to convert the fuel (e.g., natural gas) to hydrogen, a fuel cell stack that converts hydrogen to Direct Current (DC) Power and a power conditioner that converts the DC power to Alternating Current (AC) power at the voltage required by the application. When these power plants are located at individual buildings, heat is recovered for use in the building. Heat from higher temperature fuel cell power plants can be used in a gas turbine bottoming cycle to increase electric generation efficiency and there are approaches in which the fuel cell power plants can also produce hydrogen.

Fuel cells have been used for commercial purposes for several decades but this alternative has not had widespread penetration into the market. Federal research and development coupled with the DOE and Department of Defense promotion, have lowered the cost of this technology and increased its market penetration. DOE is aiming for a large fuel cell block that could create power plants capable of generating up to 100 MW.

Fuel cells are eligible for residential tax credits under the 2005 Energy Policy Act (§1335) and a business energy tax credit under §§1136-1137.

9.3.5.1. Market Penetration

According to various Internet sources, there are 10 firms listed in Arkansas as fuel cell service centers and 10 listed as firms dealing with hydrogen-powered vehicles. There is some overlap. Other sources note two stationary fuel cell installations, one at the Little Rock Air Force Base in Jacksonville and another at the Pine Bluff Arsenal, White Hall. Sizes and power equivalent data is unavailable[38].

9.3.5.2. Implications of Implementation

Fuel cells have similar effects on energy as other distributed resources, such as PV, and may be valuable in CHP systems. The long-range prognosis for fuel cell use is positive but price hurdles must be met. The highly publicized federal hydrogen fuel vehicle program has not penetrated the market significantly. There has also been an on-going discussion of fuel cells coupled with hybrid electric vehicle technology. Such units are still in the demonstration phase. Fuel cells may have a greater chance of succeeding in the distributed power generation field where they could displace high power plant capital costs and provide reliable (albeit remote from the power grid) power as well. Fuel cells using natural gas or other carbon-based fuels have carbon footprints, although smaller than other fossil fueled plants.

9.3.6. Water Power

The rise and fall of tides provides a moon- gravity-driven hydraulic system (head) that can be used to generate electric power. Tidal power, like wind, is intermittent although more predictable. It is basically a twice-a-day, flood stage cycle that operates in reverse direction as tides ebb and flow. Tidal power has no direct application pertaining to Arkansas.

[38] Sources include: Citysearch, macraesbluebook.com and fuecells.org

Low-head hydropower systems, however, are a proven technology. These systems are commonly in use in many waterways. Technology advances are being tested to provide for power generation over a wider range of river flow. The process for securing permits to install and operate such systems can be lengthy and costly. Opportunities exist in Arkansas for low-head hydro power applications for power generation.

Hydropower projects qualify for various federal funds as is explained in *The Consumer's Guide to Renewable Energy in Arkansas* cited above.

9.3.6.1. Market Penetration

The Electric Cooperatives of Arkansas operate three hydropower generation stations that have a collective capacity of 167 MW, all of which are located on the Arkansas River. One is in the Dumas area, another is near Fort Smith and a third is located at Morrilton. These are run-of-the-river installations which mean that no dams are involved and the power generation components are located below the water's surface.

The Arkansas Electric Cooperative Corporation also buys 189 MW of hydropower generated in Oklahoma from the Southwest Power Administration (SPA). This power is available only for a limited number of months and is used primarily for peaking power.

Hydropower is also produced within the state by five U.S. Army Corp of Engineer facilities.

9.3.6.2. Implications of Implementation

Low-head hydropower systems are promising for increasing energy reliability; but environmental concerns must be addressed. Environmental protection is not only a quality of life and nature issue, it is also has economic implications. Run-of-the-river installations are preferred because they are much kinder to wildlife and the environment than dam-produced hydropower.

9.3.7. Ground Source Heat Pumps

Conventional heat pumps exchange heat between a building's interior and ambient air which means that in the summer, heat is pumped from a building temperature of 70 ºF to hot air at up to 100 ºF or higher. In the winter, heat is pumped from outdoor air temperatures of 40 ºF – 50 ºF or lower to an indoor environment at 70 ºF. Since temperatures of the ground at 3 or 4 feet below the surface remain steady year round at 50 ºF – 55 ºF, a ground source heat pump exchanging heat between the ground and a building's interior requires less power and energy for both heating and cooling than does a conventional heat pump, which exchanges heat between a building's interior and ambient air.

Ground source (geothermal) systems are long lasting. Piping is generally covered by a 24-year warranty and the heat pumps are built for a minimum of 20 years of service.

9.3.7.1. Market Penetration

Ground source heat pumps are readily available and the market for these products is growing. The DOE estimates that over 40,000 are installed in the U.S. annually. Several companies throughout Arkansas install these units.

9.3.7.2. Implications of Implementation

If consumers are willing to make the initial investment in ground-source heat pump systems, energy system resilience due to increased use of these systems would:

- Reduce dependence on heating oil, natural gas and propane thus lowering risk if such fuels are curtailed or reduced in a shortage.
- Reduce summer air conditioning electric loads when systems, acting as two way heat pumps, use in-ground temperatures for cooling. This would result in a decrease in peak electricity demand. Reduced demand allows the retention of more unused capacity, thus giving electric companies more leeway to manage a fuel or other issue causing a shortage.
- Reduce load during storms, or other events that would cause a sudden outage, allowing more concentration of resources on areas in need thus hastening repair and reducing vulnerability for customers.
- Create potential need for electric power reliability because more buildings would depend on electric power for precision heating controls.
- Reduce winter heating load carried by conventional heat pumps. Ground source systems will need electricity for pumps in the circulating system that may be less efficient than an electric blower system but more efficient than pumps used to accommodate wide differences between ambient and inside air temperature. These systems will also greatly reduce electric load from radiant coils that are turned on when ambient air drops below about 40^{o}F as is typical in Arkansas.

The net change in natural gas or propane consumption depends on which fuel the ground source system replaces. One of the reasons for installing any type of heat pump is the unavailability of natural gas; therefore a heat pump cannot always be credited for a reduction in consumption of fuel gas. The National Association of Counties (NACO) has estimated that ground source heat pumps could save up to 50% of the energy in a building versus conventional heating[39]. Although savings in this area are counterbalanced somewhat by initial purchase and installation, pumping and control costs, a reduction of costs close to the NACO estimate would amortize the investment within a reasonable amount of time[40]. Further, the equipment has a smaller profile than conventional space conditioning units thus potentially lowering construction costs in new building installations. This is offset by the extra cost of drilling that is needed to install the ground source heat exchange equipment. Significant use of ground source heat pumps could result in a reduction in conventional fuel use for space heating and cooling.

9.3.8. Solar Hot Water Systems (Solar Thermal Collectors)

The heat available from solar energy can be collected for building heating or producing domestic hot water using roof-mounted collectors. While the strength (insolation) of sunlight in Arkansas is limited and variable by season and time of day, these systems currently see limited use.

There are two basic types of solar hot water heaters. The first is an integrated collector storage system, "bread box," or batch heater that is a passive system. A black coated 40-gallon heater tank is contained

[39] *Green Government, Geothermal Energy in County Facilities,* National Association of Counties, Washington, D.C.

[40] The definition of a "reasonable amount of time" is subjective, depending on the initial purchase and the volume of service required. However, as an estimate, it would be reasonable for a unit to be amortized fully far enough in advance warranty expiration that the consumer enjoys the energy cost savings for some period of time after full cost recovery and before replacement is necessary.

in a glazed housing to absorb sunlight. Water from the solar heater is usually circulated to a standard water heater which reduces its need for conventional energy.

Active solar systems come in open or closed loop models. An open-loop, or direct, system, circulates water from external solar collectors (such as an array of black pipes behind a glass covering) to the storage tank – a drain-back system reduces freezing problems. Closed systems use another heat conducting agent such as propylene glycol (antifreeze) to carry solar generated heat through a system of pumps and a heat exchanger to a storage tank. Both of these systems are generally sized at 80 gallons.

Installation costs rise from relatively inexpensive batch heaters to the more complicated closed loop systems. The former can be installed by a homeowner but the latter requires professional installation. Solar systems share one thing in common with modern high efficiency windows; efficiency and ultimately, savings require the highest quality of installation.

9.3.8.1. Market Penetration

According to AEO there is a small, but relatively steady demand for solar thermal heating units in Arkansas. Figure 9.14 provides the data.

Figure 9.14 – Recent Solar Thermal Applications (2010)

Hot Water Heating Applicants Statistics

Applicants (cumulative estimates)

- Number of HWH Applications: 5
- Collector Size: 224 square feet
- Applicant Investment: $33,644.20
- Annual Energy Savings: 40,352,000 BTUs
  - (only represents 3 of 4 systems, awaiting more info)
- Rebate Payments: $6,240

Actual

Preliminary Approvals 2

9.3.8.2. Implications of Implementation

The public is generally familiar with solar hot water installations. Widespread use of solar thermal collectors would decrease use of fuels used to heat water – a major component of many consumers' energy use profile.

Solar collector manufacturing continues to expand abetted by federal technical support and state and federal tax incentives. Efficiency for both solar thermal and photovoltaic installations has improved significantly through new solar cell technology supplying more kilowatts at lower cost and, even more, due to vastly improved industry and installation skills and equipment quality.

Electronic controls, basic solar panel costs and the labor involved in installation are cost components of solar hot water installations. However, when tax credits apply, they become more competitive with conventional systems. They could have their greatest impact in Arkansas in commercial installations where water heating is a significant production or service cost. Solar hot water systems are much less expensive than solar photovoltaic installations and can be expected to amortize the costs for high water

volume users in a reasonable amount of time (see Footnote # 9). Their lower costs also increase their appeal to homeowners.

9.3.9. Green Building Design

The U. S. Green Building Council (USGBC)[41] is promoting the design of buildings to reduce energy consumption. Such designs utilize existing products and materials while orientating the building with respect to the sun and substitution of natural for artificial light. They also feature lighting systems that respond to both the presence of people and natural light levels in order to control artificial lighting. Other components include increased insulation, green roofs, collection of rainwater and other design approaches that reduce energy and water consumption creating a healthier building environment. Materials are chosen to minimize processing, fabrication and transportation energy consumption and costs. The USGBC evaluates building designs, certifies they have incorporated green building principles, and assigns ratings indicating their level of compliance with these principles.

Building upon what has been learned after the Hurricane Katrina experience, the next step in green building design is what is termed "Passive Survivability" which goes several steps further and provides features such as:

- Cooling load avoidance
- Natural ventilation
- Efficient thermal envelope
- Passive solar gain
- Day lighting
- Rainwater collection
- Composting toilets
- Waterless urinals
- Onsite energy production to operate low power heating and ventilation
- Storage of energy (batteries, increased thermal mass)
- Incorporation of regional diversity and designed for local climate

A very recent innovation in modern building technology is so-called net zero design. Such buildings, now entering the European market, are designed to create an energy neutral footprint through extremely careful and energy conscious building design. [42]

9.3.9.1. Market Penetration

Green building design is heavily promoted in Arkansas. A large-scale program has been developed in legislation for several years. The *Green.Arkansas.Gov* program includes:

- Act 1494 directs the Arkansas Energy Office to develop a plan for reducing energy use in all existing state buildings by 20 percent by 2014 and a 30 percent reduction by 2017. According to the AEO, the state spends on average $100 million annually on energy for state buildings, including public universities and colleges.

[41] ***http://www.usgbc.org***

[42] A discussion of this type of design can be found at: *http://www.suite101.com/content/net-zero-energy-buildings-a71411*

- Act 1336 extends the legislative task force on sustainable building design and practices. The 20-member task force, composed of legislators and members of the public, is charged with developing goals and strategies to promote energy efficiency in state buildings.
- Act 1372 provides a funding mechanism for state agencies, boards and commissions who own facilities and would like to accomplish energy initiatives within their facilities.
- Act 1301 creates the Arkansas Alternative Energy Commission to study the needs and impacts of various forms of alternative energy on the economic future of Arkansas.
- Act 977 increases the incentives for alternative fuel feedstock processors and distributors.
- Act 737 provides a severance tax exemption for biomass grown for biofuels production.
- Act 736 provides incentives such as tax exemptions for qualified windmill blade and component manufacturers.

The Arkansas Building Authority lists two URLs pertaining to the state's green building initiatives.

- *Sustainable Building Design Revolving Loan Application*
- *Sustainable Building Design Program Procedures*

9.3.9.2. Implications of Implementation

When applied to new construction, these principles can reduce building energy consumption significantly (20% to 40%) and the principles can also be applied to modifications to existing buildings. A number of buildings designed to these principles already exist and the percentage of buildings so designed is increasing. Reduced energy demand from green buildings lowers energy use permanently, thus adding continuously to system reliability.

9.4. Passive Survivability for Emergency Facility Design

The cost of purchasing and installing renewable power is often used by conventional power proponents as a reason to avoid it. Conventional cost/benefit calculations that exclude environmental or other externalities are contemporary marketplace considerations. It is one thing to say that externalities "should" be included in such calculations; it is another thing to make such calculations common factors for determining cost/benefit.

