Oklahoma Energy Assurance Plan

June 2021

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PERIODIC REVIEW AND CHECK-OFF

An annual review of this plan should be conducted to update contact information, law and rule changes, and energy-related data. At least at each five-year interval, after the original plan's publication, consideration should be given to a full plan update and rewrite.

Month	Year	Action Taken
April	2013	Initial Plan Publication
June	2016	Abbreviated Plan Update
June	2021	Full Plan Update & Re-write
	2022	
	2023	
	2024	
	2025	
	2026	

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ACKNOWLEDGEMENTS

The Oklahoma Department of Commerce and the Office of the Secretary of Energy & Environment, who collectively partner to form the Oklahoma State Energy Office, would like to thank the University of Oklahoma's National Institute for Risk & Resilience for their assistance in drafting the 2021 Oklahoma Energy Assurance Plan.

Many stakeholders also gave their time and expertise during the drafting process. In particular, the following groups were instrumental in providing information for or feedback on the Plan:

AEP-Public Service Company of Oklahoma
American Red Cross
Association of Central Oklahoma Governments
CenterPoint Energy
Chesapeake Energy Corp.
Continental Resources
Devon Energy
Grand River Dam Authority
Indian Nations Council of Governments
Interstate Oil & Gas Compact Commission
KAMO Power, Inc.
Liberty-Empire District Utilities (Central Region)
Magellan Midstream Partners
Marathon Oil, Inc.
Oklahoma Association of Electric Cooperatives
Oklahoma Corporation Commission
Oklahoma Department of Emergency Management
Oklahoma Department of Environmental Quality
Oklahoma Department of Health
Oklahoma Electric Cooperative
Oklahoma Energy Resources Board
Oklahoma Gas Association
Oklahoma Gas & Electric Company
Oklahoma Municipal Alliance
Oklahoma Municipal Power Authority
Oklahoma Natural Gas Company
Oklahoma Office of Homeland Security
Oklahoma Propane Gas Association
ONEGas
Southwest Power Pool
Western Farmers Electric Cooperative

EXECUTIVE SUMMARY

The state of Oklahoma is rich in energy resources, from wind and natural gas to crude oil and solar energy. These resources, as well as additional out-of-state sources such as coal, provide energy for nearly 4 million Oklahoma residents, over 300,000 businesses, and millions of vehicles.[1] Given the state's demand for energy and extensive energy infrastructure, Oklahoma has a significant responsibility for energy assurance, ensuring a reliable energy supply for the state, and planning for and responding when energy disruptions and emergencies occur.

Each year, Oklahoma faces a variety of energy disruptions. Most of these disruptions are limited in scope but, at times, energy disruptions extend over wider areas, impact large segments of the population, or can last for long periods of time threatening the life, health, and welfare of Oklahoma residents and creating energy emergencies. These energy emergencies are highly complex and may vary in cause, form, duration, and severity. As of 2020, Oklahoma is the third most-disaster prone state in the nation, as measured by the number of Disaster Declarations issued by the Federal Emergency Management Agency (FEMA) each year.[2] Given the number of disasters occurring in Oklahoma, their potential scope and public risk, planning for and responding to energy emergencies in the state of Oklahoma requires careful, coordinated action and makes a robust state Energy Assurance Plan critical.

Government is charged with ensuring the safety and well-being of its citizens and, in Oklahoma, energy assurance responses are considered a subset of the overall state emergency response activities. To address emergencies of all types, Oklahoma has an Emergency Operations Plan (EOP) in place that provides, in cooperation with local and federal government and volunteer service organizations, a system to mitigate against, prepare for, respond to, and recover from the effects of national security incidents and natural and technological hazards affecting the state. The EOP is maintained by the Oklahoma Department of Emergency Management (OEM). This plan defines the roles of local, state and federal governmental entities in providing disaster relief and assistance; it also contains 15 Energy Support Functions and 3 Annexes, which assign responsibility and roles to identified state agencies, private firms and volunteer service organizations during specific types of emergencies. Energy emergency responsibilities are outlined in Support Function 12 (ESF-12).

This document, the Oklahoma Energy Assurance Plan (EAP), is intended to complement the state's official Emergency Operations Plan's Energy Support Function (ESF-12) by providing detailed references and supplementary information about Oklahoma's energy landscape; a detailed description of how Oklahoma currently plans for, prevents, and responds to energy emergencies;

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[1] U.S. Census Bureau. *QuickFacts Oklahoma.* https://www.census.gov/quickfacts/fact/table/OK/SBO001212#SBO001212 (June 18, 2021).
[2] Federal Emergency Management Agency. *Disaster Declarations for States and Counties.* https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties (June 18, 2021).

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and a menu of strategies for officials and stakeholders to consider as they prevent or manage these emergencies. The plan provides standard definitions for categorizing energy emergencies, both in type and severity, and provides a framework for delineating phases of energy emergency response; it also provides reference information that will assist officials in closely monitoring the conditions affecting energy supply and demand statewide and nationwide. In addition, the plan outlines the legal authorities granted to the various levels of government—federal, state, and local—that are responsible for all four phases of energy assurance.

After providing an overall framework, the Energy Assurance Plan profiles each of Oklahoma's major energy sectors through the presentation of information on energy consumption as well as provider production capacities, infrastructure under management, and programs administered.

Next, the plan assesses the state's energy vulnerabilities by analyzing historical events in Oklahoma that have caused energy disruptions. It then discusses potential infrastructure vulnerabilities in the various energy sectors, and outlines examples of sector interdependencies between energy sources, that should be considered in energy planning activities as these may affect recovery efforts during emergency situations. Not to be overlooked is a detailed discussion of cybersecurity planning in Oklahoma as vulnerabilities to the energy sector are not just physical, but electronic in nature.

After providing a detailed view of Oklahoma's energy landscape, the plan turns to a detailed description of the responsibilities of the various governmental agencies in responding to an energy emergency. In particular, it discusses communication procedures between and across governmental agencies during energy emergencies and explains the way in which public information must be disseminated to citizens of Oklahoma during such events.

The final section of the plan focuses on the specific response strategies for energy disruptions and emergencies and presents issues of emerging consideration: first, the plan presents a set of preventative strategies and measures designed to mitigate the impact of an emergency prior to its occurrence; second, a detailed menu of supply and demand response options that officials may wish to consider should an energy emergency impact the state; and third, examines emerging issues for 21st century energy assurance planning consideration.

The Energy Assurance Plan is intended for use by all governmental agencies, energy suppliers, and key service providers who have responsibilities or essential capabilities for responding to energy emergencies. The plan is meant to serve as a guide rather than a list of "one-size-fits-all" procedures. In particular, the latter portion of the plan, which suggests potential responses to an energy emergency, should be treated as a "menu" of response options from which to select and implement rather than a list of standard operating procedures. While this Plan attempts to address the most common types of energy emergencies Oklahoma may experience and outlines a wide variety of measures that might be utilized to respond, the document does not claim to provide an exhaustive review of every potential cause of emergency nor every potential remedy.

The Oklahoma State Energy Office is a partnership between the Oklahoma Department of Commerce and the Office of the Secretary of Energy and the Environment (OSEE). The OSEE maintains coordination responsibility for Oklahoma's Energy Assurance Plan. Questions and comments about the plan can be directed to Secretary Kenneth Wagner at (405) 522-7099 or Kenneth.Wagner@ee.ok.gov.

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INTRODUCTION

PURPOSE OF THE PLAN

During any given year, the state of Oklahoma faces a variety of energy disruptions. Most of these disruptions are limited in scope and quickly addressed by energy providers and emergency responders. Sometimes, energy disruptions extend over wider areas, impact large segments of the population, or can last for lengthy periods of time threatening the life, health, and welfare of Oklahoma residents. For instance, in October 2020 Oklahoma experienced one of its earliest and most disruptive ice storms in the state's history. Well over 300,000 homes and businesses across the state were without electricity for several days. many for a week or more, and the storm received national news coverage due to its severity.[3,4]

Events of this nature, which we refer to as energy emergencies, are highly complex and come in many forms. Types of energy emergencies range from blackouts caused by severe weather damage to fuel shortages that disrupt transportation or electric generation. Adding to this complexity, there are many different causes of energy emergencies—including spikes in demand during peak energy use, unanticipated power plant or refinery shutdowns, transmission system congestion, cyber-attacks, and natural disasters. Given this expansive scope, inherent complexity, and public risk, planning for and responding to energy emergencies in the state of Oklahoma often requires government action.

To address emergencies of all types, the state of Oklahoma has an Emergency Operations Plan (EOP)[5] in place which provides, in cooperation with local and federal government and volunteer service organizations, a system to mitigate against, prepare for, respond to, and recover from the effects of national security incidents and natural and technological hazards affecting the state. The EOP is maintained by the Oklahoma Department of Emergency Management (OEM). The EOP defines the roles of local, state, and federal governmental entities in providing disaster relief and assistance; it contains 15 Energy Support Functions and 3 Annexes, which assign responsibility and roles to identified state agencies, private firms, and volunteer service organizations during specific types of emergencies—responsibilities that are outlined in Emergency Support Function 12 (ESF-12).

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[3] Oklahoma's News 4. *More than 300,000 Lost Power in First 24 Hours of Oklahoma Ice Storm.* https://kfor.com/news/local/more-than-300000-lose-power-in-first-24-hours-of-oklahoma-ice-storm/ (June 18, 2021).
[4] The New York Times. *Oklahoma Ice Storms Leave Thousands Without Power on Eve of Early Voting.* https://www.nytimes.com/2020/10/28/us/ice-storm-oklahoma.html (June 18, 2021).
[5] Oklahoma Department of Emergency Management and Homeland Security. *Planning*. http://www.ok.gov/OEM/Programs_&_Services/Planning/State_Emergency_Operations_Plan_-_EOP.html (June 18, 2021).

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The document below, the Oklahoma Energy Assurance Plan (EAP), is intended to complement the state's official Emergency Operations Plan's ESF-12 by providing detailed references and supplementary information about Oklahoma's energy landscape; a detailed description of how Oklahoma currently plans for, prevents, and responds to energy emergencies; and a menu of strategies for officials and stakeholders to consider as they prevent or manage these emergencies. The Energy Assurance Plan is intended for use by all governmental agencies, energy suppliers, and key service providers who have responsibilities or essential capabilities for responding to energy emergencies. The plan is meant to serve as a guide rather than a list of "one-size-fits-all" procedures that can be generically applied without regard for the unique circumstances surrounding each emergency. In particular, the latter portion of the plan, which suggests potential responses to an energy emergency, should be treated as a "menu" of response options from which to select and implement rather than a list of standard operating procedures.

Oklahoma's Energy Assurance Plan was drafted in a collaborative effort between public agencies and private stakeholders. More information about those involved in the writing of this document can be found on the Acknowledgements page.

For this plan to be an effective tool, close communication among government agencies and between the agencies and private sector stakeholders is critical. Many of these communications channels are in place; these are noted in the appropriate sections of the Plan. In other cases, communications channels are less formal but nevertheless critical to maintain in order to facilitate an effective response should emergencies arise. Key governmental contacts for energy emergency response are maintained by the Office of Emergency Management (OEM), by the Oklahoma Corporation Commission, the Oklahoma State Energy Office, and through a password-protected website hosted by the U.S. Department of Energy. Detailed energy industry contact lists are required to be provided to the state annually by all regulated energy companies and are maintained by the Public Information Officer of the Oklahoma Corporation Commission.