There is an overriding benefit for renewable power that is justified in terms of an externality related to energy assurance. This is the value of prevention and mitigation associated with back-up power for designated critical infrastructure. A study completed by Sage Policy Group, Inc. pertaining to the risk associated with potential electromagnetic pulse (EMP) attack depicted the value of hardening critical infrastructure prior to any disruption. In short, the study holds that preparedness reduces restoration time. The study demonstrated an accelerated restoration following a potential EMP incident in which critical electric components are shielded and thus able to be on line immediately after (if not during) an incident, thus hastening recovery.[43]

9.4.1. Potential Application

While an EMP event could be mitigated by a well-built, specially shielded structure, it is not uncommon to see state emergency operation centers that are also built as secure, bunkered, structures. An

[43] Sage Policy Group Inc., *Initial Assessment of Electromagnetic Pulse (EMP) Impact upon Baltimore-Washington-Richmond Region*, EMP Economic Impact 2007, Instant Access Networks, LLC.

electricity asset built to withstand an EMP event would undoubtedly survive a severe storm. On-site generating capacity would also be critical. But to be truly independent from possible fuel disruption, solar PV and alternative power-CHP units have unique potential to enhance energy reliability and mitigate emergency situations. Fuel cells and even wind generated electricity can also be useful. A combination of liquid fuel and re-chargeable battery storage could sustain a police station, a shelter, or protect a variety of end users who serve critical societal or emergency functions. Alternative energy capability extends the ability of such a user to work even though conventional fuel is scarce or totally disrupted.

9.4.2. Implications, Cost and Benefits

It should not be difficult to include societal asset protection as an externality affecting conventional cost/benefit calculations. For example, every day that full restoration for any fuel disruption is shortened, cost-measurable commercial activity can generate cash flow sooner than might otherwise be possible. One can argue that quality of life benefits are subjective and not measurable; but commercial activity can be measured in monetary units and thus is a candidate for a convincing externality. Of course, emergency responders do indeed justify their work on quality of life and sustaining life bases and it is logical that alternative energy components can be justified on a similar basis as well.

9.5. Transportation-Related Technologies

DOE has promoted alternatively fueled vehicles since the oil crisis of the 1970's. Clean Cities, a national alternative fuel advocacy organization, was formed under the guidance of DOE to create programs for testing and promoting the use of alternate fuels vehicles. Arkansas Clean Cities Coalition is one of the 90 local coalitions participating in this effort. Within Arkansas, the Clean Cities coalition is led by the Arkansas Energy Office.

DOE, Clean Cities and many entrepreneurs have developed alternative concepts and used demonstrations and pilot programs to make drivers aware of alternative vehicles. North American Honda and Toyota have been the front runners in this effort. Some American manufacturers were early participants (the General Motors EV-1 program is an example) but did not sustain that effort. First Ford, and then GM made a major commitment to ramp-up alternative vehicle sales around 2007-2008.

Clean Cities and others have also sustained a long-term effort to create a market for compressed natural gas (CNG) vehicles. In the 1990's, several petroleum companies coordinated with local jurisdictions to build CNG re-fueling facilities. At over $250,000 per modest filling station, these investments could not be amortized with the weak volume of sales. However, CNG has found its way into fleet use, especially for centrally fueled facilities such as city fleets and airport buses.

This section highlights the most promising alternative fuel technologies. Many are in use in Arkansas and the numbers appear to be increasing.

9.5.1. Hybrid, Plug-In Hybrid and Electric Vehicles

Hybrid gasoline-electric vehicles already have a significant position in the light duty vehicle market. The concept of a hybrid gasoline-electric fuel vehicle is now a proven technology with some vehicles in their third generation of production models.

The next major improvement in hybrids is the Plug-in-Hybrid with batteries that can be charged at the home or workplace. A gasoline or diesel engine is used to extend the range of the vehicles beyond that

which is possible with batteries alone. Manufacturers are rapidly increasing the number of hybrid vehicles produced for the American market. Figure 9.15 lists current and near-term market offerings.

Figure 9.15 – Upcoming Hybrid Vehicles _USA

Manufacturer	Model	Type	Estimated Date Available*
Chevrolet	Volt	Plug-in Hybrid Car	2010
Dodge	Ram	Standard Pickup Truck	2010
Honda	CRZ	Two-Seater	2010
Honda	Fit Hybrid	Small Station Wagon	2010
Hyundai	Sonata Hybrid	Large Car	2010
Lincoln	MKZ	Midsize Car	2010
Mercedes-Benz	ML450 Hybrid	SUV	2010
Porsche	Cayenne Hybrid	SUV	2010
Volkswagen	Touareg Hybrid	SUV	2010
BMW	7 Series	Car	2010-11
Audi	Q5	SUV	2011
BMW	5 Series Active Hybrid	Car	2011
Buick	Not yet named	Plug-in Hybrid SUV	2011
Hummer	H3 Hybrid	Plug-in Hybrid SUV	2011
Infiniti	M35	Large Car	2011
Kia	Optima Hybrid	Midsize Car	2011
Volkswagen	Jetta Hybrid	Compact Car	2012
Volkswagen	Golf Hybrid	Compact Car	2013
Volkswagen	Passat Hybrid	Midsize Car	2013

Source: *New and Upcoming Hybrids* DOE and U.S. Environmental Protection Agency (EPA) *www.fueleconomy.gov*

9.5.1.1. Market Penetration

EIA data projects use for alternatively-fueled vehicles. However, due to federal mandates for reducing the use of conventional fuels, the agency's reporting of market-ready gasoline and diesel hybrids is limited. Hence the best available market data for such vehicles is on a national, rather than a state, basis. Figure 9.16 illustrates the number of hybrid-electric vehicles purchased in the U.S. in 2009.

Figure 9.16 – Hybrid Electric Vehicles Purchased in the US (2009)

Vehicle Type	Automobiles	Light Duty Trucks & SUV	Buses	Totals (Not all sources for totals are shown by EIA)
Diesel-electric hybrid	0	0	1650	1952

Gasoline-electric hybrid	275,558	62,152	w	337,768
Source: EIA: Table S7. *Projected Number of On-road Alternative Fuel and Hybrid Vehicles to be Made Available, by Fuel Type and Vehicle Type, 2009.* NOTE: w = Medium and heavy duty trucks and some buses were excluded by EIA because of proprietary concerns.				

9.5.1.2. Implications of Implementation

An electric vehicle is completely dependent on the batteries and will have limited range compared to traditional fueled vehicles. However, both electric and hybrids reduce petroleum consumption compared to conventional vehicles and can reduce emissions of controlled pollutants and greenhouse gases. Hence, they lower the risk associated with any interruption of motor gasoline supply.

As of 2010, hybrid-electric vehicles cost more than comparable conventional vehicles. Government subsidies reduce the marginal cost and many consumers are pleased with the increased mileage and motor-fuel savings. The introduction of plug-in hybrid electric vehicles should increase this market assuming that fuel prices are not artificially kept low by oil companies to combat this trend.

Plug-in hybrids may reduce consumption of petroleum products for transportation and increase the consumption of electric energy. There is some concern that day-time charging could exceed base load capacity (the most expensive generation) thus reducing the economic benefit of plug-ins. Charging such vehicles at night will be preferred so that the electric demand occurs when load is low and can be accommodated without the need for additional electric power plants.

Further dependence on the electric power supply will increase the importance of reliable electric power. Utility control of plug-in charging could mitigate adverse effects on peak demand. A potential, benefit is the possibility of using plug-in vehicle batteries to back- up the electricity supply system in the event of a shortage. Some proponents of electric plug-in vehicles have postulated that many such vehicles connected to the grid could help manage demand during a power shortage or be used to operate residential (and commercial) HVAC to prevent more costly damage from freezing. However, if vehicles were used in such a way, the required controls would be complex and transportation reliability could be compromised.

9.5.2. Alternative Fuel Vehicles (AFV) and Renewable Vehicle Fuels

There are several forms of alternative fuels extant in Arkansas. These include renewable biofuels such as ethanol as well as non-renewable natural gas, propane and biodiesel. Arkansas law and incentives tend to treat all of these fuel options as a class although some laws and some regulations pertain to specific forms only.

Both ethanol and biodiesel are currently used as vehicle fuels. Some modification to engine design is necessary to utilize high percentages of these fuels in internal combustion engines and many vehicles are marketed with this capability—particularly for gasoline engines. Generally, diesel engine manufacturers do not warrant their engines for high percentages of biodiesel.

Currently in the United States, ethanol is derived from corn and biodiesel is derived from new and used vegetable oils and animal fats. Significant efforts are underway to derive ethanol from agricultural waste or from crops grown specifically for fuel purposes. In addition, efforts are underway to produce fuels from algae. These efforts still have technological barriers to overcome before becoming commercially viable.

Ethanol and biodiesel fuels are currently employed as part of a mix with petroleum products in amounts ranging from 2% - 20%. About half the gasoline sold in the US has ethanol content up to 10%. Federal mandates will increase use of these fuels to 36 billion gallons annually by 2022. At the higher level of biofuels, dedicated tanks and dispensing equipment are required. For example, only about 2,000 service stations of the total of 160,000 stations nationwide have pumps dispensing 85% ethanol.[44]

9.5.3. State Initiatives

The state has a number of laws and opportunities supporting alternative fuels. These are summarized here:[45]

Statue and Regulation

- Arkansas Executive Order 09-07 requires state agencies to develop energy plans to reduce consumption. Developing vehicle purchase criteria that include fuel efficient vehicles is contained in this order.
- Arkansas Code §§15-13-101, 15-13-102, and 15-13-202 to 15-13-205 requires diesel-powered vehicles, light trucks and off-road equipment leased by the state to use fuel that contains a minimum of two percent biofuels by volume.
- Arkansas Code §26-62-201 allows alternative fuel to be taxed on a gasoline gallon equivalent basis thus providing tax parity among fuels according to energy produced rather than volume which would mandate greater cost of such fuel.[46]

State Incentives

- The state also offers incentives to promote the use AFV. The Arkansas Alternative Fuels Development Fund provides capital and operation incentives for the AFV industry through fuel and fuel feedstock producers and distributors.
- Heavy truck idle reduction devices are also eligible for a small business or low interest loan through the Arkansas Department of Environmental Quality.

Private Sector Incentives

- CenterPoint Energy provides feasibility studies pertaining to the use of compressed natural gas.

9.5.3.1. Market Penetration of Ethanol

Figure 9.17 depicts the most recent EIA estimates for the use of ethanol-type fuel in Arkansas for 2008. This table depicts thousands of gasoline equivalent gallons, not the number of vehicles.

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[44] US DOE, Energy Efficiency and Renewable Energy web site: http://www1.eere.energy.gov/vehiclesandfuels/technologies/fuels/nonpetro_fuels.html

[45] U.S. DOE, Energy Efficiency & Renewable Energy, Alternative Fuels and Advanced Vehicles Data Center. Federal & State Incentives & Laws, *Arkansas Incentives and Laws*

[46] The state also has laws that prohibit using tax free such as natural gas and propane for vehicles. Such fuel must be diverted from the non-tax stream and appropriately taxed for vehicle use. Conversions of conventional vehicles to AFF must also be reported.

Figure 9.17 – Estimated Consumption of Ethanol (E-85) by Vehicles (2008)
(1000 equivalent gasoline gallons)

State	Federal Agencies	State Agencies	Other Private Users and Municipal Governments	Totals
Arkansas	10	0	214	240
Source: EIA, Table C12. *Estimated Consumption of Ethanol (E85) by Vehicles, by State and User Group,* 2008, Report Release April 2010				

9.5.3.2. Implications of Implementation

The net effect of corn-based ethanol on energy consumption and greenhouse gases is controversial and so is the effect on food prices because of the major role corn and corn products have in the global food supply. There are political/economic drivers for ethanol production that emanate from the grain processing industry. In addition, tariffs are placed on imports of sugar cane-derived ethanol from Brazil although sugar cane is a much more environmentally and energy attractive source than corn. A change in the political climate supporting these drivers could alter support for government tariffs, perhaps reducing ethanol production.[47]

Increased use of biofuels through government mandate will reduce demand for petroleum products and is cited as a reason for suspending operation of the least economic oil refineries and deferring construction of new ones. Reduced refinery capacity, in turn, increases risk of supply disruption for petroleum products.

Production of more biofuels will require significant investment, particularly for ethanol derived from feedstock other than corn. Investments in truck or pipeline transportation as well as service station upgrades will be required to support increased substitution of biofuels for petroleum products.

9.5.4. Natural Gas Fueled Vehicles

Natural gas has been used as a vehicle fuel for several decades at relatively low levels of market penetration. Engine modifications to permit use of natural gas are not costly and straightforward but the large volume required for on-board fuel tanks presents a problem, particularly in light duty vehicles.

Refueling systems at service stations are very expensive to install and are few in numbers. This forms a "vicious circle" with the relatively few natural gas motor vehicles manufactured for sale and the low-level of consumer demand. Most successful natural gas vehicles are based in fleets; these include delivery vans and buses for mass transit and airport parking lots that return to a home base fueling location.

[47] It has been argued that U.S. support for ethanol production is driven by large agribusiness (in particular, *Archer Daniels Midland). If ethanol subsidies were rescinded, the use of this fuel could diminish.*

9.5.4.1. Implications of Implementation

Significant market deployment of natural gas vehicles would increase use of CNG, decrease petroleum demand and provide competition for electric drive vehicles. The primary competition would likely be in fleet markets.

Increased use of CNG-powered fleets, operating primarily in urban areas, would also reduce air and water pollution. Because natural gas has a large resource base within the U.S., the use of CNG reduces risk associated with any interruption of petroleum supply and, for the near term due to recent shale gas development, diminishes price volatility for users.

Increased availability of shale gas and potentially lower prices for natural gas could boost this market where it has clear market benefit such as in fleets as noted above.

9.5.5. Hydrogen Fueled Vehicles

Hydrogen has been strongly promoted as a vehicle fuel for over a decade; generally in conjunction with fuel cell power plants that convert the hydrogen to electricity. In contrast to all electric vehicles, refueling can occur quickly. Travel range is improved if both hydrogen and electricity are used, but the availability of hydrogen fueling stations remains an issue.

Currently, most hydrogen in the U.S. is produced from natural gas, so carbon dioxide is a product of the process and may need to be eliminated due to concerns about greenhouse gas emissions. Experimental approaches to capture and sequester carbon dioxide produced along with hydrogen, in conjunction with other environmental efforts (e.g., clean coal), are nascent and not ready for commercial deployment.

9.5.5.1. Market Penetration

Hydrogen fuel cell automobiles and buses have been manufactured for world-wide demonstrations including in Arkansas. The vehicle fuel tank volume associated with hydrogen storage is a concern, especially for smaller vehicles with limited on-board storage. The cost of the vehicles and their refueling infrastructure may also limit sales. Like CNG vehicles, fleet use appears to be a viable early application. While U.S. government support for hydrogen has waned, vehicle manufacturers forecast hydrogen-fuel automobile introduction within the next decade.

9.5.5.2. Implications of Implementation

Since hydrogen can be produced using natural gas; or through renewable sources such as solar, wind power, or algae processing, it reduces dependence on foreign sources of petroleum. The vehicle itself emits no emissions although carbon dioxide is produced when natural gas is the source.

The development of hydrogen fuel cell and hybrid-electric vehicles are complementary because fuel cell technology is compatible with electric drives. Indeed, the EIA counts electric-hybrid/hydrogen as AFV, but accounts for petroleum/electric hybrids as a “non-Alternative,” bridging technology. In the long-term, fuel cell/electric hybrids will probably compete with petroleum/electric and plug-in hybrids for market share.

Until and unless renewable sources of hydrogen are fully commercialized, the major source of hydrogen will be production from natural gas, so natural gas consumption will increase and petroleum production will decrease. Other than competition with electric drive vehicles, there will be little effect on electricity

except for electricity consumed in hydrogen production and storage (compressor power for gaseous storage or liquefaction power for liquid storage).

9.6. Conclusions

Taken as a whole, new and emerging technologies present fascinating opportunities for enhancing energy reliability. The most advanced sectors in terms of energy assurance are wind in the bulk power area and alternative vehicles in the transportation area. The former seems to be within an acceptable range of market competitiveness and, if storage and dispatchability issues are solved, could become another power source of choice for utilities. The latter has been backed by increasing automobile advertising since 2005 and now enjoys federal support to create green jobs. Even more important, the price of motor fuel appears to be rising sufficiently over time to increase the competitiveness of alternatively-fueled vehicles.

Serious issues of dispatchability and the cost of penetrating the market affect almost all other alternatives. Ethanol may be an exception but critics of that fuel hold that, without federal subsidy and political influence from powerful agricultural interests, the market penetration of ethanol could diminish rapidly. Waste-stream fuel has been able to justify its growth in the market because it reduces other hard costs for disposing of wastes and maintaining landfill operations. Water power continues to be useful where rivers run. Older facilities are already economically written off so the continuity of such units is assured as long as they can be maintained economically.

Solar power has yet to achieve market parity. As of 2010, this power source was heavily subsidized by federal and state tax credits in many states. Even with such support, the cost of solar power exceeds the range acceptable to most homeowners. Paybacks take a long time and the long-range viability of this equipment to function for a very long payback period is moot. Perhaps the most promising use of solar power for energy assurance is for hardening of government and other emergency facilities whose mission is critical for energy restoration or other critical (e.g., health and telecommunications) societal needs, especially during emergencies.

10. Communication Protocol

Figure 10.1 – Potential Public Information Steps for State Government

Phase	Suggested Response for AEO
Early Warning	• Review and reinforce communications within the state and ascertain that everyone understands their role, what can and cannot be said, and by whom • Work with APSC and ADEM to inform the Governor's office • Keep Governor's staff and legislative offices informed • Review/prepare graphic energy market presentations and other materials to explain consumption patterns and anomalies • Work with APSC to provide helpful conservation and mitigation advice to the public • Continue to acquire supply & demand data • Coordinate with ADEM on media contacts in order to help reporters (especially newly assigned) understand basic energy facts and issues • Review weather forecasts often
Pre-Emergency Declaration	• Maintain information actions per above • Coordinate with APSC, ADEM and LDCs to draft energy conservation recommendations if shortage is predicted to increase • Work with natural gas utilities on heating issues to provide media advisories on setting back thermostats, using cooking fuel wisely, checking heating equipment and conserving hot water • Consider public meetings and use of the Internet as appropriate • Share state energy data with other states, NASEO and DOE, as needed • The Governor may make follow-up announcements to assure the public and to encourage continued cooperation and compliance • Estimate the probability and timing of greater shortage • Prepare briefings on possible supply and demand restraint measures should shortage intensify
Emergency Declared	• Maintain information actions per above • Assist APSC and ADEM with media briefings (sometimes in conjunction with energy stakeholder representatives) • Develop follow-up messages from Governor to assure public and to maintain compliance • APSC and ADEM (in coordination/conjunction with the Governor's office or others) announces enforcement actions, if any

10.1. Electricity

In the event of an extended disruption of electric service, the AEO will coordinate with other State Agencies to assist in public information related to the extended disruption of electric service. Figure 10.1 lists examples of coordinating activities which may be helpful.

Figure 10.1 – Examples of Possible Coordinating Activities Between the AEO and Other State Agencies

Phase	Suggested Response (may be undertaken by AEO or others)
Monitoring	• Review and reinforce communications within the state and ascertain that everyone understands their role, what can and cannot be said, and by whom • Inform ADEM and APSC if AEO is aware of cross-cutting shortage impacts such as gasoline fuel pump or natural gas pipeline pump failure due to electricity outage • Work with APSC and ADEM and inform the Governor's office • Keep Governor's staff and legislative offices informed • Review/prepare energy market presentations and other materials to explain consumption patterns and anomalies with special attention to graphic displays • Provide public relations officers with regular updates approved by APSC • Coordinate with the APSC and ADEM on media contacts in order to help reporters (especially newly assigned) understand basic energy facts and issues • Review weather forecasts
Interruptions or Loss Affecting a Limited Number of Communities	• Maintain information actions per above • Coordinate with ADEM, and EDC to draft energy conservation recommendations if shortage/disruption is predicted to increase • For heating issues, work in coordination with APSC and electric utilities to provide media advisories on setting back thermostats, using cooking fuel wisely, checking heating equipment and conserving hot water • Consider public meetings and use of the Internet as appropriate • Share state energy data with distribution associations, other states, NASEO and DOE as needed • Coordinate with APSC to estimate the probability and timing of greater shortage/disruption • Prepare briefings on possible supply and demand restraint measures should shortage/disruption intensify
Statewide Disruption	• Maintain information actions per above • Assist APSC and ADEM with media briefings (sometimes in conjunction with energy stakeholder representatives) • Develop follow-up messages from Governor to assure public and to maintain compliance • APSC and ADEM (in coordination/conjunction with the Governor's office or others) announces enforcement actions if any

10.2. Natural Gas

In the event of an extended natural gas disruption or shortage, the AEO will coordinate with other State Agencies to assist with public information related to the extended natural gas disruption or shortage. Figure 10.2 lists examples of coordinating activities which may be helpful.

Figure 10.2 – Examples of Possible Coordinating Activities between the AEO and Other State Agencies

Phase	
Early Warning	• Review and reinforce communications within the state and ascertain that everyone understands their role, what can and cannot be said, and by whom • Work with APSC and ADEM to inform the Governor's office • Keep Governor's staff and legislative offices informed • Review/prepare graphic energy market presentations and other materials to explain consumption patterns and anomalies • Work with APSC to provide helpful conservation and mitigation advice to the public • Continue to acquire supply & demand data • Coordinate with ADEM on media contacts in order to help reporters (especially newly assigned) understand basic energy facts and issues • Review weather forecasts often
Pre-Emergency Declaration	• Maintain information actions per above • Coordinate with APSC, ADEM and LDCs to draft energy conservation recommendations if shortage is predicted to increase • Work with natural gas utilities on heating issues to provide media advisories on setting back thermostats, using cooking fuel wisely, checking heating equipment and conserving hot water • Consider public meetings and use of the Internet as appropriate • Share state energy data with other states, NASEO and DOE, as needed • The Governor may make follow-up announcements to assure the public and to encourage continued cooperation and compliance • Estimate the probability and timing of greater shortage • Prepare briefings on possible supply and demand restraint measures should shortage intensify
Emergency Declared	• Maintain information actions per above • Assist APSC and ADEM with media briefings (sometimes in conjunction with energy stakeholder representatives) • Develop follow-up messages from Governor to assure public and to maintain compliance • APSC and ADEM (in coordination/conjunction with the Governor's office or others) announces enforcement actions, if any

If a natural gas shortage were to continue for an extended time, the state may wish to invoke energy emergency mitigation measures. Illustrative examples of possible mitigation measures are listed in Appendix M.

10.3. Petroleum

10.3.1. Public Relations

The first suggested measure is public information. Energy shortages require public explanations. Most small events are not reported in the media. But any event can come to the media's attention regardless of how many customers are affected or the time it takes to restore the system. For example, a small event in downtown Little Rock may be reported by media while a similar event in a suburb or rural area might be ignored. An event affecting several hundred customers may or may not be reported; an event affecting thousands is likely to be. People will turn to the media for answers and the media may query both company and state officials.

The public will expect energy companies and government in Arkansas to provide accurate information without exacerbating the situation. Most citizens can manage short-term outages and, although annoyed, will be patient. Over the years, most energy companies and governments have learned the value of being forthright when discussing energy interruptions. Lack of candor can turn public opinion against energy providers and government thus diminishing cooperation during restoration.

10.3.1.1. Media Preparation

The keys to successful media relations are planning, preparation and training. Maintaining updated information on normal energy consumption patterns is the first step toward accurate reporting of a shortage. When a petroleum shortage occurs, AEO may first contact affected energy-provider distribution associations in order to learn the cause and assess the situation. If an energy shortage develops slowly, state officials will have time to prepare and check facts. Equally important, preparation permits government responders to interpret what is learned from energy companies. This enhances government's perspective and ability to assist as needed.

A useful part of preparation for an energy emergency is regular staff training that includes practice in media relations. This involves gathering data under pressure, completing analyses rapidly, and conveying complex information effectively. Those who answer media questions will benefit by participating in media response simulation training.

10.3.2. Coordinating Information

AEO will work in coordination with ADEM and other to brief senior state officials and perhaps reply directly to energy emergency questions from the media. Energy providers and associations also will respond to the media. The Governor may choose to meet the media as well. ADEM is prepared to coordinate in order to avoid contradictory and confusing statements.

Preparing and coordinating public relations materials and protocols for a petroleum shortage is the same for other energy forms as well. AEO should anticipate that not all stakeholders will be equally prepared or sufficiently knowledgeable to speak about or provide advice on energy matters. It is always prudent to coordinate and cooperate in order to provide a timely and consistent message for the Governor, to the general public and neighboring states.

Figure 10.3 – Public Relations Response Levels

Phase	Suggested Response for AEO
Early	• Review and reinforce communications within the state and ascertain that everyone understands their role, what can and cannot be said, and by whom • Work with ADEM and inform the Governor's office • Keep Governor's staff and legislative offices informed • Review/prepare graphic energy market presentations and other materials to explain consumption patterns and anomalies • Provide ADEM public relations officer with regular approved updates • Continue to acquire supply & demand data • Coordinate with the ADEM on media contacts in order to help reporters (especially newly assigned) understand basic energy facts and issues • Review news and weather forecasts often • Counsel local governments to arrange credit with oil companies (especially major suppliers) well in advance of an anticipated shortfall, because companies may not approve such credit expeditiously.
Tightening	• Maintain information actions per above • Coordinate with ADEM, and distribution industry associations to draft energy conservation recommendations if shortage is predicted to increase • For propane issues, work with AOMA and/or APGA to provide media advisories on setting back thermostats, using cooking fuel wisely, checking heating equipment and conserving hot water • For vehicle issues, provide driving tips in coordination with Arkansas Department of Highway and Transportation (ADHT), Arkansas Motor Vehicle Commission (AMVC),State Police, AOMA and APGA • Consider public meetings and use of the Internet as appropriate • Share state energy data with distribution industry associations, other states, NASEO and DOE as needed • The Governor may make announcements to assure the public and to encourage continued cooperation and compliance • Estimate the probability and timing of a greater shortage • Prepare briefings on possible supply and demand restraint measures should shortage intensify
Serious	• Maintain information actions per above • Assist ADEM with media briefings (sometimes in conjunction with energy stakeholder representatives) • Develop follow-up messages for the Governor to assure public and to maintain compliance • ADEM (in coordination/conjunction with the Governor's office or others) announces enforcement actions if any

Appendices

APPENDIX A

RULES AND REGULATIONS FOR THE IMPLEMENTATION AND OPERATION OF THE ARKANSAS STATE SET-ASIDE PROGRAM UNDER THE ARKANSAS EMERGENCY PETROLEUM SET-ASIDE ACT OF 1983 (as amended) ACA 15-72-801 et. seq. September, 2007

SECTION 1. POLICY AND PURPOSE

A. The following rules and regulations of the Arkansas Energy Office, a division of the Arkansas Economic Development Commission, are promulgated pursuant to ACA §15-702-804 (a) (1)-(2) of the Arkansas Emergency Petroleum Set-Aside Act (ACA §15-72-801 et. seq.) and the Arkansas Administrative Procedure Act (25-15-201 et. seq. as amended).

B. It is the purpose of these rules and regulations, and it is hereby declared to be the policy of the Arkansas Energy Office:

1. to provide for the orderly operation of the state authorized program;

2. to implement said set-aside program whenever the Governor, in his discretion, finds that such a program is necessary to manage a shortage of petroleum products which threatens the continuation of emergency services and essential industrial or agricultural activities;

3. to prevent duplication of state and federal regulatory requirements;

4. to implement only that portion of the set-aside program (with regard to the number of petroleum products covered) as is deemed necessary by the Governor to manage the existing shortage; and

5. to terminate the set-aside program as soon as the Governor finds that it is no longer necessary to manage a shortage.