To ensure the Plan remains up to date and functional as an emergency planning document, each year, at a minimum, the contact list and data portions of the plan should be reviewed and updated by the Oklahoma State Energy Office. Plan updates will be documented on the Periodic Review Log located on page 6 of this Plan.

As mentioned previously, questions and comments about this plan can be directed at any time to Secretary Kenneth Wagner at (405) 522-7099 or Kenneth.Wagner@ee.ok.gov.

CONTENTS OF THE PLAN

With the previous discussion in mind, the following sections comprise the Energy Assurance Plan (EAP) for the state of Oklahoma.

First, the EAP sets the stage for energy assurance planners in Oklahoma. It provides standard definitions for categorizing energy emergencies, both in type and severity, and provides a framework for delineating phases of energy emergency response; it also provides reference

information that will assist officials in closely monitoring the conditions affecting energy supply and demand statewide and nationwide. In addition, the plan outlines the legal authorities granted to the various levels of government—federal, state, and local—that are responsible for all four phases of energy assurance.

After providing an overall framework, the Energy Assurance Plan profiles each of Oklahoma's major energy sectors through the presentation of information on energy consumption as well as provider production capacities, infrastructure under management, and programs administered.

Next, the plan assesses the state's energy vulnerabilities by analyzing historical events in Oklahoma that have caused energy disruptions. It then discusses potential infrastructure vulnerabilities in the various energy sectors, and outlines examples of sector interdependencies between energy sources that should be considered in energy planning activities, as these may affect recovery efforts during emergency situations. Not to be overlooked is a detailed discussion of cybersecurity planning in Oklahoma, as vulnerabilities to the energy sector are not just physical but electronic in nature.

After providing a detailed view of Oklahoma's energy landscape, the plan turns to a detailed description of the responsibilities of the various governmental agencies in responding to an energy emergency. In particular, it discusses communication procedures between and across governmental agencies during energy emergencies and explains the way in which public information must be disseminated to citizens of Oklahoma during such events.

The final section of the plan focuses on the specific response strategies for energy disruptions and emergencies and presents issues of emerging consideration: first, the plan presents a set of preventative strategies and measures designed to mitigate the impact of an emergency prior to its occurrence; second, a detailed menu of supply and demand response options that officials may wish to consider should an energy emergency impact the state; and third, discusses emerging issues for 21st century energy assurance planning consideration.

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ENERGY ASSURANCE PLANNING OVERVIEW

IDENTIFYING AND CATEGORIZING ENERGY EMERGENCIES

Energy emergencies come in many forms, but most can be categorized as either service interruptions or supply shortages. Though we often treat these two types of emergencies as if they were mutually exclusive, it is important to recognize that one type of emergency can lead to another, or they can both occur simultaneously. For example, significant supply shortages can lead to service interruptions.

Types and Potential Causes of Energy Emergencies

Service Interruptions

Sometimes when energy service is interrupted, public demand for energy cannot be met at any price. Generally, damage to local distribution infrastructure causes this type of emergency. Accordingly, response measures usually involve repairing the damaged infrastructure. In all but the most extreme instances, governmental response to a service interruption is limited because energy providers are responsible for repairing their own systems. As such, the government's role is often one of support rather than direct action.

Although many variables can lead to infrastructure damage, some of the most common causes of damage to local energy infrastructure in Oklahoma include inclement weather (lightning, wind, tornadoes, ice, flooding, drought, etc.), earthquakes, temperature extremes, accidents, or mechanical failure due to faulty or aging transmission or distribution lines.

Supply Shortages

In other instances, an energy emergency can be a supply shortage. Supply shortages can be caused by insufficient fuel availability of any type, including natural gas, petroleum, and even a lack of sun to generate solar power or lack of wind to generate wind power. During such emergencies, energy supplies become insufficient or too expensive to meet public demand. Whereas the solution to service interruptions often requires local infrastructure repair, responses to supply shortages generally involve increasing supply or decreasing demand. In such instances, state officials often play a more significant role by encouraging consumption reductions, assisting with fuel switching when feasible, or temporarily lifting restrictions, such as lifting wellhead restrictions on the production of natural gas. Energy providers can also encourage or require consumption reductions, utilize fuel reserves, engage in fuel switching when technically feasible, or purchase additional fuel, often at increased prices.

The list of variables that could cause a supply shortage is quite lengthy. For organizational purposes, they can be divided into two categories — causes that limit the energy supply and causes that stimulate an abnormal demand spike. Factors that might limit energy supply include major infrastructure damage or limitations due to causes such as: explosions, extreme cold or heat, natural disasters that impair operations, railway damage, unsuitable driving conditions, and/or

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international events that radically increase the price or curtail the energy supplies from abroad. Variables that could cause demand spikes include prolonged periods of abnormally hot or cold weather that trigger a surge in demand for heating and cooling or crisis events that strike general public fear and uncertainty that causes them to stock-up on fuel and other resources.

Levels of Energy Shortage

Efforts to respond to an energy emergency must correspond with the severity of the crisis. In other words, state officials must consider the seriousness of the emergency prior to selecting and implementing appropriate response measures. For conceptual purposes, we draw from National Association of State Energy Officials (NASEO) guidelines[6] to define four levels of energy shortages, although it is important to note that the levels shown below are only intended to serve as broad guidelines. Because each energy emergency not only varies in severity but is also multidimensional, effective categorization requires qualitative assessment including analyzing the number of customers (meters) affected, the vulnerability of the affected population, and the circumstances surrounding the incident. For instance, a short electrical outage during an extremely cold winter day can be more severe than a sustained outage in the fall or spring.

Level 1:

Normal Conditions
No discernable shortage
Shortages could exist in locations outside the state or elsewhere but not pose a local threat

Level 2:

Mild Shortage
5-10% reduction in petroleum supply for a week or more
5-10% reduction in natural gas nominations
Localized infrastructure damage causing short-term electric transmission/distribution interruptions
No immediate threat to public health, safety, welfare, and/or economic vitality

Level 3:

Moderate Shortage
10-15% reduction in petroleum products for three weeks or more
10-15% reduction in natural gas nominations
Curtailments by local gas distribution companies for two weeks or more
Moderate infrastructure damage causing widespread electric transmission/distribution interruptions
Situation threatens to disrupt or diminish public health, safety, welfare, and/or economic vitality

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[6] NASEO. *State Energy Assurance Guidelines, Version 3.1, December 2009, p. 46.* http://www.naseo.org/eaguidelines/ (June 18, 2021).

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Level 4:

Severe Shortage
Greater than 15% reduction in the availability of petroleum products and/or natural gas for more than two weeks
Severe drops in natural gas nominations or other production problems
Severe infrastructure damage causing widespread interruptions in electric transmission/distribution that extend for several weeks
Situation poses an immediate threat to public health, safety, welfare, and/or economic vitality

Again, classifying an emergency as one level or another is as much a matter of qualitative judgment as it is a matter of quantitative or objective definition. Likewise, movement from one level to another is not necessarily linear or incremental. There are cases where conditions can escalate from normal or mild to severe in a matter of hours.

ENERGY ASSURANCE AND THE PHASES OF EMERGENCY MANAGEMENT

In managing complex and potentially catastrophic emergencies, government officials must look beyond the traditional idea of emergency response planning. Emergency preparedness and response planning is predominantly reactive toward energy assurance as a whole, although preparedness and response planning does incorporate a number of proactive and preemptive actions designed to prepare for many different types of emergencies, mitigate their potential impact, and learn from those that do occur by considering results of actions taken.

As defined by the U.S. Department of Energy (DOE), energy assurance involves a vast array of activities that fall into three main categories: prepare and plan, mitigate and respond, and education and outreach. Preparation and planning involve identifying key assets and points of contact, designing and updating energy emergency response plans, training personnel, and conducting exercises that test the effectiveness of response plans. Mitigation and response activities include monitoring events that may affect energy supplies, assessing disruption severity, situational awareness, coordinating restoration efforts, and tracking recovery. Education and outreach activities include communicating and coordinating with key stakeholders, increasing public awareness, and forming partnerships across sectors and jurisdictions.

With this definition in mind, NASEO suggests that energy assurance include four phases: monitor and alert; assess and take action; actions and feedback; and review lessons learned.[7] In the early phases, government action revolves around preparedness and mitigation. In the later phases, governmental action involves responding to and recovering from the energy emergency, as well as learning from the event itself. Regardless of the phase, the agencies charged with responding to

[7] NASEO. *State Energy Assurance Guidelines, (Version 3.1, December 2009, p. 46).* http://www.naseo.org/eaguidelines/ (June 18, 2021).

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an emergency must have as much information as possible—including critical background information—which enables an up-to-date understanding of the situation on the ground, an in-depth understanding of the energy profile in Oklahoma, familiarity with critical infrastructure and potential vulnerabilities, as well as a keen awareness of state history and previous events. This information should be carefully considered when making key decisions during each of the four phases of emergency management.

Phase I: Monitor and Alert

Phase I involves the ongoing monitoring of energy supplies, public demand, and prices. During this phase, state agencies monitor data and information, as it becomes available through energy supply reporting systems, continuously paying attention to supply and distribution problems.

Phase II: Assess and Determine Action

In Phase II, having noticed early signs indicating a potential energy emergency, government agencies intensify their data and information collection efforts to ensure that they have the best and most recent information. This data is used to evaluate the severity of the potential emergency, to locate the population that is likely to be impacted, and to determine whether governmental action is necessary.

Phase III: Actions and Feedback

If the government decides action is needed to ensure Oklahoma citizens' health, welfare, and safety, and the continued economic vitality of the state, Phase III activity begins. Government actions during Phase III, which is sometimes referred to as the response phase, include:

- Increase the level of communication among state agencies and the public
- Convene emergency planning and response organizations to consider actions that might be taken by the various state departments and agencies
- Implement voluntary programs to maximize the availability of energy supplies and/or programs designed to reduce existing demand
- If the problem involves multiple states, share information among state energy coordinators
- If implementation of voluntary programs or other emergency deterrent actions fail to mitigate the emergency, take additional actions
- If the situation continues to deteriorate, recommend a *State of Energy Emergency* be declared by the Governor, which will enable advanced response measures and activate requests for and access to federal assistance
- Continued monitoring of energy supply and demand to determine if governmental action has been effective

Phase IV: Review Lessons Learned

As emergency operations are phased out, state agencies thoroughly evaluate their actions and report the results to interested parties, such as the Governor's Office, cabinet level officers, legislative committees, and energy policy councils. These evaluations should include:

- Reports describing the nature of the energy emergency and a chronology of the actions taken to respond to it.