SECTION 2. DEFINITIONS

When used in these regulations:

“Act” means the Emergency Petroleum Set-Aside Act ACA §15-72-801 et. seq.

“Agricultural Activities” means commercial farming, dairy, poultry, livestock, horticulture, forestry and aquaculture activities and services directly related to the planting, cultivation, harvesting, milking, processing and distribution of fiber, timber and food intended for human consumption and animal feed.

"Assignment" means an action taken by the Arkansas Energy Office, designating that a prime supplier or broker of petroleum products supply them to an authorized consumer, dealer, wholesale purchaser-consumer or wholesale purchaser-reseller to facilitate relief of emergency or hardship needs pursuant to ACA §15-72-804 of the Act.

"Blended Fuels" are mixtures composed primarily of gasoline or diesel fuel that may have additional alternative fuels blended into the petroleum products in varying percentages. For diesel fuel, B2, B5, B20 or similar conventional/biodiesel blends shall be considered to be diesel fuel. For gasoline, E10 or similar gasoline/ethanol blends shall be considered to be gasoline.

"Broker" means a marketer of petroleum products who performs none of the basic marketing functions but normally brings buyer and seller together and receives a fee or commission for his services.

"Bulk User" means any firm that is an ultimate consumer which, as a part of its normal business practices, purchases or obtains a product subject to the state set-aside from a supplier and receives delivery of that product into a storage tank substantially under the control of that firm at a fixed location.

"Consumer" or "End User" means any individual, trustee, agency, partnership association, corporation, company, municipality, political subdivision or other legal entity which purchases petroleum products for ultimate consumption in Arkansas.

"Dealer" or "Retailer" means and includes any person or firm engaged in the business of selling petroleum products at retail.

"Director" means the Director of the Arkansas Energy Office who serves under the consent of the Executive Director of the Arkansas Economic Development Commission.

"Electronic Transmission" means any process of communication that does not directly involve the physical transfer of paper and that is suitable for the retention, retrieval and reproduction of information by the recipient.

"Emergency" or "Hardship" means any situation which, in the judgment of the Arkansas Energy Office, presents a threat to the economic, social or personal welfare of the areas, regions or individual users for which an assignment from the state set-aside is requested.

"Emergency Services" means vital services, including but not limited to, law enforcement, firefighting, medical care, sanitation, etc.

"Executive Director" means the Executive Director of the Arkansas Economic Development Commission.

"Firm" means any association, company, corporation, estate, individual, joint venture, partnership, or sole proprietorship or any entity however organized, including charitable, or education institutions and the Federal Government, including federal corporations, departments and agencies and state and local governments.

"Industrial Activities" means all industrial activities which create or change materials into another form as well as commercial activities involving the sale of goods and services.

“Jobber of Petroleum Products” means any firm or any part or subsidiary of any firm, other than the United States Department of Defense, which supplies, sells, transfers, or otherwise furnishes any allocated product to wholesale purchasers or end-users.

“Petroleum Products” means propane, motor gasoline, blended fuels, kerosene, #2 fuel oil, diesel fuel, kerosene-base jet fuel, naphtha-base jet fuel, and aviation gasoline.

“Petroleum Wholesaler” means any firm or any part or subsidiary of any firm, other than the United States Department of Defense, which supplies, sells, transfers, or otherwise furnishes any allocated product to wholesale purchasers or end-users.

"Prime Supplier" means the supplier which makes the first sale of any petroleum product subject to the state set-aside into the state distribution system for consumption within the state. Notwithstanding the above, "Prime Supplier" shall not include any firm, or any part or subsidiary of any firm, which supplies, sells, transfers or otherwise furnishes any allocated product exclusively to utilities for generation of electric energy.

"Purchaser" means a wholesale purchaser or consumer, or both.

"Reference Month" means the calendar month and year to which the reported information on actual sales volume relates.

"Set-Aside" means, with respect to a particular prime supplier, the amount of petroleum product which is made available from the total supply of a prime supplier, pursuant to the provisions of ACA 15-72-804 of the Act, for utilization by the Arkansas Energy Office to resolve emergencies and hardships due to shortages or other dislocations in petroleum distribution systems.

"Supplier" means any firm or any part or subsidiary of any firm other than the United States Department of Defense, which supplies, sells, transfers or otherwise furnishes any allocated product to wholesale purchasers or end-users, including but not limited to refiners, importers, resellers, brokers, jobbers and retailers. Notwithstanding the above, "Supplier" shall not include any firm, or any part or subsidiary of any firm, which supplies, sells, transfers or otherwise furnishes any allocated product exclusively to utilities for generation of electric energy.

"Undue Economic Burden" means, as used in ACA §15-72-804 (d) (2) (B) of the Act, any assignment which, in the judgment of the Arkansas Energy Office, creates an extraordinary and financially prohibitive burden on a prime supplier or broker. Such judgments by Arkansas Energy Office personnel shall take into account written evidence of such a burden furnished by the prime supplier or broker involved.

"Wholesale Purchaser" means a wholesale purchaser-reseller or wholesale purchaser-consumer, or both.

"Wholesale Purchaser-Consumer" means any firm that is an ultimate consumer which, as a part of its normal business practices, purchases or obtains a product subject to the state set-aside from a supplier and receives delivery of that product into a storage tank substantially under the control of that firm at a fixed location.

“Wholesale Purchaser-Reseller" means any firm, including dealers, which purchases, receives through transfers or otherwise obtains, as by consignment, a product subject to the state set-aside and resells or otherwise transfers it to other purchasers without substantially changing its form.

SECTION 3. ESTABLISHMENT OF STATE SET-ASIDE SYSTEM

A. Percentage of Products Set-Aside

1. The monthly set-aside percentages applicable to prime suppliers and brokers for petroleum products subject to the set-aside program shall be as follows:

Motor Gasoline	5 percent
Diesel Fuel	4 percent
Kerosene	4 percent
#2 Fuel Oil	4 percent
Aviation Gas	5 percent
Jet Fuel (kerosene base)	5 percent
Jet Fuel (naphtha base)	5 percent
Propane	3 percent

B. Volume in Set-Aside System

1. The set-aside volume available to the Arkansas Energy Office for any particular month when the program is in effect shall be calculated as the product of the monthly set-aside percentage multiplied by each prime supplier’s or broker’s reported delivery for the most recent reference month.

C. Notification of Prime Suppliers and Brokers by Arkansas Energy Office

1. The Director shall notify each prime supplier or broker of the adoption of these rules and regulations and of the set-aside percentage applicable to each product by mailing them a copy thereof.

D. Designation of Representative by Prime Suppliers and Brokers

1. Each prime supplier or broker subject to the state set-aside program shall designate a representative to act for and in behalf of the prime supplier or broker, with respect to the set-aside program. Each prime supplier or broker shall notify the Arkansas Energy Office in writing of that designation within ten (10) business days of the date of this notification, of such designation. Change of the designated company representative shall be transmitted to the Arkansas Energy Office by the prime supplier or broker within ten (10) business days of the effective date of the change. This communication may be by U.S. Postal Service or electronic transmission.

SECTION 4. APPLICATIONS FOR ASSIGNMENTS

A. Who May Apply

1. A wholesale purchaser-consumer, dealer or end-user seeking an assignment from the state set-aside system to meet a qualifying hardship or emergency requirement, and a wholesale purchaser-reseller seeking an assignment to enable him to supply dealers, wholesale purchaser-consumers and end-users to meet qualifying hardship or emergency requirements, may apply for an assignment from the state set-aside program when the program is in effect.

B. What to File

1. Each applicant for an assignment from the state set-aside program must submit a completed and signed Application to State for Petroleum Product Hardship or Emergency Relief. This application may be submitted by US Postal Service or electronic transmission.

2. Each application submitted may request only one type of petroleum product and shall apply only for the month specified.

C. Where to File

1. Applications must be filed with the:

Arkansas Energy Office
Arkansas Economic Development Commission
900 West Capitol Avenue, Suite 400
Little Rock, Arkansas 72201.

2. Or filed by electronic transmission.

SECTION 5. PROCEDURES FOR ASSIGNMENTS

A. Order and Timing for Processing of Applications

1. Each application shall be dated and assigned a case number indicating the order in which it has been received and will be processed.

2. The Arkansas Energy Office reserves the right to depart from the procedure described in subsection A (1) above when required by extraordinary circumstances.

3. As a general rule, all applications will be processed, and orders will be issued, as quickly as possible. In no event shall a decision on an order be delayed more than ten (10) business days from the date assigned to it unless:

a. additional information is required for any reason;

b. no product is available from the state set-aside system; or

c. the applicant is a dealer with an allocation from his regular supplier, in which case such decision may take longer to insure that needs of priority users can be met.

B. Records

1. Records shall be maintained in which the numbered applications, names of suppliers, brokers, distributors, and applicants, as well as the type and amount of petroleum products requested, will be stored.

C. Evaluation

1. No assignment shall be made to applicants who can obtain sufficient amounts of petroleum products through normal supply channels, but are unwilling to pay the selling price.

2. No assignment shall be made unless the justification and product end-use stated indicate, in the judgment of the Arkansas Energy Office, that an emergency or hardship exists relating to the continuation of:

   a. emergency services; or
   b. essential agricultural activities; or
   c. essential industrial activities, as defined herein.

3. If at any time during a given month applications are expected to exceed remaining product in the set-aside system, applicants may be granted relief based upon a pro-rata share of the remaining product and in consideration of the following priority uses (without regard to order listed below):

   a. agricultural production including perishable agricultural commodity transport and distribution
   b. aviation ground support vehicles and equipment
   c. cargo, freight and mail hauling by truck
   d. communications companies
   e. emergency medical services
   f. energy production and energy suppliers
   g. firefighting units
   h. government critical maintenance activities or mission-essential Department of Defense requirements
   i. health care facilities
   j. law enforcement
   k. marine shipping (commercial shipping on navigable state waterways)
   l. public and community and school transportation
   m. public utility services (including water and sanitation)

D. Investigations

1. In evaluating applications for assignments from the set-aside system, the Arkansas Energy Office may initiate an investigation of any statement or justification made

therein and may take into account any relevant information obtained from such investigation in its decision-making process.

E. Amount of Product Assigned

1. In evaluating the amount of a particular petroleum product to be assigned, the Arkansas Energy Office may consider, among other things, the following:

    a. amount of a particular product available in the total set-aside system for the month;
    b. number of applications received to date for that particular supplier or broker;
    c. amount requested;
    d. historical demand;
    e. growth factors;
    f. daily consumption; and
    g. storage capacity.

F. Assignment

1. Upon consideration of an application and other relevant information, the Arkansas Energy Office shall issue an assignment granting or denying the applicant's requests.

2. The assignment shall include the following:

    a. a brief statement summarizing the action taken, including comments;

    b. a statement indicating that it is effective for ten (10) business days from date of issuance;

    c. a statement indicating the process by which a person aggrieved by the order may appeal it; and

    d. a statement directing the prime supplier or broker to furnish the product assigned through the distributor (if identified) or the applicant named therein.

G. Notification

1. The Arkansas Energy Office shall serve a copy of an assignment authorizing an application upon the applicant, the prime supplier or broker, and the distributor (if identified).

2. The Arkansas Energy Office shall notify applicants of decisions denying an application.

3. The Arkansas Energy Office may follow up the notification process described above with additional communications in order to expedite the delivery of product and to insure that such delivery is made within the required ten (10) business day period.

H. Supply Lines

1. To the maximum extent possible, historic supply lines will be honored. If it becomes necessary for supply lines to be crossed in order to assist an otherwise qualified applicant, the Arkansas Energy Office may require any supplier or broker having product in the state set-aside system to supply said applicant (provided that said applicant can satisfy the existing credit, insurance, or other reasonable requirements, of the prime supplier or broker involved). This provision shall apply in extraordinary cases only.

I. Suppliers Responsibilities

1. Suppliers shall provide the assigned amount of a product subject to the set-aside program to an applicant upon receipt of a duly authorized assignment from the Arkansas Energy Office, unless the assignment(s) creates an undue economic burden as defined in ACA §15-72-804 (d)(2)(B) of the Act.

2. A duly authorized assignment(s) shall entitle the applicant to receive product from any reasonably convenient local wholesale purchaser-reseller of the prime supplier or broker from which the set-aside assignment has been made.

3. Wholesale purchaser-resellers of prime suppliers or brokers shall, as non-prime suppliers, honor such duly authorized assignment(s) upon presentation, and shall not, without good cause, delay deliveries required by said authorized assignment(s). Such deliveries should be confirmed with the prime supplier or broker.

4. Any non-prime supplier which provides an allocated product pursuant to an authorized assignment(s) from the Arkansas Energy Office shall in turn receive from its supplier or broker an equivalent volume of the allocated product which shall not be considered part of its allocation entitlement.

SECTION 6. APPEAL

A. Purpose and Scope

1. This section establishes the procedure for the filing of an administrative appeal of state set-aside orders issued by the Arkansas Energy Office.

2. A person has not exhausted the administrative remedies until an appeal has been filed and an order granting or denying the appeal has been issued.

3. If the Director of the Arkansas Energy Office is unable to conduct an administrative appeal, the authority for conducting said administrative appeal shall revert to the Executive Director of the Arkansas Economic Development Commission or his or her designee.

B. Who May File

1. A wholesale purchaser-consumer, dealer or end-user seeking an assignment from the state set-aside system to meet a qualifying hardship or emergency requirement, and a wholesale purchaser-reseller seeking an assignment to enable him to supply dealers, wholesale purchaser-consumers and end-users to meet qualifying hardship or emergency requirements who is wholly denied or partially denied an assignment of the requested amount may file an administrative appeal.