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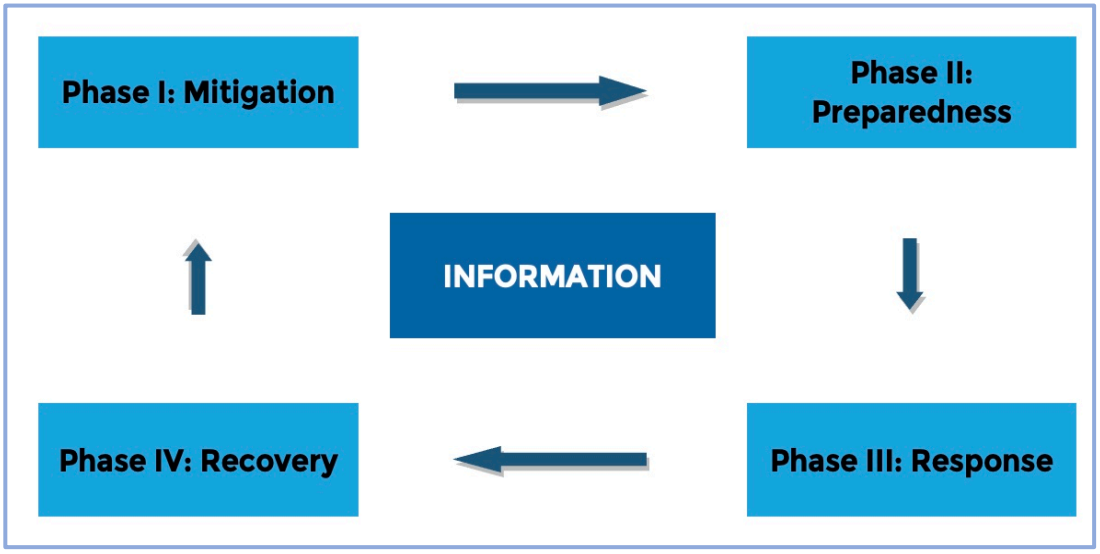
- An evaluation of the different response measures taken, with a specific focus on effectiveness and timeliness.
- A critical review of the overall performance of the state's energy assurance plan in addressing the specific emergency.

Oklahoma's four phases of emergency management, outlined in the state's Emergency Operations Plan (EOP),[8] utilize different category titles but are tightly aligned with the NASEO guidelines. Oklahoma's four phases of emergency management are depicted in Figure 1.

Figure 1:The Four Phases of Energy Emergency Management



The Oklahoma EOP defines mitigation activities as ones that are designed to prevent emergency occurrences or minimize adverse consequences after an emergency. It defines preparedness activities and systems as ones in existence prior to emergencies that are used to support and enhance response to emergencies. Planning, training, and mock exercises are included in this category. Response activities and programs address immediate effects of an emergency and include direction and control, warning, evacuation, and other activities. Finally, recovery activities are ones which restore normal operation of systems. Recovery activities can be short or long term.

MONITORING ENERGY SUPPLY AND DEMAND

The information sources below provide reliable information for energy planners that can be used to monitor or predict energy supplies or situations that may occur. By maintaining an understanding of energy markets and environmental conditions, state planners and responders will

[8] Oklahoma Department of Emergency Management. *Oklahoma Emergency Operations Plan, Revised October 2019.* https://oklahoma.gov/content/dam/ok/en/oem/documents/state-eop-101219.pdf (June 18, 2021).

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be better prepared to address shortage or emergency situations that may arise.

In addition to these general sources of information, Oklahoma has two designated Energy Emergency Assurance Coordinators who receive regular updates regarding energy security issues, daily news summaries, emergency situation reports, lessons learned from other states, and links to outage and curtailment information. This password-protected site is maintained and administered by the U.S. DOE's Office of Electricity Delivery and Energy Reliability. A full discussion of the role of Oklahoma's Energy Emergency Assurance Coordinators can be found in the Communications Section of this Plan.

For more information and resources to monitor energy supply and demand by sector, see Appendix B.

For more information and resources for legal authority regarding energy emergency planning and response, see Appendix C.

ENERGY PROFILE FOR OKLAHOMA

This section of the plan provides a summary description of Oklahoma's available energy resources, energy use, and expenditures to familiarize readers with the state's energy landscape and to provide context for the relative risks for each energy sector when considering the possibility of energy emergencies, outages, and other impacts. This section also provides an overview of major energy producers and providers, their production capacities, and complementary programs that play a role in Oklahoma's energy assurance and resilience. A companion discussion of Oklahoma's energy infrastructure vulnerabilities and modeled energy infrastructure emergency scenarios appears in the chapter titled "Preparing For, Mitigating, and Responding to Energy Emergencies." For purposes of organization, this section begins with an energy demand profile, then provides infrastructure overviews and discusses energy supply by energy sector in individual subsections.

OVERVIEW

Oklahoma is fortunate to have plentiful and diverse energy resources within its borders and is known as a major energy producing state. Significant oil and natural gas fields can be found in Oklahoma's Anadarko, Arkoma, and Ardmore geologic basins and modest coal deposits lie in northeast Oklahoma. For decades, Oklahoma has been one of the top oil and gas producing states in the nation. Oklahoma also has multiple hydroelectric dams and is one of the top-producing states for wind power; wind resources are particularly strong in the western portion of the state. Finally, Oklahoma ranks highly in solar resource potential, and currently produces a small but growing amount of solar power annually. Specific figures for energy production are provided in the sector profiles below.

ENERGY DEMAND PROFILE

Oklahoma has a strong demand for energy. In 2018, Oklahomans consumed approximately 433 million Btu of energy per capita ranking it 10th in the nation. [9] In total this amounted to over 1,700 trillion Btu of energy consumed in the state, which ranked 22nd out of the 50 states for 2018.[10] Oklahoma's higher-than-average per capita and overall energy consumption is due in part to the state's robust, yet energy-intensive, oil and gas industry. It is also due in part to Oklahoma's natural climate, which can bring both extreme heat in the summer and cold in the winter, driving up the need for climate control in residences and businesses.

[9] U.S. Energy Information Administration. *Total Energy Consumption Estimates per Capita by End-Use Sector, Ranked by State, 2018*. https://www.eia.gov/state/seds/sep_sum/html/pdf/rank_use_capita.pdf (June 18, 2021).
[10] U.S. Energy Information Administration. *Oklahoma State Energy Profile: Consumption & Expenditures*. https://www.eia.gov/state/print.php?sid=OK (December 29, 2020).

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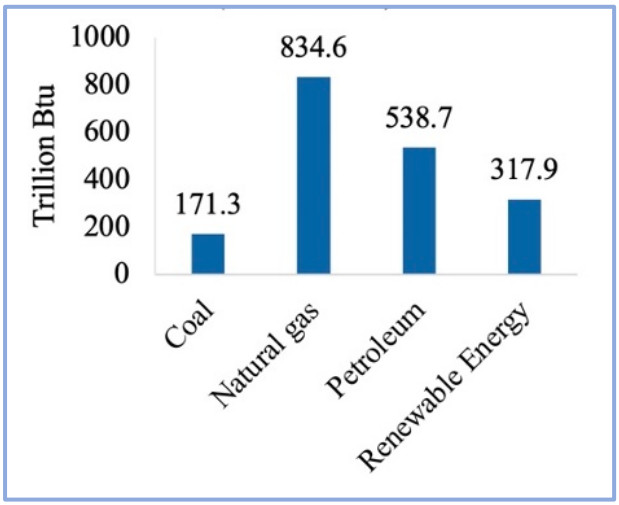
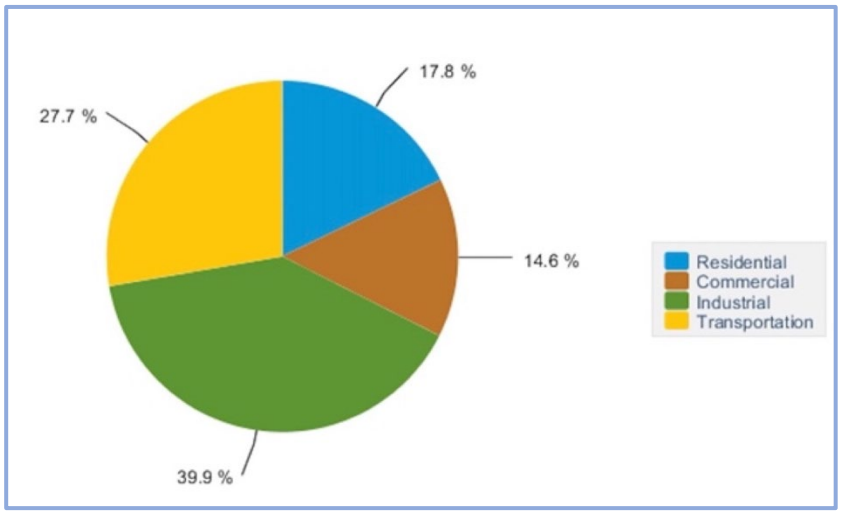
Table 1: State of Oklahoma: Energy Consumption by Fuel Source, 2018 (trillion Btu)



In Oklahoma there are four primary fuel sources that meet the demand for energy: natural gas, petroleum, renewable energy (primarily wind), and coal. Table 1, to the right, depicts Oklahoma's energy consumption by fuel source.[11]

Figure 2: Oklahoma Energy Consumption by End-Use Sector, 2019



As shown in Figure 2, to the left, Oklahoma's industrial sector is the heaviest energy user, consuming 658.1 trillion Btu in 2018, or approximately 39% of the state's total.[12] By comparison, the transportation sector consumed about 28%, the residential sector consumed approximately 18%, and the commercial sector consumed approximately 15% of the state's energy total.

[11] U.S. Energy Information Administration. *Energy Consumption Overview: Estimates by Energy Source an End-Use Sector, 2018.* https://www.eia.gov/state/seds/sep_sum/html/pdf/sum_btu_1.pdf (December 15, 2020).
[12] U.S. Energy Information Administration. *State Energy Data System*. https://www.eia.gov/state/?sid=OK#tabs-2 (June 1, 2020).

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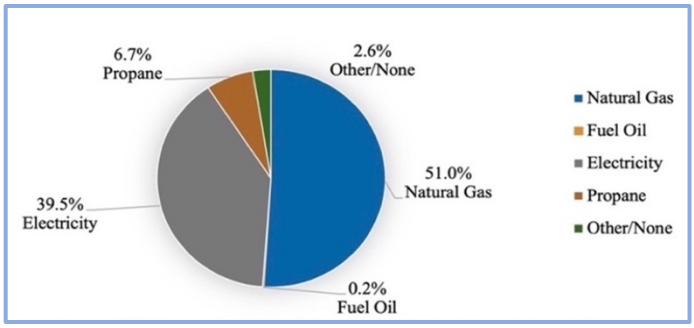
Further analyzing residential consumption by heating source, Figure 3 shows that approximately 51% of Oklahoma homes are heated by natural gas, approximately 40% are heated by electricity, and approximately 7% of residents rely on liquefied petroleum gases (propane) for heat. A mere 0.2% rely on fuel oil and another nearly 3% have some other or no heating source.

Figure 3: State of Oklahoma: Residential Consumption by Heating Source

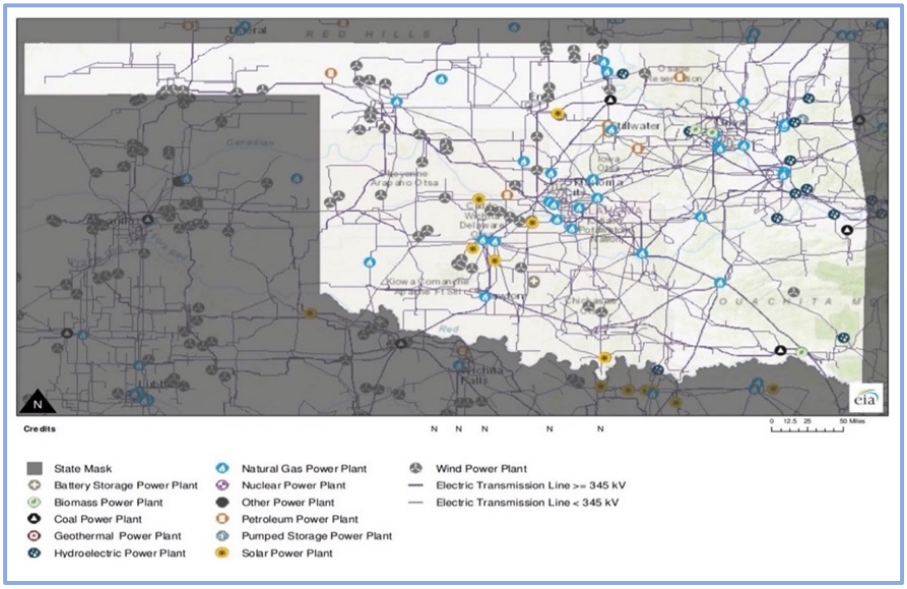


ELECTRICITY SUPPLY PROFILE

Electric Infrastructure Overview

Oklahoma's electric infrastructure includes generation facilities as well as transmission lines, substations, and distribution lines. Figure 4 displays a statewide overview of the myriad facilities that comprise electric infrastructure in Oklahoma.[13]

Figure 4: State of Oklahoma: Electric Infrastructure Map



[13] U.S. Energy Information Administration. *Oklahoma Profile Overview 2020*. https://www.eia.gov/state/?sid=OK (October 12, 2020).

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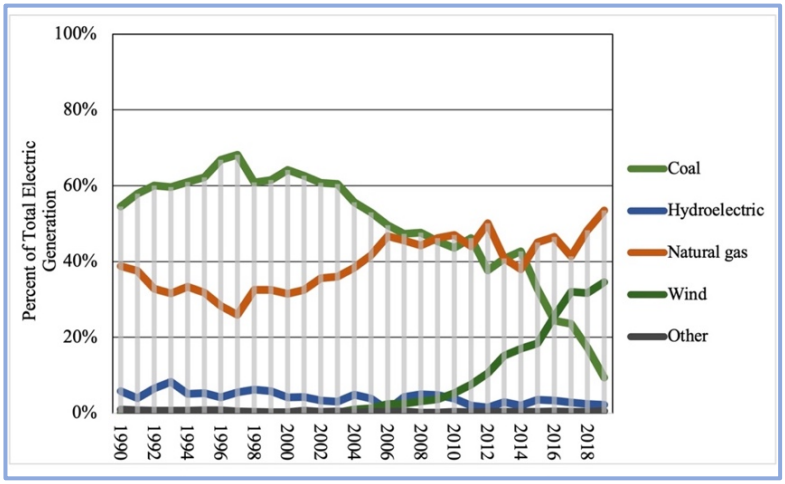
Electricity Supply Overview

Overall, Oklahoma's electricity generation capacity trends somewhat higher than the national average, as measured by state rank, while consumption trends very close to the national average. Using the most recent data available, as shown in Table 2 to the right, the state's electric power industry had net summer generation capacity of 27,376 MW of electricity in 2019 and net generation of 85,216,501 MWh, the majority of which comes from electric utilities, ranking the state 14th and 18th in these respective categories as compared to other U.S. states.[14] Total retail sales were 65 million MWh in 2019, accounting for approximately 76% of the total electricity generated. In this indicator, Oklahoma ranks 24th in the nation—near the national average. However, one aspect of Oklahoma's electric sector diverges from the state's trend towards national averages. Electricity in Oklahoma is consistently inexpensive; in 2019, Oklahoma's average price of electricity per kWh was $0.0786, which ranks as the least expensive in the United States.

Table 2: State of Oklahoma: Electricity Summary Profile, 2019

Item	Value	U.S. Rank
Net Summer Capacity (Megawatts)	27,376	14
Electric Utilities	16,390	16
Indepentent Power Producers & Combined Heat and Power	10, 986	10
Net Generation (megawatt hours)	85,216,501	18
Electric Utiities	41,188,172	25
Indepentent Power Producers & Combined Heat and Power	44,028,329	8
Total Retail Sales (megawatthours)	64,795,946	24
Full Service Provider Sales (megawatt hours)	64,795,946	20
Direct Use (megawatt hours)	888,870	28
Average Retail Price (cents/kWh)	7.86	50
kWh = Kilowatt hour		

Figure 5: Electric Power Industry Net Generation by Energy Source, 1990-2019



In Oklahoma, there have been major shifts within the last decade in the leading mix of fuel sources for the state's electric generation. Today, natural gas is the largest source of electric power generation, with renewable energy, predominantly from wind power, providing a significant source of electric power generation as well. As shown in Figure 5, coal was historically a major fuel source for the state's electric generation needs, but coal

[14] U.S. Energy Information Administration. *Table 1: 2019 Summary Statistics (Oklahoma).* http://www.eia.gov/electricity/state/oklahoma/ (December 15, 2020).

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use has decreased markedly in recent years.[15] As of 2019, natural gas powers over 50% of kilowatt hours generated in Oklahoma. The next highest source, wind, was responsible for fueling approximately 35% of the kilowatt hours generated in the state. Today, only about 9% of Oklahoma's kilowatt hours of electricity are generated from coal.

Electricity Providers

Electricity in Oklahoma is provided at the generation, transmission, and distribution levels. Some suppliers work across all these components and others are focused on only certain aspects of electricity provision. The state of Oklahoma has eight generation- and transmission-level electric suppliers operating in the state and dozens of distribution-level suppliers. Of the eight generation and transmission suppliers, six own and/or operate electric generation facilities, or portions of generation facilities, within the borders of Oklahoma. Three of these eight are investor-owned utilities which offer services at generation, transmission, and distribution level, three are generation and transmission cooperatives, and two are public sector utilities. Most of the wholesale electric power supply is coordinated and optimized through the Southwest Power Pool, which operates the bulk of the electric power grid across Oklahoma and the southwest region.

Investor-Owned Utilities

The three investor-owned electric utilities that provide electric service to most of the state, and which are also regulated by the state, are:

- Oklahoma Gas and Electric Company
- Public Service Company of Oklahoma
- Liberty Utilities-Empire District Electric Company

Oklahoma Gas & Electric

Oklahoma Gas and Electric Company (OG&E) is the largest provider of electricity in Oklahoma in terms of number of customers served. It provides electric service to 865,000 customers and has nearly 7,100 megawatts of generating capacity. OG&E owns 16 power generation facilities. Its current generation mix includes 67% natural gas, 26% coal, and 7% renewable energy.[16] In addition to its owned resources, OG&E has 342 MW in wind capacity through power purchase agreements.[17] OG&E has over 5,000 miles of transmission lines in Oklahoma and over 43,000 miles of distribution lines. Table 3 and Figure 6, both on the following page, show OG&E's owned generation facilities by fuel type, capacity and location.[18]

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[15] U.S. Energy Information Administration. *Net Generation by State by Type of Producer by Energy Source, 1990-2019*. https://www.eia.gov/electricity/data/state/ (December 18,2020)

[16] OG&E. *OG&E Investor Fact Sheet. (November 2020).* https://ogeenergy.gcs-web.com/static-files/6fcae252-0084-4cad-bd7f-3d50d5707108 (December 18, 2020).

[17] OG&E. *OG&E SEC Filings. 2020 Form 10-K.* https://ogeenergy.gcs-web.com/static-files/1b4987cc-fd2f-46c4-9cac-5c19bd55e8fd (June 23, 2021).

[18] OG&E. *OG&E SEC Filings. 2019 Form 10-K.* https://ogeenergy.gcs-web.com/static-files/bdc49724-36dc-47f1-ac99-f9d0381365ce (June 24, 2021).

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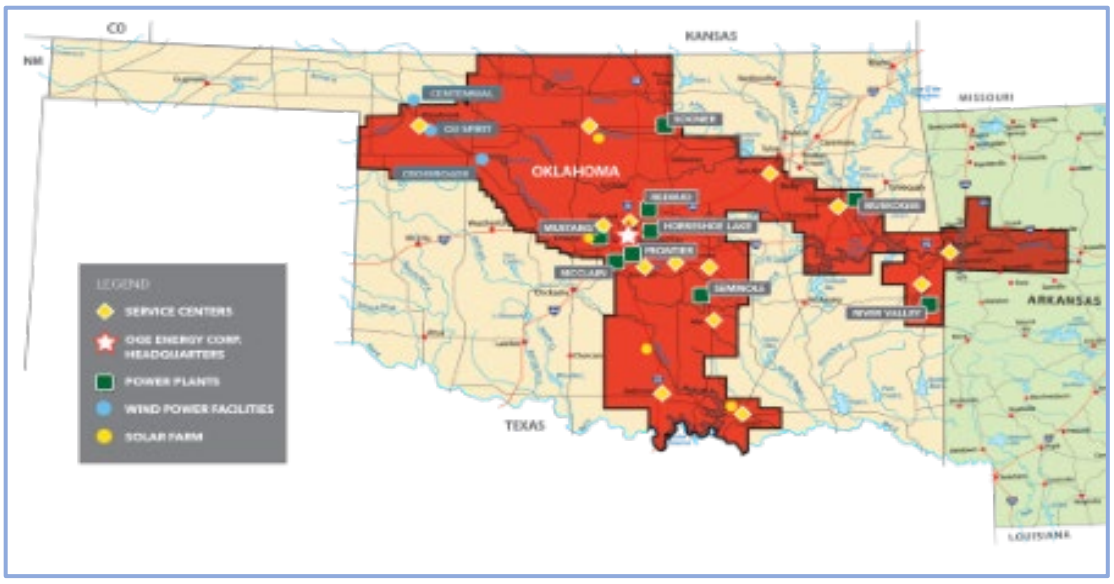
Table 3:OG&E-Owned Generation Sources

Facility Name	Location	Generating Capacity (MW)
Frontier (gas)	Oklahoma City	120
Horseshoe Lake Units 5-10	Oklahoma City	927
McClain (gas)	Newcastle	378
Muskogee Units 4 & 5 (gas)	Muskogee	865
Muskogee Unit 6 (coal)	Muskogee	503
Mustang Units 6-12 (gas)	Oklahoma City	401
redvud Units 1-4 (gas)	Luther	615
River Valley Units 1 & 2 (gas)	Poteau	320
Seminole Units 1-3 (gas)	Seminole	1,460
Sooner Units 1 & 2 (coal)	Red Rock	1,031
Centennial (wind)	Laverne	120
OU Spirit (wind)	Woodward	101
Crossroads (wind)	Canton	228
Mustang (solar)	Oklahoma City	2
Covington (solar)	Covington	10
Chickasaw Nation (solar)	Davis	5
Choctaw Nation (solar)	Durant	5

Figure 6: OG&E Regional Asset Map and Service Territory



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Public Service Company of Oklahoma

Public Service Company of Oklahoma (PSO), a unit of American Electric Power, is the second-largest provider of electricity in Oklahoma, serving approximately 557,000 customers in the state,[19] mostly in the eastern and southwestern areas. The green highlighted areas in Figure 7 show PSO's service territory in Oklahoma.[20]

Figure 7: PSO Service Territory Map

Table 4: PSO-Owned Generation Facilities

Facility Name	Location	Generating Capacity (MW)
Tulsa Power Stateion (gas)	Tulsa	321
Northeastern Station 1 & 2 (gas)	Oologah	856
Northeastern Station Unit 3 (coal)	Oologah	469
Riverside (gas)	Jenks	1,061
Comanche (gas)	Lawton	248
Weleetka (gas)	Weleetka	100
Southwestern Station (gas)	Anadarko	616
Oklaunion (coal)	Vernon, TX	102*
*Co-owned. Capacity listed is PSO-owned generation capacity.		