2. Any person, company, organization, agent of said company or organization acting with authority of said company or organization who has been aggrieved by a decision from the Arkansas Energy Office who is filing an appeal under this section shall submit a signed, written document entitled "Appeal of Order" which shall be clearly labeled as such.

    a. An appeal can be granted on the grounds that the assignment was wholly denied, or partially denied.

    b. If the appellant wishes to claim confidential treatment for any information contained in the appeal, the appellant shall file together with the appeal a second copy of the document from which has been deleted the information for which such appellant wishes to claim confidential treatment. The appellant shall indicate in the original document that it is confidential or contains confidential information and shall file a statement specifying the justification for non-disclosure of such information.

C. Where to File

1. Appeals from state set-aside orders shall be filed with:

    Director
    Arkansas Energy Office
    Arkansas Economic Development Commission
    900 West Capitol Avenue, Suite 400
    Little Rock, Arkansas 72201.

D. Notice

1. The appellant shall send, in such manner that it shall be received within five (5) business days after the filing of an appeal, a copy of the appeal and any subsequent amendments or other documents relating to the appeal, or a copy from which confidential information has been deleted in accordance with this section and 10 CFR 205.9(f), to each person who is reasonably ascertained by the appellant as a person who will be aggrieved by the action sought, including those who participated in the prior proceedings. The copy of the appeal shall be accompanied by a statement that the

person may submit comments regarding the appeal to the Director within five (5) business days from the time of receipt.

2. The appeal shall include certification that the appellant has complied with the requirements of this section and shall include the names and addresses of each person to whom a copy of the appeal was sent.

3. Notwithstanding the provision of Section 6 (D) (1) and (2) above, if an appellant determines that compliance with Section 6 (D) (1) and (2) would be impracticable, the appellant shall:

    a. comply with Section 6 (D) (1) and (2) above with regard to those persons whom it is reasonable and possible to notify;

    b. include with the appeal a description of the persons or classes of persons to whom notice was not sent; and

    c. the appellant may be required to provide additional or alternative notice if it is determined that the notice required by Section 6 (D) (1) and (2) above is not practicable.

E. Contents

1. The Appeal shall contain a concise statement of the grounds upon which it is brought and a description of the relief sought.

2. A copy of the order that is the subject of the appeal shall be submitted with the appeal.

F. Evaluation of Appeal

1. Before the appeal is reviewed, the Director shall give notice to the appealing party the issues upon review. These will be the only issues that the Director will grant a decision on. The Director may give this notice by US Postal Service or electronic transmission.

2. Processing

    a. The Director may initiate an investigation of any statement in an appeal and utilize in its evaluation any relevant facts obtained by such investigation. The Director may solicit and accept submissions relevant to any appeal provided that the appellant is afforded an opportunity to respond to all submissions. In evaluating an appeal, the Director may consider any other source of information.

    b. If the Director determines that there is insufficient information upon which to base a decision and if, upon request, the necessary additional information is not submitted, the Director may dismiss the appeal with leave to amend within a specified time. If the failure to supply additional information is repeated or

willful, the Director may dismiss the appeal with prejudice. If the appellant fails to provide the notice required under this section without a showing it was for good cause, the Director may dismiss the appeal with prejudice.

c. A hearing will take place within five (5) business days of granting the appeal if appealing party so requests. There the appealing party can state their argument orally and produce additional evidence. All other parties in interest will have a chance to be present and give an oral argument. Notice shall be given by the Director to all persons originally notified under D of this section. The Director may give notice by US Postal Service or electronic transmission.

3. Criteria

a. An appeal may be summarily denied if:

i. it is not filed within ten (10) business days from receiving notice of a judgment from the Arkansas Energy Office, unless good cause is shown; or

ii. it is defective on its face for failure to state, and to present facts and legal arguments in support thereof, that the Arkansas Energy Office's action was erroneous in fact or in law, or that it was arbitrary or capricious.

b. The Director may deny an appeal if the applicant does not establish that:

i. the appeal was filed by a person aggrieved by the Arkansas Energy Office's action;

ii. the Arkansas Energy Office's action was erroneous in fact or in law; or

iii. the Arkansas Energy Office's action was arbitrary or capricious.

c. The denial of an appeal shall be a final order of the Arkansas Energy Office of which judicial review may be sought by the appellant.

G. Decision and Order

1. The possible outcomes of an appeal are:

a. reverse prior Arkansas Energy Office decision and grant requested fuel assignment; or

b. modify prior Arkansas Energy Office decision; or

c. affirm the prior Arkansas Energy Office decision.

2. Upon consideration of the appeal and other relevant information received or obtained during the proceeding, the Director shall enter an appropriate order, which may include the modification of the order that is the subject of the appeal.

3. The order shall include a written statement setting forth the relevant facts and the legal basis of the order. The order shall state that it is a final order of the Arkansas Energy Office from which the appellant may seek judicial review.

H. Timeliness

1. When the Director has received all substantive information deemed necessary to process any appeal filed under this section, the Director shall serve notice of that fact upon the appellant and shall take action on the appeal within five (5) business days of serving such notice.

SECTION 7. RELEASE OF STATE SET-ASIDE

A. At any time during the month, the Director may order the release of part or all of the prime supplier's or broker's set-aside volume through the prime supplier's or broker's normal distribution system in accordance with ACA §15-72-804(f) (1)-(3) of the Act.

SECTION 8. TERMINATION OF SET-ASIDE PROGRAM

A. The set-aside program shall remain in effect for a period of 120 days from the date the Governor directs the Arkansas Energy Office to implement it, and shall automatically terminate thereafter, unless:

1. the Governor directs that the program should be extended for an additional 30 days because it is still necessary to manage a shortage of petroleum products; or

2. the Governor finds that the program is no longer necessary to manage a shortage of petroleum products and directs that the program be terminated prior to the expiration of said 120-day period.

B. The Arkansas Energy Office shall be responsible, in consultation with other state agencies, representatives of the petroleum industry, appropriate legislative committees, and other interested parties, for providing the Governor with timely data on the status of the supply and distribution of petroleum products in this state in order to assist in the decision-making process described in Sub-section 8(A) above.

SECTION 9. REPORTING FORMS

A. In the event the Governor declares an energy emergency, upon notification each prime supplier or broker of petroleum products shall file with the director, no later than 20 calendar days after the close of each reference month, a report providing the actual sales (the total volume sold and delivered into the state for consumption) for the reference month. This report may be filed by electronic transmission.

B. The Arkansas Energy Office may require that said data shall be provided by each prime supplier and broker on an on-going monthly basis regardless of whether or not the set aside program has been implemented, using form EIA 782C or equivalent. This information will be required for the duration of the declared energy emergency and may be filed by electronic transmission.

C. Information furnished pursuant to this section shall be treated as confidential in accordance with ACA §15-72-805 of the Act.

SECTION 10. PENALTIES

A. Persons violating any provisions of the Act are subject to criminal and civil penalties as provided herein.

APPENDIX B

Emergency Support Function #12 – Energy Annex

ESF Coordinator:
Arkansas Public Service Commission (APSC)

Support Agencies:
Arkansas Economic Development Commission/Arkansas Energy Office (AEO)
Arkansas Department of Emergency Management (ADEM)
Arkansas State Highway and Transportation Department (AHTD)/Arkansas State Highway Police
Arkansas Department of Environmental Quality (ADEQ)
Arkansas National Guard (AR NG)
Arkansas State Highway and Transportation Department (AHTD)
County Emergency Management Coordinators
U.S. Department of Energy
U.S. Department of Transportation Office of Pipeline Safety
U.S. Department of Homeland Security, Federal Emergency Management Agency
Federal Regulatory Commission
Federal Communications Commission
U.S. Department of Commerce
Private Utility Companies

Authorities and References:

- Arkansas Code Annotated 12-75-101 et al.
- Rules and Regulations for the Implementation and Operation of the Arkansas State Set-Aside Program under the Arkansas Emergency Petroleum Set-Aside Act of 1983, amended in September 2007
- Act 377 of 1983– The Arkansas Emergency Petroleum Set-Aside Act, ACA 15-72-801 et seq.
- Arkansas Code Annotated Title 23. Public Utilities and Regulated Industries
- Act 2017 of 2005 - An Act for the Arkansas Public Service Appropriation for the 2005 – 2007 Biennium

Introduction

Purpose
Emergency Support Function (ESF) #12 – Energy is intended to restore damaged energy systems and components during a potential or actual disaster. Under the leadership of the Arkansas Public Service Commission (APSC), ESF #12 is an integral part of the responsibility to maintain continuous and reliable energy supplies for the State of Arkansas through preventive measures as well as restorative actions.

Scope
ESF #12 collects, evaluates, and shares information on energy system damage and estimations on the impact of energy system outages within affected areas. The term “energy” includes producing, refining, transporting, generating, transmitting, conserving, building, distributing, and maintaining energy

systems and system components. Additionally, ESF #12 provides information concerning the energy restoration process such as projected schedules, percent completion of restoration, geographic information on the restoration, and other information as appropriate.

Policies

- Restoration of normal operations at energy facilities is the responsibility of the facility owners.
- ESF #12 maintains lists of energy-centric critical assets and infrastructures, and continuously monitors those resources to identify and correct vulnerabilities to energy facilities.
- ESF #12 addresses significant disruptions in energy supplies for any reason, whether caused by physical disruption of energy transmission and distribution systems or unexpected operational failure of such systems. ESF #12 also recognizes that damage to telecommunications facilities may disrupt or impair the operation of other utility and energy delivery systems and components.
- ESF #12 addresses the impact that damage to an energy system in one geographic region may have on energy supplies, systems, and components in other regions relying on the same system. Consequently, energy supply and transportation problems can be intrastate, interstate, and international.

Concept of Operations

General

While restoration of normal operations at energy facilities is the primary responsibility of the owners of those facilities, ESF #12 provides the appropriate supplemental State assistance and resources to enable restoration in a timely manner. Collectively, the primary and support agencies that comprise ESF #12:

- Serve as the focal point within State Government for receipt of information on actual or potential damage to energy supply and distribution systems. Sources of such information include news media reports on international conditions indicating an imminent oil embargo, refinery reports that crude oil or product storage levels are low, reports on impending shutdowns of power plants, United States Department of Energy statements, APSC statements and predictions, warnings from regional transmission organizations, utility companies, or regional reliability organizations, ADEM public statements, warnings from petroleum marketing and distribution organizations.
- Serve as the focal point within State Government regarding requirements for system design and operations, and on procedures for preparedness, prevention, recovery, and restoration;
- Advise State and local authorities on priorities for energy restoration, assistance, and supply;
- Assist industry, State, local, and tribal authorities with requests for emergency response actions as they pertain to the State's energy supply;
- Assist departments and agencies by locating fuel for transportation, communications, and emergency operations;
- Recommend actions to conserve fuel and electric power; and
- Provide energy supply information and guidance on the conservation and efficient use of energy to State and local governments and to the public.

Organization

Headquarters

- Provides representatives to the State Emergency Operations Center as required.

- Assesses fuel and electric power damage and energy supply and demand, and identifies requirements to repair energy systems.
- Coordinates with other ESFs to provide timely and accurate energy information, recommends options to mitigate impacts, and coordinates repair and restoration of energy systems.
- In coordination with State and local governments, APSC prioritizes plans and actions for the restoration of energy during response and recovery operations.

Local
Local governments have primary responsibility for prioritizing the restoration of energy facilities.

Private Sector
- The private sector owns and operates the majority of the State's energy infrastructure and participates along with the APSC in developing best practices for infrastructure design and operations.
- The private sector normally takes the lead in the rapid restoration of infrastructure-related services after an incident occurs. Appropriate entities of the private sector are integrated into ESF #12 planning and decision making processes.

Actions

Pre-Incident
In cooperation with the Energy Sector, ESF #12 develops and, where possible, implements standards for physical, operational, and cyber security for the energy industry.

ESF #12 conducts energy emergency exercises with the energy industry, States, and local governments to prepare for energy and other emergencies.

Incident
- APSC assesses the energy impacts of the incident, including resources needed, via Emergency Incident and Disturbance Reports from the electric power industry, and provides assessments of the extent and duration of energy shortfalls.
- Provides representation to the State Emergency Operations Center and/or the JFO as required.
- Coordinates fuel movement into shortage areas, equitable resource distribution, and utility service restoration.
- Coordinates with ESF #1 to obtain information regarding pre-designated transportation/evacuation routes in order to determine the location of fuel supplies (primarily gasoline and diesel fuels). Considerations will include availability of fuel for individuals who are self-evacuating, availability of fuels for government-supplied transportation vehicles, and provision of fuel to emergency response vehicles along transportation/evacuation routes.
- Reduces energy consumption through established curtailment policies and procedures, and conservation methods such as reducing speed limits, shortening work weeks, telecommuting, etc.

Post-Incident

- Participates in post-incident hazard mitigation studies to reduce the adverse effects of future disasters.
- When requested, assists the Arkansas Department of Emergency Management (ADEM) in determining the validity of disaster-related expenses for which the energy industry is requesting reimbursement based upon the Stafford Act.

Responsibilities

Primary Agency:

APSC

- Follow the APSC's established procedures for responding to a disruption of utility service;
- Support and provide timely and accurate information regarding efforts to restore utility service including the repair of any damaged utility systems and components;
- Issue any orders necessary to enable the restoration of utility service (including jurisdictional telecommunications service);
- Serve as a liaison to jurisdictional utilities (including jurisdictional telecommunications utilities);
- Work closely with AEO and ADEM to identify any energy source curtailments or interruptions that may affect the provision of utility service;
- Work closely with identified federal agencies to support the restoration of utility service following any disruption of utility and other energy delivery systems and components; and
- Provide representation in the State EOC as needed
- With AEO, will maintain responsibility for the content of this ESF and will review and revise the same on at least an annual basis.

Support Agencies:

Agency	Function
Arkansas Energy Office	• Implement AEO's established plans and procedures for responding to an energy crisis; • Monitor energy related issues to preclude a surprise energy shortage; • Work closely with the APSC to identify any utility issues that may affect other energy sources; • Coordinate with the Department Of Energy and develop procedures for responding to national or regional energy shortages; • Provide representation in the State EOC as needed • With APSC, will maintain responsibility for the content of this ESF and will review and revise the same on at least an annual basis. • Will administer the Petroleum Set-Aside Program during a declared petroleum emergency. The AEO has resources to provide public information (and to respond to inquiries) on energy related matters.

Arkansas Department of Emergency Management	• Inform AEO and APSC of any development during an emergency or disaster that may affect utility or other energy delivery systems or components; • Coordinate with APSC and utilities on restoration of telephone, water, gas and electric power for essential facilities; • Incorporate the content of the ESF properly into the Arkansas State Emergency Operations Plan.
Arkansas Army National Guard	• Emergency Debris Clearance – National Guard personnel and equipment may be utilized to open an access path into the disaster area for emergency vehicles. • Emergency Restoration of Facilities – The National Guard has limited engineering personnel and equipment that can be used to facilitate the commercial restoration of vital utilities, roads, etc. • Other Resources – The National Guard also has other resources such as generators that are available, when commercial power is lost for an extended period.
Arkansas Department of Environmental Quality	• Provide regulatory guidance/assistance to permittees during restoration of energy supplies, services after a disruption of services. • Assist permitted facilities with temporary variances from permit requirements as needed to expedite energy supply/service restoration. • Approve temporary storage, distribution and use of lower grade and or alternate energy supplies and or sources. • Liaison with EPA to coordinate State and Federal regulatory requirements. • Provide assistance with procurement of Federal variances.
Arkansas State Highway and Transportation Department, Arkansas State Highway Police	• Provide assistance with permitting of oversize and overweight loads in the event of a disaster. Provides information regarding pre-designated transportation/evacuation routes so that fuel supplies may be located.
County and Local Governments	• Analyze county and local vulnerability to an interruption of utility or other energy service; • Plan for county and local utility outage or energy shortage
U.S. Department Of Energy	• Implement ESF #12 of the NRF if an emergency shortage develops that cannot be alleviated by the state; • Inform AEO of any incidents that may affect the status of state energy supplies
U.S. Department of Transportation, Office **of** Pipeline Safety	• Follow established procedures and coordinate with the APSC's Pipeline Safety Office in responding to any jurisdictional incident

U.S. Department of Homeland Security, Federal Emergency Management Agency	• Follow established procedures and coordinate with ADEM in determining whether ESF #12, should be activated and whether a request should be made for activation of the National Response Plan ESF #12
Federal Energy Regulatory Commission	• Follow established procedures and coordinate with the APSC in responding to a disaster, either natural or manmade, that damages utility and other energy delivery systems and components, interrupting or constraining supply; and • Issue orders as needed to enable the restoration of utility service
Department of Commerce	• Provide assistance in pipeline safety
Federal Communications Commission	• Follow established procedures and coordinate with the APSC in responding to a disaster, either natural or manmade, that damages utility and other energy delivery systems and components, interrupting or constraining supply; and • Issue orders as needed to enable the restoration of jurisdictional telecommunications service
Utility Companies	• Coordinate with and assist state, county, and local governments during an interruption in service. • Encouraged to build/retrofit for earthquake resistance when possible; develop and maintain recovery plans; provide first responder training to personnel; and to develop Standard Operating Guidelines and Continuity of Operations Plans.

APPENDIX C

2010 Arkansas Energy Profile

http://www.arkansasenergy.org/energy-in-arkansas/energy-data-profile.aspx

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APPENDIX D

Electricity Industry Contact Lists

Investor Owned Utilities

Empire District Electric Company
602 S Joplin Avenue
PO Box 127
Joplin, MO 64802
Electric Service:
Tel: (800) 206-2300
Corporate contact:
Tel: (417) 625-5108
Entergy Arkansas

Entergy
425 West Capitol Ave., 27th Floor
Little Rock, AR 72201
Tel: (501) 377-4434 or (888) 301-5861
Fax: (501) 377-4448
Mailing Address
P.O. Box 551
Little Rock, AR 72203
Director, External Affairs
Tel: (501) 377-4474
Customer service and emergencies:
Tel: (800) 368-3749 (1-800-ENTERGY)

Oklahoma Gas and Electric
Business Address:
OGE Energy Corp
OG&E Electric Services
PO Box 321
Oklahoma City, OK 73101-0321
Emergencies/Report an Outage
Available 24/7 including holidays
Toll Free: (800) 522-6870
Corporate Information
Tel: (405) 553-3000

Southwestern Electric Power Company
(SWEPO)
428 Travis Street
Shreveport, LA 71101-3105
Tel: (318) 222-2141
In Arkansas:
401 N 2nd Street
Rogers, AR 72756-6631
Phone: (479) 636-1650
Customer Solutions Center:
Tel: (888) 218-3919
Other customer service, call: Tel: (888) 216-3523

Regional Transmission Organization

Southwest Power Pool
415 North McKinley, Suite 140 Plaza West
Little Rock, AR 72205-3020
Tel: (501) 614-3200
Fax: (501) 664-9553
questions@spp.org

APPENDIX E

Electric Cooperatives of Arkansas

Distribution Cooperatives

Electric Cooperatives of Arkansas
Your Local Energy Partners

Arkansas Valley Electric Cooperative
1811 West Commercial St.
P.O. Box 47
Ozark 72949-0047
Telephone: (479) 667-2176
Fax: (479) 667-5238
www.avecc.com
District Offices:
Van Buren - (479) 474-8854
Waldron - (479) 637-2151
Pocola, OK - (918) 436-2419

Ashley-Chicot Electric Cooperative
307 East Jefferson St.
P.O. Box 431
Hamburg 71646-0431
Telephone: (870) 853-5212
Fax: (870) 853-2531
www.ashley-chicot.com

C & L Electric Cooperative
900 Church St.
P.O. Box 9
Star City 71667-0009
Telephone: (870) 628-4221
Fax: (870) 628-4676
www.clelectric.com
District Offices:
Dumas - (870) 382-5555
Sheridan - (870) 942-2732

Carroll Electric Cooperative
920 Highway 62 Spur
P.O. Box 4000
Berryville 72616-4000
Telephone: (870) 423-2161
Fax: (870) 423-4815
www.carrollecc.com
District Offices:
Bentonville - (479) 273-2421
Huntsville - (479) 738-2217
Jasper - (870) 446-5114

Clay County Electric Cooperative
300 North Missouri Ave.
P.O. Box 459
Corning 72422-0459
Telephone: (870) 857-3521
Fax: (870) 857-3523
www.claycountyelectric.com
District Office:
Pocahontas - (870) 892-5251

Craighead Electric Cooperative
4314 Stadium Blvd.
P.O. Box 7503
Jonesboro 72403-7503
Telephone: (870) 932-8301
Fax: (870) 972-5674
www.cecc-ark.com
District Offices:
Paragould - (870) 239-2557
Walnut Ridge - (870) 886-1616

Farmers Electric Cooperative
300 Highway 367 North
P.O. Box 708
Newport 72112-0708
Telephone: (870) 523-3691
Fax: (870) 523-6853
www.farmerselec.com

First Electric Cooperative
1000 South JP Wright Loop Rd.
P.O. Box 5018
Jacksonville 72078-5018
Telephone: (501) 982-4545
Fax: (501) 985-4551
www.firstelectric.coop
District Offices:
Benton - (501) 315-7438
Heber Springs - (501) 362-3166
Perryville - (501) 889-2312
Riceland - (870) 673-2695

Mississippi County Electric Cooperative
510 North Broadway
P.O. Box 7
Blytheville 72316-0007
Telephone: (870) 763-4563
Fax: (870) 763-0513
www.mcec.com

North Arkansas Electric Cooperative
225 South Main St.
P.O. Box 1000
Salem 72576-1000
Telephone: (870) 895-3221
Fax: (870) 895-6241
www.naeci.com
District Offices:
Ash Flat - (870) 994-2191
Mountain Home - (870) 425-2141

Ouachita Electric Cooperative
700 Bradley Ferry Rd.
P.O. Box 877
Camden 71711-0877
Telephone: (870) 836-5791
Fax: (870) 836-5794
www.oecc.com
District Office:
Hampton - (870) 798-2811

Ozarks Electric Cooperative
3641 Wedington Dr.
P.O. Box 848
Fayetteville 72702-0848
Telephone: (479) 521-2900
Fax: (479) 444-0943
www.ozarkselec.com
District Offices:
Springdale - (479) 751-2342
Stilwell, OK - (918) 696-7733
Westville, OK - (918) 723-5455

Petit Jean Electric Cooperative
270 Quality Dr.
P.O. Box 37
Clinton 72031-0037
Telephone: (501) 745-2493
Fax: (501) 745-4150
www.pjecc.com
District Office:
Marshall - (870) 448-3477

Rich Mountain Electric Cooperative
515 Janssen Ave.
P.O. Box 897
Mena 71953-0897
Telephone: (479) 394-4140
Fax: (479) 394-1211
www.rmec.com
District Office:
Dierks - (870) 286-2012

South Central Arkansas Electric Cooperative
1140 Main St.
P.O. Box 476
Arkadelphia 71923-0476
Telephone: (870) 246-6701
Fax: (870) 246-8223
www.scaec.com

Southwest Arkansas Electric Cooperative
2904 East 9th St.
P.O. Box 1807
Texarkana 75504-1807
Telephone: (870) 772-2743
Fax: (870) 773-2408
www.swrea.com
District Offices:
Bradley - (870) 894-3329
DeQueen - (870) 642-2737
Nashville - (870) 845-1313

Woodruff Electric Cooperative
3190 N. Washington St.
P.O. Box 1619
Forrest City 72336-1619
Telephone: (870) 633-2262
Fax: (870) 633-0629
www.woodruffelectric.com
District Offices:
Augusta - (870) 347-2431
Moro - (870) 768-4821

GENERATION & TRANSMISSION COOPERATIVE
Arkansas Electric Cooperative Corporation
1 Cooperative Way
P.O. Box 194208
Little Rock 72219-4208
Telephone: (501) 570-2200
Fax: (501) 570-2900
www.aecc.com

STATEWIDE ASSOCIATION
Arkansas Electric Cooperatives, Inc.
1 Cooperative Way
P.O. Box 194208
Little Rock 72219-4208
Telephone: (501) 570-2200
Fax: (501) 570-2900
www.aeci.com

Electric Cooperatives of Arkansas
www.ecark.org

Source: Electric Cooperatives of Arkansas, Distribution Cooperatives 2010

APPENDIX F

Municipal Utilities

Augusta Light, Water & Gas Service 114 S. 2nd Street Augusta, AR 72006-2310 Tel: (870) 347-2041
Benton Utilities Electric Distribution Department 114 South East Street Benton, AR 72015 Tel: (501) 776-5931
Bentonville Electric Utilities Department 608 Southeast Third Street Bentonville, AR, 72712 Engineering Director Tel: (479) 271-5941 Assistant Electric Utility Manager (479) 271-3159
City of Paris Utilities, Electric Department 101 N. Express Paris, AR 72855 Tel: (479) 963-2450
City of Siloam Springs Electric Department Director 1600 West Quarter Road Siloam Springs, AR 72761 ElectricDept@siloamsprings.com Tel: (479) 524-3777
Clarksville Light & Water Company 400 W Main St Clarksville, AR 72830 Tel: (479) 754-3148
Conway Corporation 1307 Prairie Street Conway, AR 72033 Tel: (501) 450-6000
Hope Water & Light 105 North Elm Street P.O. Box 2020 Hope, AR 71801-2020 Tel: (870) 777-3000
Jonesboro City Water & Light 400 East Monroe Avenue Jonesboro, AR 72401 Operations Tel: (870) 930-3382 Engineering Services: Tel: (870) 930-3320 Customer Service Tel: (870) 930-3300

North Little Rock Electric Department 8th & Main Street P.O. Box 159 North Little Rock, AR 72115 Tel: (501) 975-8768
Osceola Municipal Light & Power 303 West Hale P.O. Box 443 Osceola, AR 72370 Tel: (870) 563-5245 Fax: (870) 563-5195 Email: admin@osceolalightandpower.com
Paragould Light Water and Cable 1901 Jones Rd Paragould, AR 72450 Po Box 9 Paragould, AR 72451 Tel: (870) 239-7700
Piggott Municipal Electric Utility 194 West Court Piggott, AR 72454 Tel: (870) 598-3791 City Clerk Tel: (870) 598-2388 mayor@piggott.org
Prescott Water & Light Company 118 East Elm Prescott, AR 71857 Tel: (870) 887-2210
West Memphis Utility Commission Electric Department 204 South Redding PO Box 1728 West Memphis, AR 72301 Electrical Superintendent Tel: (870) 702-5134 Fax: (870) 732-7621
Source: Various City URLs

APPENDIX G

Illustrative Excerpts from Entergy Arkansas Contingency Emergency Power Conservation and Curtailment Plan

This plan is filed with the APSC under Docket Number 06-101-U, per Order #16, Effective June 16, 2007.

Definition of an Emergency

This plan sorts emergencies into two categories in order to guide appropriate response – projected and dynamic emergencies. These are written and defined as:

10.2.1. PROJECTED EMERGENCY

A projected emergency is any situation for which, in the near future, the projected system demand exceeds available generating capacity and purchased power. Capacity may not be available because of extended outages caused by the time needed to repair a failure in existing equipment, because of delays in construction of new generating facilities, because of unanticipated excessive peak load demands, or because of shortages or interruptions of the supply of fuels for electric generation. The action to be taken for projected emergencies is described in § 10.4.