As shown in Table 4, to the left, PSO currently has a generation capacity of 3,773 megawatts from 8 generating stations, 7 of which are located in Oklahoma, and also purchases power under long-term contracts.[21] Overall, PSO's fuel mix includes 14% coal, 21% natural gas, 22% wind purchased under long-term contracts, and 43% other purchased power.[22] PSO has 3,786 miles of transmission lines and 22,000 miles of distribution lines in Oklahoma.

[19] Public Service Company of Oklahoma. *PSO 2020 Fact Sheet.* https://www.psoklahoma.com/global/utilities/lib/docs/info/facts/factsheets/PSOFactSheet2020.pdf (October 26, 2020).
[20] Public Service Company of Oklahoma. *Our Company.* https://www.psoklahoma.com/company/ (June 24, 2020).
[21] Public Service Company of Oklahoma. *PSO Fact Sheet.* https://psoklahoma.com/global/utilities/lib/docs/info/facts/factsheets/PSOFactSheet2020.pdf (December 1, 2020).
[22] Public Service Company of Oklahoma. *PSO 2020 Fact Sheet.* https://www.psoklahoma.com/global/utilities/lib/docs/info/facts/factsheets/PSOFactSheet2020.pdf (October 26, 2020).

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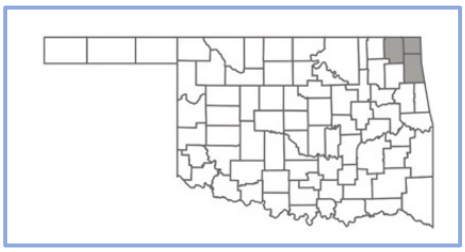
Liberty Utilities-Empire District Company

Liberty Utilities is an investor-owned public utility with a Central Region territory that provides electric service in Arkansas, Kansas, Missouri, Illinois, Iowa and Oklahoma; its Central Region is headquartered in Joplin, Missouri. There are multiple local utilities under the Liberty umbrella, with its Liberty Utilities-Empire District company providing service in three counties, Craig, Delaware, and Ottawa,[23] in far northeastern Oklahoma. Liberty Utilities' central region has a generation capacity of 1,135 megawatts and operates seven generation plants, none of which are in Oklahoma. Most of Empire's generating facilities are located in southwestern Missouri; however, Liberty does have generation facilities located at Riverton, Kansas and Osceola, Arkansas. Table 5 and Figure 8 show Liberty's Central Region generation sources by fuel type, location, and capacity, and display the utility's service central region service territory, respectively.

Table 5: Liberty Utilities Generation Sources

Facility Name	Location	Generating Capacity
Riverton (gas)	Riverton, KS	275 MW
Iatan Units 1 & 2 (coal)	Weston, MO	192 MW*
State Line Combined Cycle (gas)	Joplin, MO	292 MW*
State Line Unit 1 (gas)	Joplin, MO	93 MW
Energy Center (gas)	LaRussell, MO	232 MW
Ozark Beach (hydro)	Ozark Beach, MO	16 MW
Plum Point (coal)	Osceola, AR	51 MW*
* Co-owned. Capacity listed is Liberty-owned capacity.		

Figure 8: Liberty Utilities Oklahoma Territory Map



Cooperatives

Oklahoma is served by dozens of electric cooperatives. The role of electric cooperatives in the state is a critical one as combined they are the only utility entity that has infrastructure in, and provides service to, all 77 counties in Oklahoma. Appendix D gives a complete listing of cooperatives serving Oklahoma.

There are three generation and transmission cooperative providers serving the state: Western Farmers Electric Cooperative (WFEC), KAMO Electric Cooperative and Golden Spread Electric Cooperative. These entities are comprised of individual member cooperatives that provide electric service at the distribution level. WFEC and KAMO are the predominant providers in Oklahoma. Golden Spread Electric Cooperative is based in Amarillo, Texas and serves only one Oklahoma distribution cooperative. Detailed distribution-level membership lists for these three providers are contained as part of Appendix D.

[23] Liberty Utilities. *Fact Sheet.* https://central.libertyutilities.com/uploads/Fact%20sheet.pdf (December 29, 2020).

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Western Farmers Electric Cooperative

Western Farmers Electric Cooperative (WFEC), headquartered in Anadarko, Oklahoma, is the largest generation and transmission cooperative in Oklahoma. WFEC, owned by its member electric cooperatives, is a regional electric generation and transmission cooperative founded in 1941.

It generates electric power from self-owned generation facilities and purchases power for 17 Oklahoma distribution electric cooperatives and Altus Air Force Base, with a total service area that covers three-quarters of the state. WFEC member cooperatives operate in all but the northeastern portion of Oklahoma and serve over two-thirds of rural Oklahoma. WFEC owns and maintains more than 3,800 miles of transmission line and has over 1,300 MW of owned generating capacity in Oklahoma.

In addition to its owned generation capacity, WFEC also has 43 MW of owned generation capacity in New Mexico and over 1,760 MW of generating capacity obtained through power purchase agreements with other entities both inside and outside of Oklahoma, including approximately 957 MW of wind, 308 MW of natural gas, 32 MW of solar, 268 MW of hydroelectric power and 200 MW of blended fuel types.

Table 6: WFEC-Owned Generation Facilities

Facility Name	Location	Generating Capacity (MW)
Anadarko Units 3-6 (gas	Anadarko	329
Canadian Valley 1 & 2 (solar)	Seminole/Shawnee	0.50
Cimarron (solar)	Kingfisher	0.125
Cotton (solar)	Randlett	0.25
Cyril (solar)	Cyril	5
East Central (solar)	Okmulgee	0.25
GENCO U7 & U8 (gas)	Anadarko	92
Harmon (solar)	Hollis	0.10
Hinton (solar)	Hinton	3
Hugo (coal)	Hugo	400
Kiamichi (solar)	Wilbuton	0.25
LCEC (gas)	Lovington, NM	43
Marietta (solar)	Marietta	3
Mooreland Units 1-3 (gas)	Mooreland	343
Northwestern (solar)	Woodward	0.125
OEC (solar)	Norman/Moore	0.25
Orme Units 9-11 (gas)	Anadarko	142
Pine Ridge (solar)	Ft. Cobb	3
Red River (solar)	Marietta	0.25
Southeastern (solar)	Durant	0.25
Southwest Rural OK & TX	Federick/Vernon, TX	0.35
Tuttle (solar)	Tuttle	4

Figure 9: Western Farmers Electric Cooperative Service Territory Map

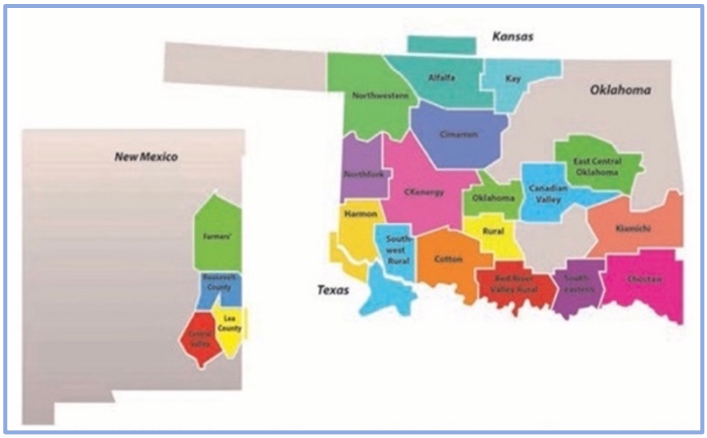

Table 6, above, shows WFEC's owned generation sources by fuel type, location and capacity, and Figure 9, left, displays the cooperative's service territory.[24]

[24] Figures include 2020 Net Output and were obtained directly from WFEC employees in December 2020 and the *WFEC 2019 Annual Report*. https://www.wfec.com/publications-b/2020/5/21/2019-annual-report (December 29, 2020).

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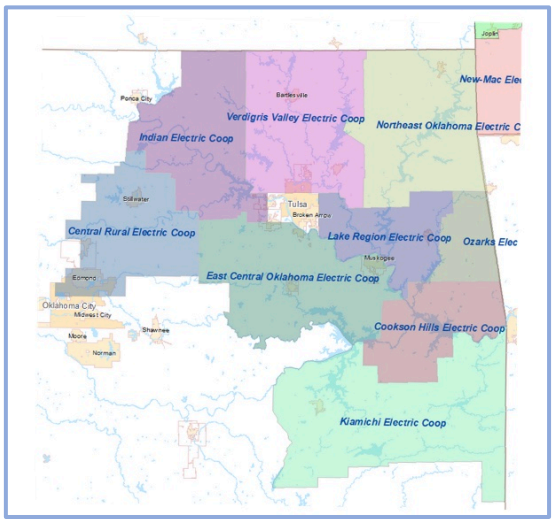
KAMO Electric Cooperative

KAMO Electric Cooperative (KAMO Power), headquartered in Vinita, Oklahoma, is a major transmission cooperative providing wholesale electric power in Oklahoma. This member-owned transmission cooperative serves customers in northeastern Oklahoma and southwestern Missouri. KAMO Power serves 17 electric distribution cooperatives, nine of which are located in Oklahoma. All of KAMO Power's electric generation is purchased from Associated Electric Cooperative, Inc. (AECI), of which it is a part owner. AECI does have one generation facility in Oklahoma, a combined cycle gas facility with approximately 1,000 MW of generation capacity. In addition, AECI also has a purchase power agreement from the Osage Wind Farm for 150MW of wind generation. Figure 10 displays KAMO's service territory.[25]

Figure 10: KAMO Power Service Territory



Golden Spread Electric Cooperative

Golden Spread Electric Cooperative (GSEC) is headquartered in Amarillo, Texas, and serves one Oklahoma distribution cooperative in the Oklahoma Panhandle, Tri-County Electric Cooperative (TCEC). Golden Spread owns four generation facilities, none of which are located in Oklahoma. Table 7 displays GSEC's owned generation capacity.