10.2.2. DYNAMIC EMERGENCY

A dynamic emergency is any situation of such a severe nature that the automatic system protective and control equipment, coupled with manual operator intervention, cannot supply the load demand with available capacity within the time necessary to maintain the integrity of the bulk power facilities. These emergencies are generally caused by major system disturbances. The action to be taken for dynamic emergencies is described in § 10.5.

The plan would not become effective until the company had exhausted all efforts to obtain additional power.

Actions for Projected Emergencies

The core of the plan contains the "Action to Be Taken for Projected Emergencies." The first of these is §10.4.1, Curtailment Due to a Fuel Shortage. Steps outlined for this measure as it relates to Arkansas facilities are related to a diminishing scale of fuel use called "burn days" and include, in order of severity: The second is §10.4.2, Curtailment Due to a Capacity Shortage.

10.4.1: Curtailment Due to a Fuel Shortage	
Burn Days	**Action to Take**
45	• Request industrial and commercial customers to voluntarily curtail non-essential power use • Request consuming public to conserve • Request wholesale electric systems (municipals, cooperatives) to implement conservation and curtailment plans
30	• Reduce distribution system voltage up to 5% • Request emergency allocation • Request industrial and commercial customers to substantially reduce power
25	• Buy emergency power
20	• Request emergency natural gas
15	• Open selected circuits for short periods of time • Implement rolling curtailment as necessary for non-critical customer circuits
The above are summaries. Full descriptions should be read if any of these actions are indicated.	

Curtailment due to a capacity shortage relates to the loss of either generation or transmission capacity (or both). The Energy Assurance Plan defines this condition as occurring when a loss of generation capacity or bulk transmission exceeds supply on hand that is available from operating units or for purchase.

10.4.2: Curtailment Due to Capacity Shortage	
Step	**Action taken in order listed**
1	Reduce power manually at all company facilities
2	Request wholesale power customers to run all available generation and reduce company power use
3	Request public conservation
4	Request municipal and other dependent systems to implement conservation and curtailment plans
5	Reduce distribution system voltages up to 5%
6	Ask industrial and commercial companies to reduce non-essential power
7	Implement controlled load tariff load reduction
8	Request industrial and commercial customers to substantially reduce power
9	• Open selected circuits for short periods of time • Implement rolling curtailment as necessary for non-critical customer circuits
The above are summaries. Full descriptions should be read if any of these actions are indicated.	

Actions for Dynamic Emergencies

This type of action pertains to sudden loss of major infrastructure resulting in the immediate loss of power. This is determined whenever the system cannot maintain an electric frequency of 60 hertz to satisfy load demand.

10.5 1 though 10.6: Dynamic Emergency	
Number	**Action**
10.5.1	Switch off interruptible load and controlled loads per tariff
10.5.2	Reduce distribution system voltages up to 5%
10.5.3	• Open selected circuits for short periods of time • Implement rolling curtailment as necessary for non-critical customer circuits
10.5.4	• Selected under frequency relays are tripped • If load tripping is anticipated to last "for a substantial period of time," implement procedures found in 10.4.2
10.6	Totally discontinue service during the emergency to any customer who refuses to comply with procedures outlined in 10.4 and 10.5
The above are summaries. Full descriptions should be read if any of these actions are indicated.	

Upon the termination of any emergency, the company will initiate full system restoration. The company also reports to the APSC "as soon as practicable after interruption" and notifies FERC as well.

APPENDIX H

Potential Emergency Measures to Propose if Deemed Useful

Measure	What It Does	Recommended Steps for State Responders
Public Information for Energy Conservation **Voluntary Measure**	Promotes voluntary reduction in energy use to aid recovery and restoration efforts, share limited energy supplies equitably and assure sufficient energy for priority customers. Gives the public specific guidance for type of energy shortage and may stimulate the use of alternatives.	**General** ▪ Use APSC, AEO & ADEM staff knowledge; obtain information from sister states, DOE, NASEO and others to develop conservation guidance **Administration** ▪ Coordinate with state natural gas utilities, ADEM and APSC working with their media and public relations professionals ▪ Develop brochures, handouts, video, audio, Internet and other dissemination materials ▪ Work with media and others to obtain low cost or free airtime or print space ▪ Hold public meetings for concerned citizens ▪ Provide feedback to legislature and local jurisdictions
Compressed Work Week **Voluntary Measure**	This is a form of flexible time management. It could reduce hours of operation for buildings and thus the volume of natural gas required. Many federal agencies already support a 10-hour, 4-day/week schedule for employees.	**General** ▪ Requires state and local government leadership ▪ Participation of major employers is highly desirable ▪ Certain businesses and agencies cannot participate due to the nature of their work **Administration** ▪ AEO works with state personnel management and private employers to enlist support ▪ Work with unions and other employee organizations to obtain support ▪ Ask affected local jurisdictions to help solicit participants; Coordinate with Arkansas Economic Development Commission (AEDC) and Department of Labor (ADL) Determine which businesses/agencies are capable of participating ▪ If mandatory, develop list of exemptions ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Assist participants in coordinating with out-of-state entities if necessary ▪ Ascertain equity issues (including overtime pay) if measure is mandatory ▪ Coordinate with affected local jurisdictions

Measure	What It Does	Recommended Steps for State Responders
Telecommuting **Voluntary Measure**	Reduces natural gas consumed in places of employment.	**General** ▪ Needs assistance from AEDC, business associations, employee unions and groups **Administration** ▪ Encourage all business sectors to participate ▪ Provide technical assistance ▪ Seek advice and operating procedure help from national and regional telecommuting organizations ▪ Publicize and explain ▪ Design this measure for self-administration ▪ Consider publicized recognition or awards for participating employers ▪ Coordinate with affected local jurisdictions ▪ Provide "success stories" to media
Reducing Government Agency Hours of Operation **Voluntary Measure** **or** Mandatory Measure	Creates a short workweek for state and local government in order to provide limited natural gas for high priority use by critical care and residential consumers.	**General** ▪ Obtain support and help of chief elected official, cognizant agencies and other authorities or leaders as needed ▪ Approval and coordination required **Administration** ▪ Develop criteria to identify agencies/buildings to reduce hours or close ▪ Develop criteria for return to normal operations ▪ Coordinate with employee unions, if applicable ▪ Attend to employee issues such as criteria for any wage/salary changes, and impact on benefits, such as sick leave/vacation time ▪ Provide timely notice to employees
Hot Water Set Back **Voluntary Measure** or Mandatory Measure	Reduces temperature of hot water at commercial, governmental and industrial facilities. Also recommended as a voluntary measure for residential and institutional users.	**General** ▪ Recommend a percentage (e.g., 5% or 10%) reduction in temperature and consult with cross-section of user representatives ▪ Design this measure for building operator self-certification ▪ Use local inspectors for random verification **Administration** ▪ Notify the public ▪ Use standard testing procedures ▪ Arrange media coverage ▪ Enlist support and technical assistance from plumbing professionals ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Coordinate with local authorities as appropriate

Building Temperature Adjustment **Voluntary Measure** or Mandatory Measure	Reduces/restricts space conditioning in commercial, institutional and public facilities.	**General** ▪ Recommend a +/- 5 % seasonal temperature adjustment in consultation with commercial, institutional and industry representatives ▪ Use building operator self-certification (building operator keeps log for review by management) for this measure ▪ Use local inspectors for random verification **Administration** ▪ Work with AEDC for support ▪ Notify the public ▪ Establish self-certification and self-enforcement feedback ▪ Use standard testing procedures ▪ Arrange media recognition for participating companies ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Coordinate with affected local jurisdictions

APPENDIX I

Contact Information for Natural Gas Utilities

Investor Owned Utilities

Arkansas Oklahoma Gas Corporation
115 N. 12th Street
P.O. Box 2414
Fort Smith, AR 72902-2414
Tel: 479-783-3181
Mailing
P.O. Box 2415
Fort Smith, AR 72902-2415
Emergencies
Tel: 479 784–2052
Tel: 800- 883-3181

Arkansas Western Gas Company
655 East Millsap Drive
Fayetteville, AR 72703-1002
Mailing
P.O. Box 660559
Dallas, TX 75266-0559
Tel: 800-563-0012
Tel: 800-563-0012

CenterPoint Energy, Arkansas:
401 West Capitol Ave, Ste: 102
Little Rock, AR 72201
Corporate:
1111 Louisiana, 11th Floor
Houston, Texas 77002

Municipal Utilities

August Light, Water and Gas
112 So. 2nd Street
Augusta, AR 72006
Tel: 870-347-2041

Des Arc Gas Company
107 S. Third Street
Des Arc, AR 72040

DeValls Bluff Natural Gas System
Box 297
De Valls Bluff, AR 72041
Tel: 870-998-2577

City of Harrisburg Water and Gas Division
201 N Main Street
Harrisburg AR 72432

Hazen Natural Gas Company
Note: Hazen is served by CenterPoint Energy.
185 N. Hazen Avenue
Hazen AR 72064
Tel: 870-255-4521

North Crossett Utilities
1645 Highway 52 West
Crossett AR 71635
Tel: 870-304-7048

APPENDIX J

Natural Gas Storage, Southwest Region

Southwest Region -- Underground Natural Gas Storage, by State and Reservoir Type, Close of 2007

	Depleted Gas/Oil Fields			Aquifer Storage			Salt Cavern Storage			Total		
Region/ State	Sites	Working Gas Capacity (Bcf)	Daily Withdrawal Capability (MMcf)	Sites	Working Gas Capacity (Bcf)	Daily Withdrawal Capability (MMcf)	Sites	Working Gas Capacity (Bcf)	Daily Withdrawal Capability (MMcf)	Sites	Working Gas Capacity (Bcf)	Daily Withdrawal Capability (MMcf)
Southwest Region												
Arkansas	2	15	231	0	0	0	0	0	0	2	15	231
Louisiana	8	286	3,965	0	0	0	7	48	3,165	15	334	7,130
New Mexico	2	54	375	0	0	0	0	0	0	2	54	375
Oklahoma	13	194	3,772	0	0	0	0	0	0	13	194	3,772
Texas	20	365	5,334	0	0	0	14	78	6,361	34	443	11,695
Total Sites	45	914	13,677	0	0	0	21	126	9,526	66	1,040	23,203
(Marginal Sites)[1]	(8)	(30)	(184)	(0)	(0)	(0)	(1)	(4)	(0)	(9)	(34)	(184)
Percent of U.S.	14	26	21	0	0	0	68	73	70	17	25	26

[1] Marginal sites: very little or no activity reported during the 2007 calandar year. Marginal sites included in State/Regional total.

Note: Bcf = Billion cubic feet. MMcf = Million cubic feet.

Source: Energy Information Administration, Gas Transportation Information System, December 2008.

Source: EIA Underground Natural Gas Storage,
http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/undrgrnd_storage.html

APPENDIX K

Arkansas Western Gas Customer Data

Local Offices Contact phone number for all offices: 1-800-563-0012

Blytheville
533 N 10th Street
Blytheville, AR 72316

Harrison
900 HWY 62-65 North
Harrison, AR 72602

Fayetteville
655 East Millsap Drive
Fayetteville, AR 72703

Ozark
101 E Commercial
Ozark, AR 72949

Communities

- Alix
- Alma
- Alpena
- Altus
- Armorel
- Avoca
- Bassett
- Batavia
- Bellefonte
- Bentonville
- Bergman
- Berryville
- Bethel Heights
- Black Oak
- Blytheville
- Branch
- Burdette
- Calico Rock
- Capps
- Caraway
- Caulksville
- Cave Springs
- Centerton
- Charleston
- Clarksville
- Coal Hill
- Combs
- Cotter
- Crosses
- Decatur
- Delaney
- Dell
- Denning
- Durham
- Dyer
- Elkins
- Elm Springs
- Eureka Springs
- Farmington
- Fayetteville
- Flippin
- Gassville
- Gentry
- Gravette
- Green Forest
- Goshen
- Gosnell
- Greenland
- Greenway
- Harmon
- Harrison
- Hartman
- Highfill
- Hindsville
- Huntsville
- Hunt Town
- Johnson
- Joiner
- Lake City
- Leachville
- Lincoln
- Little Flock
- Lowell
- Luxora
- Manila
- Marble
- Marmaduke
- Melbourne
- Monette
- Mountain Home
- Mountain View
- Mulberry
- New Spadra
- Norfork
- Oark
- Osceola
- Old Alabam
- Osage
- Ozark
- Ozone
- Paris
- Patrick
- Pea Ridge
- Piggott
- Pineville
- Prairie Grove
- Ratcliff
- Rector
- Rogers
- Roseland
- Rudy
- Salesville
- Saint Paul
- Siloam Springs
- Sonora
- Springdale
- Springtown
- St Francis
- Subiaco
- Sulphur Springs
- Summers
- Summitt
- Tontitown
- Victoria
- Webb City
- West Fork
- Wilson
- Yarbro
- Yellville

Source: Arkansas Western Gas, Web site

APPENDIX L

Representative Gas Customer Base and Sales - 2009

Gas Companies - Arkansas Only
Customers; Mcf Sold; Revenues
Year Ended December 31, 2009

Company	No. of Customers	MCF Sold	Revenues	Average Revenues Per Customer	Average MCF Per Customer
Arkansas Oklahoma Gas Corporation					
Residential	40,510	2,620,810	$28,460,089	$703	65
Commercial	5,275	1,830,093	15,089,903	2,861	347
Industrial	7	564,037	3,036,822	433,832	80,577
Public Authority	0	0	0	0	0
Totals Without Other Revenues	45,792	5,014,940	$46,586,814	$1,017	110
Other Revenues	N/A	N/A	4,432,570	N/A	N/A
Totals	45,792	5,014,940	$51,019,384	N/A	N/A
Arkansas Western Gas Company					
Residential	134,932	8,952,455	$86,960,383	$644	66
Commercial	16,822	5,100,590	42,374,944	2,519	303
Industrial	215	1,068,647	6,758,882	31,437	4,970
Public Authority	0	0	0	0	0
Totals Without Other Revenues	151,969	15,121,692	$136,094,209	$896	100
Other Revenues	N/A	N/A	8,193,269	N/A	N/A
Totals	151,969	15,121,692	$144,287,478	N/A	N/A
CenterPoint Energy Arkansas Gas					
Residential	375,911	22,228,298	$316,774,061	$843	59
Commercial & Industrial	45,903	16,104,008	178,174,345	3,882	351
Public Authority	0	0	0	0	0
Totals Without Other Revenues	421,814	38,332,306	$494,948,406	$1,173	91
Other Revenues	N/A	N/A	20,781,025	N/A	N/A
Totals	421,814	38,332,306	$515,729,431	N/A	N/A
Logan Township Gas Users Association					
Residential	76	5,561	$22,190	$292	73
Commercial	7	1,633	6,517	931	233
Public Authority	0	0	0	0	0
Totals Without Other Revenues	83	7,194	$28,707	$346	87
Other Revenues	N/A	N/A	0	N/A	N/A
Totals	83	7,194	$28,707	N/A	N/A
Gas Industry Totals Without Other Revenues	619,658	58,476,132	$677,658,136	$1,094	94
Other Revenues			33,406,864		
Industry Totals	**619,658**	**58,476,132**	**$711,065,000**	**$1,148**	**94**

APPENDIX M

Illustrative Examples of Possible Emergency Mitigation Measures

If an energy disruption or shortage were to continue for an extended time, the state may wish to propose energy emergency mitigation measures. Following are illustrative examples of possible energy emergency mitigation measures.