Table 7: Golden Spread Electric Cooperative-Owner Generation Facilities

Facility Name	Location	Generating Capacity (MW)
Antelope Station (gas)	Abernathy, TX	165*
Elk Station (gas)	Abernathy, TX	582*
Mustang Station (gas)	Denver City, TX	927*
Panhandle Ranch (wind)	Wildorado, TX	78
*Offers grid-switching capability allowing this generation facility to suply either ERCOT or SPP's transmission grids		

Public Sector Utilities

Under Oklahoma statutes, the Oklahoma Corporation Commission (OCC) does not regulate any entity that is operated by a governmental subdivision. Of the largest providers of electricity in Oklahoma, two providers, the Oklahoma Municipal Power Authority and the Grand River Dam Authority, fall into the category of public sector utilities.

[25] KAMO Power. *2019 Annual Report.* https://www.kamopower.com/content/kamp-power-annual-report (December 30, 2020).

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Oklahoma Municipal Power Authority

The Oklahoma Municipal Power Authority (OMPA) is a not-for profit organization created by Oklahoma statute[26] for the purpose of providing an adequate, reliable, and affordable supply of electrical power and energy to Oklahoma's municipally owned electric systems. As of 2020, OMPA serves 42 municipally-owned electric systems in Oklahoma.[27] As a consumer-owned public power entity, OMPA is owned by the member cities it serves. The members of OMPA include:

City of Altus	City of Geary	City of Newkirk	Town of Spiro
City of Blackwell	Town of Goltry	Town of Okeene	City of Tecumseh
City of Comanche	Town of Granite	Town of Olustee	City of Tonkawa
Town of Copan	City of Hominy	Town of Orlando	City of Walters
City of Cordell	City of Kingfisher	City of Pawhuska	City of Waynoka
City of Duncan	Town of Laverne	City of Perry	City of Watonga
City of Edmond	City of Lexington	City of Ponca City	City of Wetumka
Town of Eldorado	City of Mangum	City of Pond Creek	City of Wynnewood
City of Fairview	Town of Manitou	City of Prague	City of Yale
City of Frederick	City of Marlow	City of Purcell	
Town of Ft. Supply	Town of Mooreland	Town of Ryan	

OMPA owns or co-owns eight generation facilities to serve its members. Coal, natural gas, and hydroelectricity are all utilized in electricity generation by the plants. Table 8, next page, shows OMPA's owned generation sources by fuel type, location and capacity, and Figure 11, also next page, displays the Authority's member locations. [28] OMPA also has purchased power resources from a variety of renewable power resources, including nearly 142 MW of wind, 3 MW from methane (landfill) gas, 50 MW of natural gas, 24 MW of diesel from municipal generating facilities, 20 MW of coal, and 40 MW from a variety of other resources. Overall, the 2020 fuel mix for OMPA's generation resources included 48% natural gas, 28% renewables, 13% coal, and 11% other purchased power.

[26] Oklahoma Municipal Power Authority. *Home.* http://ompa.com/ (December 30, 2020).
[27] Oklahoma Municipal Power Authority. *About Us.* https://ompa.com/about/ (December 30, 2020).
[28] Oklahoma Municipal Power Authority. *2019 Annual Report.* https://ompa.com/about/financial/ (December 30, 2020).

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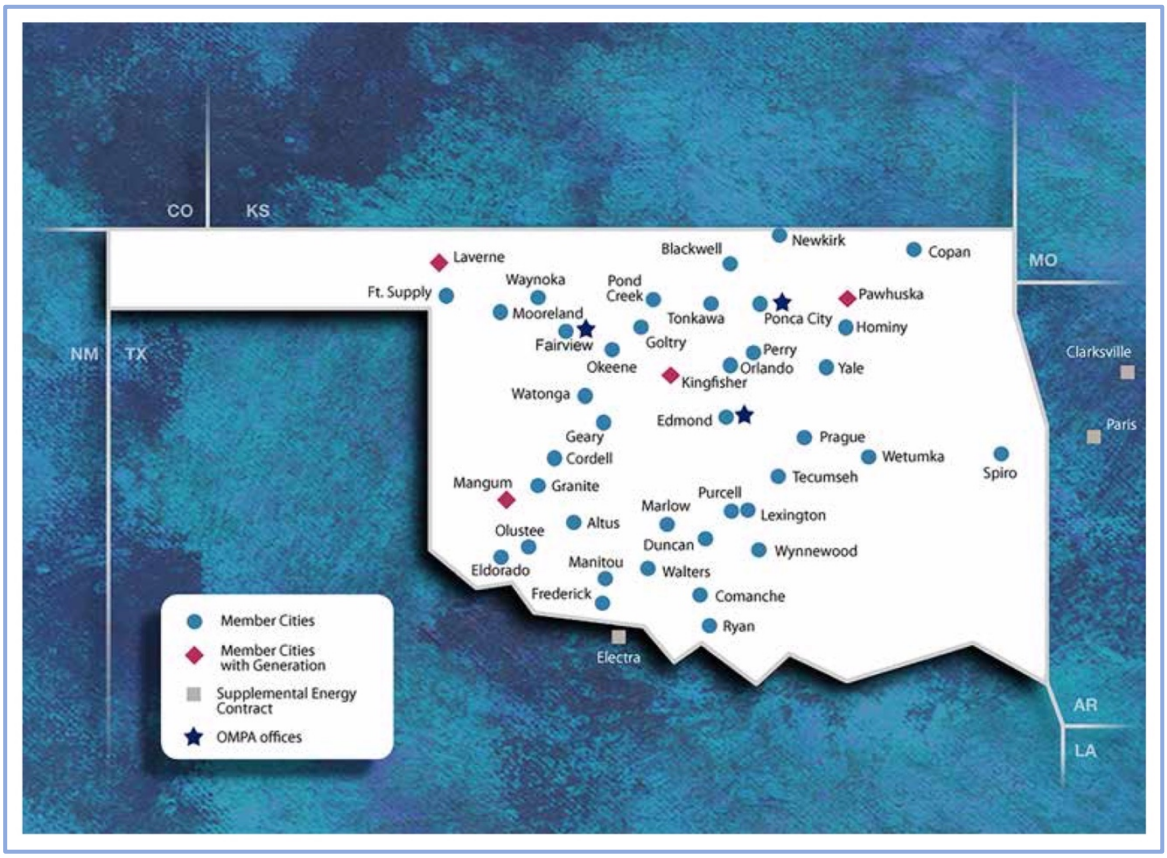
Table 8: OMPA-Owned Generation Facilities

Facility Name	Location	Generating Capacity (MW)
Kaw Hydroelectric Plant (hydro)	Ponca City	29
Charles D. Lamb Energy Center (gas)	Ponca City	103
McClain Plant (gas)	Newcastle	118*
Redbud Generating Facility (gas)	Luther	155*
Henry W. Pirkey Plant (coal)**	East Texas	16*
Dolet Hills Power Station (coal)***	DeSoto Parish, LA	25*
John W. Turk, Jr. Power Plant (coal)	Fulton, AR	43*
* Co-owned. Capacity listed as OMPA-owned generation capacity.		
**Retiring in 2023		
***Retiring in 2021		

Figure 11: OMPA Member Municipalities Map



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Grand River Dam Authority

The Grand River Dam Authority (GRDA) is an agency of the state of Oklahoma authorized under 82 O.S. § 861. GRDA was created by the Oklahoma Legislature in 1935 as a conservation and reclamation district and it owns and operates electric generation, transmission, and distribution facilities mainly within the northeastern portion of the state. GRDA is a non-appropriated state agency—funded fully by revenues generated from the sale of electricity and water, and not by public dollars. GRDA has a seven-member governing board that includes three gubernatorial appointments, one member appointed by the President Pro Tempore of the Oklahoma State Senate, one member appointed by the Speaker of the Oklahoma House of Representatives, one member appointed by the Oklahoma Association of Electric Cooperatives, and one designee of the Municipal Electric Systems of Oklahoma. GRDA headquarters are located in Chouteau, Oklahoma.

Table 9: GRDA-Owned Generation Facilities

Facility Name	Location	Generating Capacity (MW)
Pensacola Dam Units 1-6 (hydro)	Langley	126
Robert S. Kerr Dam Units 1-4 (hydro)	Locust Grove	128
Salina Pumped Storage Units 1-3 (hydro)	Salina	129
Salina Pumped Storage Units 4-6 (hydro)	Salina	129
Grand River Energy Center Unit 2 (coal)	Chouteau	520
Grand River Energy Center Unit 3 (gas)	Chouteau	495
Redbud Gas Plant Units 1-4 (gas)	Luther	443*
* Co-owned. Capacity listed is GRDA-owned generation capacity.		

Figure 12: GRDA Service Territory

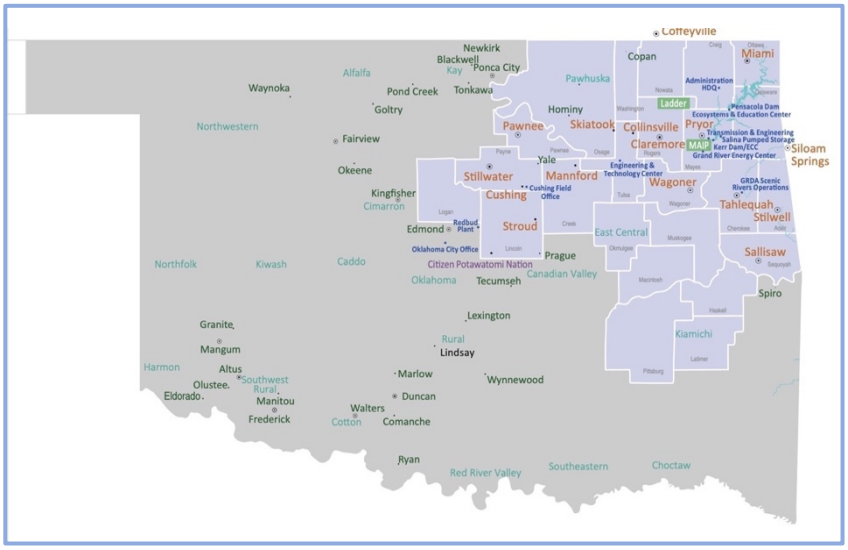

Table 9 shows GRDA's owned generation sources by fuel type, location and capacity, and Figure 12 displays this organization's service territory. In addition to its owned generation capacity, GRDA has 387 MW of wind capacity through four power purchase agreements, and 168 MW of capacity from customer capacity purchase agreements. GRDA owns over 1,200 miles of transmission line in Oklahoma.[29]

[29] Grand River Dam Authority. *GRDA 2018-2019 Comprehensive Annual Financial Report.* https://www.grda.com/wp-content/uploads/2020/06/GRDA%20CAFR%20_2019_v2_2020-06-11_FINAL.pdf (December 18, 2020).

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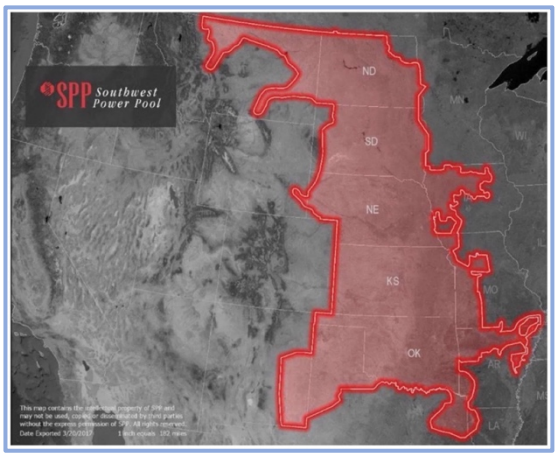
Regional Transmission Organizations

Southwest Power Pool

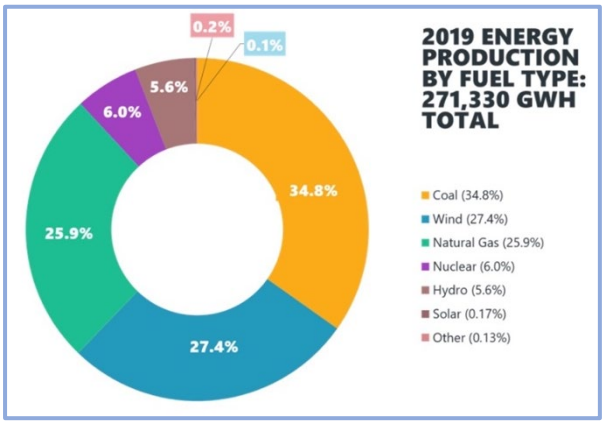
The Southwest Power Pool (SPP) is a Regional Transmission Organization ("RTO") mandated by the Federal Energy Regulatory Commission. Its mission is to ensure reliable supplies of power, adequate transmission infrastructure, and competitive wholesale electricity prices on behalf of its members. Through its integrated marketplace for electricity, it is designed to reduce the cost of electricity to the customer. As an RTO, SPP upholds reliability and infrastructure and manages competitive wholesale electricity prices within its region. SPP has over 100 members in its territory, including all 8 of Oklahoma's electricity providers profiled above. SPP's footprint, for which it provides reliability coordination, planning, market administration and other services, is shown in Figure 13.

Figure 13: Southwest Power Pool Territory



SPP provides its members reliability coordination, regional scheduling, transmission planning, grid monitoring, and many other services. In particular, the SPP's Integrated Marketplace, a day-ahead wholesale electricity market, facilitates the sale and purchase of cost-effective electricity. All major Oklahoma electric utilities sell into the SPP Integrated Marketplace.[30]

Figure 14: SPP Members' Energy Production by Fuel Type: 2019



Overall, the Southwest Power Pool offers a diverse fuel mix comprised of members' generation that is offered into the marketplace. As shown in Figure 14, the generating mix across SPP in 2019 was dominated by coal, wind, and natural gas.

Energy Efficiency and Demand Management for Electricity

Energy efficiency simply means using less energy to accomplish the same goal or task and is a key component in assuring an energy resilient Oklahoma since reduced energy demand reduces strain

[30] Southwest Power Pool. *About Us.* https://spp.org/about-us/ (December 19, 2020).

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on energy resources. Demand management helps reduce strain on existing generating capacity by shifting demand from peak load to off-peak times.

The state of Oklahoma, local governments, and Oklahoma electric utilities all offer energy efficiency and demand management programs to help reduce demand, shift usage to lower-demand times to reduce system strain, and delay the need for new electric generation sources.

Utility-Administered Programs

The state's largest electric utility, Oklahoma Gas and Electric (OG&E), is mid-way through its currently approved 3-year energy efficiency and demand management program. The current programming structure went into effect in 2019 and will be maintained through 2021; however, all the currently offered programs have been in place prior to this current 3-year programming cycle. The following programs are included in the current energy efficiency portfolio: Home Energy Efficiency Program (HEEP), Weatherization Residential Assistance Program (WRAP), Commercial Energy Efficiency Program (CEEP), and an Education Program (EP). Cumulatively in program year 2019, these programs created 155,696 MWh savings for customers[31] and OG&E projects that for 2020 its programs will reduce overall demand by 70 MW. [32] OG&E also offers a SmartHours program that provides variable peak pricing to customers to incentivize load shifting to off-peak periods. Over the past ten years, over 200,000 customers have participated in at least one of these programs.

Oklahoma's other major regulated utility, PSO, is also mid-way through its 3-year approved demand management program, which is approved from 2019-21. Its current portfolio includes eight energy efficiency programs: Business Rebates, Multi-Family, Home Weatherization, Energy Saving Products, Homes Rebates, Education, Behavior Modification, and Conservation Voltage Reduction. In program year 2019, these programs cumulatively created 132,689 MWh in savings. PSO also offers Power Hours, a demand management program that is similar to OG&E's SmartHours program, which uses price signaling to customers to incentivize load shifting to off-peak times. Together these programs expect to serve over 200,000 customers per year.[33]

Western Farmers Electric Cooperative's energy efficiency and demand management programs are handled through its member distribution cooperatives. However, Western Farmers Electric Cooperative (WFEC) does use rate signals to its members through an unbundled rate structure called managed generation charges. This signals peak demand days to members on the morning of the day of a called peak. Then, member coops can use this signal to implement their diverse demand management programs. Examples of energy efficiency and demand management

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[31] OG&E. *OG&E Oklahoma Comprehensive Demand Program Portfolio: 2019 Annual Report (July 2020).* https://oklahoma.gov/content/dam/ok/en/occ/documents/pu/energyefficiency/demand-program-annual-reports/ogande-2019-demand-report.pdf (June 18, 2021).
[32] OG&E. *Oklahoma Comprehensive Demand Program Portfolio 2019 Annual Report.* https://oklahoma.gov/content/dam/ok/en/occ/documents/pu/energyefficiency/demand-program-annual-reports/ogande-2019-demand-report.pdf (June 23, 2021).
[33] Received from PSO employees in August 2020.

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programs offered by WFEC's distribution co-ops include residential time-of-use rates, energy efficiency audits, and one distribution co-op, Oklahoma Electric Cooperative, offers special nighttime electric vehicle charging rates and utilizes distributed solar generation as additional demand management programs.

The Oklahoma Municipal Power Authority (OMPA) also offers a variety of efficiency and demand management programming: the WISE program, which offers rebates to residential and commercial customers to install highly efficient electric heat pumps and ceiling insulation, and the DEEP program, which provides matching funds to commercial and industrial customers who implement energy-saving measures that will reduce peak demand. The DEEP program alone reduced demand by 620 kW in 2020. Finally, OMPA offers free energy audits for all member cities' residential customers to further identify opportunities for members to achieve energy savings.

Most energy efficiency programming for the Grand River Dam Authority (GRDA) is offered by its individual municipal customers. However, GRDA has implemented several energy efficiency projects with its industrial customers in the MidAmerica Industrial Park.

In total for 2019, Oklahoma utilities reported 185.4MW of peak demand savings to the U.S. Energy Information Administration.[34]

State-Administered Programs

At the state level, beginning in 2009, 61 O.S. § 213 required all new state-owned buildings or major renovations of state-owned buildings of 10,000 square feet or more to meet Leadership in Energy and Environmental Design (LEED) or Green Building Initiative's Green Globes standards. In addition, in 2012, 27A O.S. § 3-4-106.1 established the Oklahoma State Facilities Energy Conservation Program, in which all state agencies and higher education institutions have achieved an energy efficiency and conservation improvement target of at least 20 percent. Improvement was based upon benchmarks prior to implementation of the program. Upon implementation, and all agencies were required to input historical utility cost into approved software on a monthly basis. Costs associated with the implementation of this program were fully funded by program savings.

In addition to these programs, the Oklahoma Department of Commerce administers nearly $5 million in weatherization funds from the U.S. Department of Energy and Oklahoma Department of Human Services to accomplish residential energy efficiency initiatives in all 77 Oklahoma counties.

Local Government-Administered Programs

Finally, there are numerous local energy efficiency efforts underway which are coordinated by the state. These efforts mainly include energy efficient upgrades of municipal lighting, HVAC equipment, and insulation of public buildings; these upgrades are often funded by the State Energy

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[34] U.S. EIA. *Annual Electric Power Industry Reports: Detailed Data Files, Demand Response*. https://www.eia.gov/electricity/data/eia861/ (December 20, 2020).

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Program housed in the Oklahoma Department of Commerce and funded by the U.S. Department of Energy.

In addition, Oklahoma's Energy Independence Act has authorized county governments to develop commercial Property-Assessed Clean Energy (C-PACE) programs. Counties are authorized to create "County District Energy Authorities" that can issue notes/bonds, seek out public/private lenders, or apply for grants/loans from other governmental entities to establish and fund local PACE programs.[35] Once a county has established the Authority and PACE program, county property owners can receive a loan from the county for permanently fixed renewable energy or energy efficiency improvements to their property. These loans are then repaid on the owner's property taxes and constitute a lien on the property until paid in full. PACE program authorization is an important feature in stimulating additional efficiency investments. As of 2020, there is statewide program guidance available to ease the process for counties to establish C-PACE programs and Tulsa County has launched its program.[36]

Renewable Energy for Electricity

Renewable energy is a growing and significant source of Oklahoma electricity due to the state's plentiful natural resources of wind, water, and sun as well as technology developments that have improved pricing and deployment opportunities.

As of 2019, Oklahoma sourced just under 40% of its net electricity generated, based on MWh, from renewable sources, mainly from wind and hydroelectric sources.[37] Oklahoma remains a national leader in wind energy. In 2019, Oklahoma ranked 3rd in the nation for installed wind capacity with more than 8,173 MW installed.[38]

The state also relies on hydroelectricity to meet a portion of its electric demand, with the overall megawatt hours generated in decline for most of the 2010s, and then a resurgence in 2019. Overall, Oklahoma's ten hydroelectric generating facilities provided just under 5% of net electricity generation in Oklahoma in 2019.[39]

Currently, solar energy provides only a fraction of a percent of Oklahoma's electric generation. Today, the state has approximately 68 MW of installed solar capacity, enough to power just over

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[35] 19 O.S. § 19-460.1-460.7. Oklahoma Energy Independence Act.
[36] Indian Nations Council of Governments. *Oklahoma C-PACE Program Guidelines - October 2020.* http://www.incog.org/Environmental_Planning/Documents/CPACE/OK%20C-PACE%20Program%20Guidelines%20OCT%202020%20FINAL.pdf (May 28, 2021).
[37] U.S. Energy Information Administration. *US States: Oklahoma.* https://www.eia.gov/state/?sid=OK#tabs4 (May 19, 2020).
[38] American Wind Energy Association. *Oklahoma Wind Energy Fact Sheet*. https://www.awea.org/resources/fact-sheets/state-facts-sheets (May 26, 2020).
[39] U.S. Energy Information Administration. *Net Generation by State by Type of Producer by Energy Source, 1990-2019*. https://www.eia.gov/electricity/data/state/ (December 18, 2020).