Measure	*What It Does*	*Possible Steps for State Responders*
Public Information for Energy Conservation **Voluntary Measure**	Promotes voluntary reduction in energy use to aid recovery and restoration efforts, share limited energy supplies equitably and assure sufficient energy for priority customers. Gives the public specific guidance for type of energy shortage and may stimulate the use of alternatives.	**General** ▪ Use APSC & ADEM staff knowledge; obtain information from sister states, APSC may wish to use AEO resources to assist DOE, NASEO and others to develop conservation guidance **Administration** ▪ Coordinate with state electric utilities working with their media and public relations professionals ▪ Develop brochures, handouts, video, audio, Internet and other dissemination materials ▪ Work with media and others to obtain low cost or free airtime or print space ▪ Hold public meetings for concerned citizens ▪ Provide feedback to legislature and local jurisdictions
Compressed Work Week **Voluntary Measure** (State agencies would likely require a directive from the Governor, and Federal agencies may require approval from their authorities.)	This is a form of flexible time management. It could reduce hours of operation of buildings and thus reduce electricity load. Many federal agencies already support a 10-hour, 4-day/week schedule for employees.	**General** ▪ Requires state and local government leadership ▪ Participation of major employers is highly desirable ▪ Certain businesses and agencies cannot participate due to the nature of their work **Administration** ▪ APSC works with state personnel management and private employers to enlist support ▪ Work with unions and other employee organizations to obtain support ▪ Ask affected local jurisdictions to help solicit participants • Coordinate with the Arkansas Economic Development Commission (AEDC) and Department of Labor (ADL) ▪ Determine which businesses/agencies are capable of participating ▪ If mandatory, develop list of exemptions ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Assist participants in coordinating with out-of-state entities if necessary ▪ Ascertain equity issues (including overtime pay) if measure is mandatory ▪ Coordinate with affected local jurisdictions

Telecommuting **Voluntary Measure**	Reduces electric load in places of employment.	**General** ▪ Needs assistance from ADEC in reaching business associations, business community and perhaps employee unions and groups **Administration** ▪ Encourage all business sectors to participate ▪ Provide technical assistance ▪ Seek advice and operating procedure help from national and regional telecommuting organizations ▪ Publicize and explain ▪ Design this measure for self-administration ▪ Consider publicized recognition or awards for participating employers ▪ Coordinate with affected local jurisdictions ▪ Provide "success stories" to media
Reducing Government Agency Hours of Operation (State agencies would require a directive from the Governor.)	Creates a short workweek for state and local government in order provide limited electricity load to critical and residential consumers.	**General** ▪ Contact chief elected official, cognizant agencies and other authorities or leaders to obtain approval and support ▪ Approval and coordination required **Administration** ▪ Develop criteria to identify agencies/buildings to reduce hours or close ▪ Develop criteria for return to normal operations ▪ Coordinate with employee unions, if applicable ▪ Attend to employee issues, such as criteria for any wage/salary changes, and impact on benefits, such as sick leave/vacation time ▪ Provide timely notice to employees
Hot Water Set Back **Voluntary Measure** or **Mandatory Measure**	Reduces temperature of hot water at commercial, governmental and industrial facilities. Also recommended as a voluntary measure for residential and institutional users.	**General** ▪ Recommend a percentage (e.g., 5% or 10%) reduction in temperature and consult with cross-section of user representatives ▪ Design this measure for building operator self-certification ▪ Use local inspectors for random verification **Administration** ▪ Notify the public ▪ Use standard testing procedures ▪ Arrange media coverage ▪ Enlist support and technical assistance from plumbing professionals ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Coordinate with local authorities, as appropriate

Building Temperature Adjustment **Voluntary Measure** or **Mandatory Measure**	Reduces/restricts space conditioning in commercial, institutional and public facilities.	**General** ▪ Recommend a +/- 5% seasonal temperature adjustment in consultation with commercial, institutional and industry representatives ▪ Use building operator self-certification (building operator keeps log for review by management) for this measure ▪ Use local inspectors for random verification **Administration** ▪ Work with ADEC for support ▪ Notify the public ▪ Establish self-certification and self-enforcement feedback ▪ Use standard testing procedures ▪ Arrange media recognition for participating companies ▪ If mandatory, work with Attorney General to set up enforcement and appeals procedures ▪ Coordinate with affected local jurisdictions

APPENDIX N

Contact Information for Pipelines Serving or Transiting Arkansas

Pipeline Company	Contact Information
ANR Pipeline Co	717 Texas Avenue Houston, TX 77002 **Mailing:** PO Box 2446 Houston, TX 77252-2446 Tel: (823) 320-5000 **Gas Control:** Tel: (888) 427-2875
Arkansas Oklahoma Gas Corp.	Box 2415 Ft. Smith, AR 72902-2415 Tel: (479) 783-3181
CenterPoint Energy Gas Transmission Company	**Corporate:** 1111 Louisiana, 11th Floor Houston, TX 77002-5231 **System Control** Tel: (318) 429-2782
Mississippi River Transmission Corp (MRT) A subsidiary of CenterPoint Energy	1600 S. Brentwood Blvd #590 St. Louis, MO 63144 Tel: (314) 991-7451
Natural Gas PL Co of America	**Corporate Headquarters**: Kinder Morgan 500 Dallas St., Suite 1000 Houston, TX 77002 Tel: (713) 369-9000 **Emergency Contact Interstate Pipelines** Tel: (888) 763-3690
Ozark Gas Transmission LLC	515 Centry Park Drive #600 Oklahoma City, OK 73105 Tel: (405) 525-7788
Source Gas	370 Van Gordon St. #4000 Lakewood, CO 80228 Tel: (800) 563-0012
Southwestern Energy Pipeline	1083 E. Sain Street Fayetteville, AR 72703 Tel: (479) 521-1141
Southern Natural Gas Co.	Box 2563 Birmingham, AL 35202-2563 Tel: (205) 325-7410
Tennessee Gas Pipeline Co	**Mailing Address** Tennessee Gas Pipeline Company P.O. BOX 2511 Houston, TX 77001-2511 **Gas Control:** Tel: (713) 420-6828

Enterprise Products Partners LP (Formerly Texas Eastern Transmission Co)	Spectra Energy Group 5400 Westheimer Court Houston, TX 77056-5310 Tel: (713) 627-5400 **Emergency:** Texas Eastern: Tel:800-231-7794 Ozark: Tel: (877) 535-0242
Texas Gas Transmission Co	Williams Gas Pipeline South Central 3800 Frederica Street Owensboro, KY 42301 Tel: (270) 926-8686 **Gas Control:** Tel: (800) 626-1948
Trans-Union Interstate Pipeline, L.P.	100 S. Ashley Dr. #1400 Tampa, FL 33602 Tel: (813) 301-4998
Trunkline Gas Co	5444 Westheimer Houston, TX 77056 Tel: (713) 989-7000 **Emergency** Tel: (800) 225-3913

APPENDIX O

Representative Gas Customer Base and Sales - 2009

Source: APSC- Annual Report to the Governor

Gas Companies - Arkansas Only
Customers; Mcf Sold; Revenues
Year Ended December 31, 2009

Company	No. of Customers	MCF Sold	Revenues	Average Revenues Per Customer	Average MCF Per Customer
Arkansas Oklahoma Gas Corporation					
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Commercial	5,275	1,830,093	15,089,903	2,861	347
Industrial	7	564,037	3,036,822	433,832	80,577
Public Authority	0	0	0	0	0
Totals Without Other Revenues	45,792	5,014,940	$46,586,814	$1,017	110
Other Revenues	N/A	N/A	4,432,570	N/A	N/A
Totals	45,792	5,014,940	$51,019,384	N/A	N/A
Arkansas Western Gas Company					
Residential	134,932	8,952,455	$86,960,383	$644	66
Commercial	16,822	5,100,590	42,374,944	2,519	303
Industrial	215	1,068,647	6,758,882	31,437	4,970
Public Authority	0	0	0	0	0
Totals Without Other Revenues	151,969	15,121,692	$136,094,209	$896	100
Other Revenues	N/A	N/A	8,193,269	N/A	N/A
Totals	151,969	15,121,692	$144,287,478	N/A	N/A
CenterPoint Energy Arkansas Gas					
Residential	375,911	22,228,298	$316,774,061	$843	59
Commercial & Industrial	45,903	16,104,008	178,174,345	3,882	351
Public Authority	0	0	0	0	0
Totals Without Other Revenues	421,814	38,332,306	$494,948,406	$1,173	91
Other Revenues	N/A	N/A	20,781,025	N/A	N/A
Totals	421,814	38,332,306	$515,729,431	N/A	N/A
Logan Township Gas Users Association					
Residential	76	5,561	$22,190	$292	73
Commercial	7	1,633	6,517	931	233
Public Authority	0	0	0	0	0
Totals Without Other Revenues	83	7,194	$28,707	$346	87
Other Revenues	N/A	N/A	0	N/A	N/A
Totals	83	7,194	$28,707	N/A	N/A
Gas Industry Totals Without Other Revenues	619,658	58,476,132	$677,658,136	$1,094	94
Other Revenues			33,406,864		
Industry Totals	**619,658**	**58,476,132**	**$711,065,000**	**$1,148**	**94**

APPENDIX P

Southwest Power Pool

SPP is an entity managing electric transmission in Arkansas. As a non-generating, independent and designated state Regional Transmission Organization, its role is described further.

The RTO is designed to lower wholesale, and thus retail, electricity cost by introducing greater efficiency to the transfer of electric power. The regulated electricity market, originally designed to prevent monopoly excess, contained inherent inefficiencies. As it became necessary to move power from longer distances to meet local demand, many power line owners imposed fees for use of their transmission property. Complex contracting and administration of this arrangement increased system costs. Also, a complex system of electron transfer components added brittleness to the system reducing flexibility and the ability to move power when demand was high and the system was stressed. The RTO was designed to reduce barriers, simplify the fee structure and develop common rules, rates and service requirements. The resulting "Open Access Transmission Tariff" system reduces transmission constraints that formerly imposed inefficiencies on individual utilities. One-on-one power acquisition meant that utilities had to increase their electricity reserves to assure sufficient capacity for meeting demand obligations. The efficiency gained through the power pool improved energy assurance by increasing system resiliency and reliability. An Energy Imbalance Service (EIS) market with a central, independent operator, efficiently and quickly locates and schedules needed power, reduces some of the need for additional expensive generation, lowers market transfer costs, improves regional system reliability and thus reduces risk.

This added efficiency may not meet the needs of all utilities. In some cases, utilities may be able to negotiate power acquisition at a more favorable rate than that quoted by the RTO. For example, municipal and cooperative utilities that had obtained very favorable rates through direct negotiations with power providers may have lost an advantage. Also, Entergy withdrew from the SPP and joined SERC before the SPP became an RTO. As market complexity increases however, stakeholders such as Entergy are reconsidering in light of complexities and market conditions that have become increasingly costly to maintain.

Although SPP is an independent operator that does not sell power directly to consumers, it is considered a public utility. The SPP has requested and received a Certificate of Public Convenience and Necessity from the APSC, and is therefore regulated utility by the APSC. The SPP reports to FERC on interstate matters. By working closely with both state and federal regulatory bodies, SPP adds significantly to the reliability of electric power in the state.

The stated goal of SPP is to administer the regional power grid. This is accomplished on an electronic platform with constant monitoring and minute-by-minute dispatch. In addition to its member distribution and generation utilities, other entities belonging to the pool include independent power producers, power marketers and independent transmission companies. At least one APSC Commissioner sits on its Board and APSC staff regularly work and coordinate with SPP managers.
SPP also works under the umbrella of NAERC. Using NAERC's functional models, SPP is registered as a reliability coordinator and transmission provider.