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8,000 homes.[40] Today, the majority of solar capacity is utility scale solar; however, residential rooftop solar is a growing trend as costs continue to decrease rapidly and consumers are increasingly interested in the ability to self-generate electricity. Despite solar's modest profile in the state today, Oklahoma has strong solar resources and the Solar Energy Industries Association projects over 600 MW of growth for installed solar in Oklahoma over the next five years. [41,42]

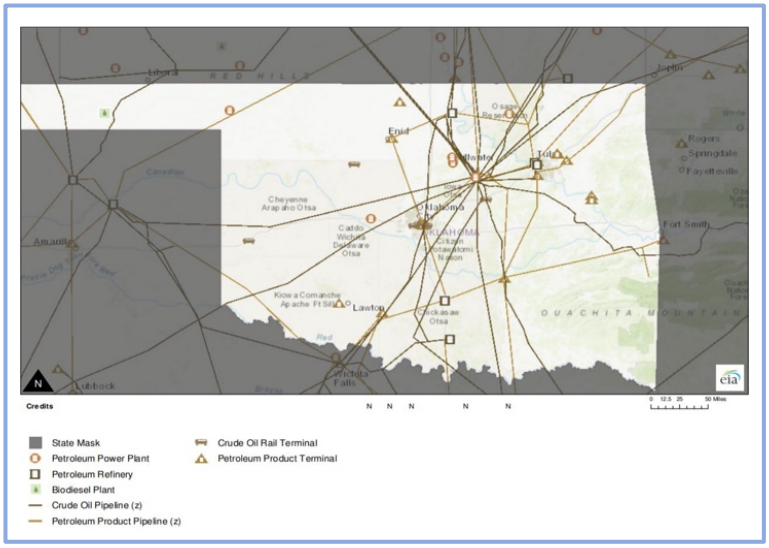
Finally, biomass represents an emerging fuel source within Oklahoma's energy portfolio, although embodying only a fraction of a percent of the state's electricity generation. In Oklahoma, biomass is currently generated primarily from burning wood but landfill gas and agricultural and municipal waste are also sources of Oklahoma biomass.

Additional detailed examples of Oklahoma's projects in each of these areas can be found in the Oklahoma Energy Plan, which can be accessed at https://ee.ok.gov/resource/oklahoma-energy-plan. Further discussion of these topics can be found in the chapter titled "Emerging Issues in 21st Century Energy Assurance Planning."

CRUDE OIL AND PETROLEUM PRODUCTS SUPPLY PROFILE

Crude Oil and Petroleum Products Infrastructure Overview

Figure 15: State of Oklahoma: Crude Oil and Petroleum Infrastructure Map



Oklahoma's crude oil and petroleum infrastructure includes wells and gathering lines, drilling pads, pipelines, compressor stations and refineries, storage facilities, water transfer and saltwater disposal facilities, and product and rail terminals. Although the precise location of the thousands of wells and drilling locations are too many to display in this report, Figure 15 displays key infrastructure for the crude oil and petroleum sector in Oklahoma.[43]

[40] Solar Energy Industries Association. *State Solar Spotlight: Oklahoma.* https://www.seia.org/state-solar-policy/oklahoma-solar (December 20, 2020).
[41] National Renewable Energy Laboratories. *Global Horizontal Solar Irradiance.* https://www.nrel.gov/gis/assets/images/nsrdb-v3-ghi-2018-01.jpg (December 20, 2020).
[42] Solar Energy Industries Association. *State Maps.* https://www.seia.org/state-solar-policy/oklahoma-solar (December 20, 2020).
[43] U.S. Energy Information Administration. *Oklahoma Profile Overview 2020.* https://www.eia.gov/state/?sid=OK (October 12, 2020).

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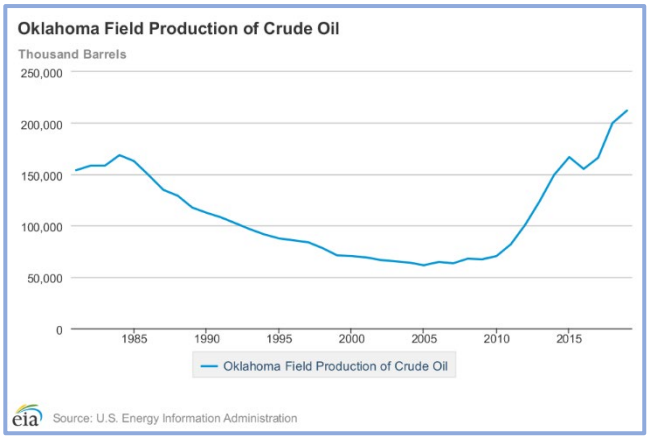
Crude Oil and Petroleum Products Supply Overview

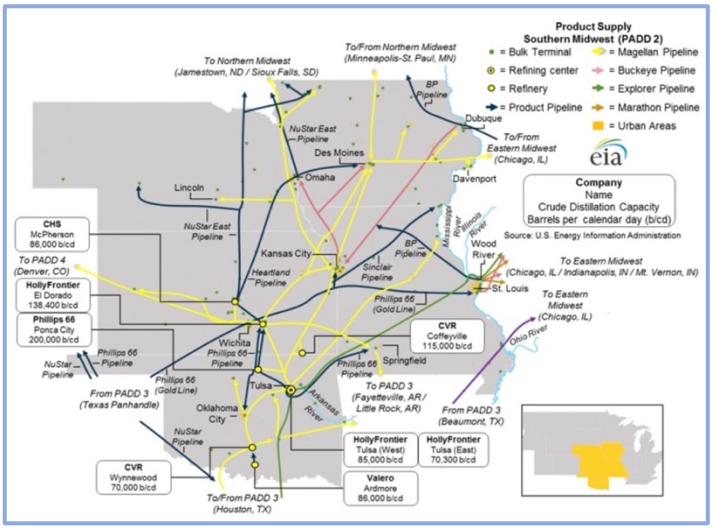
Oklahoma has myriad crude oil producers which together produce a substantial amount of crude oil, accounting for nearly 5% of total U.S. production in recent years. Currently, Oklahoma ranks 4th in crude oil production nationally.

Figure 16: State of Oklahoma: Production of Crude Oil (thousand barrels), 1981-2019



Oklahoma produces on average about 580,000 barrels per day of crude oil.[44] Figure 16 visually summarizes a 30-year history of oil production in Oklahoma.[45] Crude oil production went through a period of decline from the mid-1980s through the early 2000s, but hydraulic fracturing, an extraction technique that removes oil from tight shale rock formations, allowed production to increase again beginning in 2010.

Figure 17: Southern Midwest Transportation Fuels Markets Map



In terms of future production, Oklahoma had 2,120 million barrels of proven reserves at the end of 2018, accounting for 4.8% percent of all U.S. reserves.[46]

In addition to the crude oil pipelines that serve Oklahoma markets, Oklahoma refineries create petroleum products which are connected by pipelines to consumption markets in Oklahoma and nearby states. Figure 17, left, gives an overview map of the transportation flow of petroleum products within Oklahoma and its surrounding region.[47]

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[44] U.S. EIA. *Crude Oil Production: Annual-Thousand Barrels per Day*. https://www.eia.gov/dnav/pet/PET_CRD_CRPDN_ADC_MBBLPD_A.htm (December 21, 2020).
[45] U.S. EIA. *Oklahoma Field Production of Crude Oil*. https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpok1&f=a (December 21, 2020).
[46] U.S. EIA. *Crude Oil Proved Reserves, Reserves Changes, and Production.* http://www.eia.gov/dnav/pet/pet_crd_pres_a_EPC0_R01_mmbbl_a.htm (December 21, 2020).
[47] U.S. EIA. *Midwest and Rocky Mountain Transportation Fuels Markets*. https://www.eia.gov/analysis/transportationfuels/padd2n4/ (December 21, 2020).

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The City of Cushing, in central Oklahoma, is a major crude oil trading hub that connects Gulf Coast refiners to producers both in the United States and Canada. The Cushing Hub is home to 15% of the U.S. commercial storage capacity and is also the location where the West Texas Intermediate spot price, the benchmark price in the U.S. domestic spot market, is set.[48]

Exploration & Production Supplier Profile

Below are selected crude oil producer profiles for several top producers that operate in Oklahoma. Due to the number of producers in the state, it would be impossible to profile them all in this report. Within these profiles, there are multiple references to Oklahoma's two major oil reserves, the South Central Oklahoma Oil Province (SCOOP) and the Sooner Trend Anadarko Canadian Kingfisher (STACK). The geologic formations in the SCOOP and STACK have multiple zones that allow for production from multiple layers of rock formations that lie thousands of feet below the surface.[49] Together these two oil reserves drive the majority of Oklahoma's oil (and gas) production today.

Ovintiv, Inc.
Based in Denver, Colorado, Ovintiv, Inc. is a leading production company, with global resources, focused on North America. Ovintiv's Oklahoma resources lie in several counties of the Anadarko Basin and produce an average 44,000 barrels of crude oil per day in 2019. The company's leases include areas of Blaine, Canadian, Custer, Dewey, Grady, Kingfisher, Major, and McClain counties. The majority of the crude oil produced in this area is transported to sales points by pipeline.[50]

Devon Energy
Devon Energy is an Oklahoma-City based oil and gas exploration and production company with multi-state operations. It's primary Oklahoma exploration and production occurs in the Anadarko Basin's STACK development, which is located primarily in Canadian, Blaine and Kingfisher counties. Devon produced 31,000 barrels per day and 9 million barrels of crude oil from this development area in 2019.[51]

In early 2021, Devon Energy completed a merger with WPX Energy to enhance the scale of its operation and grow its position in several oil basins while also firmly establishing the organization

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[48] U.S. EIA. *Oklahoma State Profile and Energy Estimates.* https://www.eia.gov/state/?sid=OK (December 21, 2020).
[49] Oklahoma Energy Resources Board. *SCOOP and STACK*. https://oerb.com/environment-innovation/scoop-stack/ (June 18, 2021).
[50] Ovintiv, Inc. *U.S. Securities and Exchange Commission Form 10-K: 2019.* https://investor.ovintiv.com/sec-filings (December 21, 2020).
[51] Devon Energy. *2019 Annual Report.* https://s2.q4cdn.com/462548525/files/doc_financials/Annual/2019/DVN-2019-10-K.pdf (December 21, 2020).

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as an even stronger energy producer in the U.S. market.[52] WPX Energy, Inc. was a leading oil and gas production and exploration company located in Tulsa, which has significant stakes in the Delaware Basin in Texas, as well as stakes in the Williston Basin in North Dakota.[53] Under the merger, the new entity will operate as Devon Energy and be headquartered in Oklahoma City.

Continental Resources

Continental Resources is an Oklahoma-based company with major oil and gas exploration and development holdings in Oklahoma and North Dakota. Within Oklahoma (Continental's South Region), the company primarily has leases in the SCOOP and STACK development areas. The SCOOP play leases extend across Garvin, Grady, Stephens, Carter, McClain, and Love counties. Most of Continental's leased acreage in the STACK play is in Blaine, Dewey, and Custer counties. In the 4th quarter of 2020, Continental produced over 107,000 barrels of crude oil per day from the SCOOP play and over 42,000 barrels per day from the STACK play. The company also has significant future production ability in this region. As of the end of 2020, Continental had 80.6 million barrels of crude oil in proved developed and 48 million barrels of proved undeveloped reserves in its South Region. As Continental is an exploration and production company only, it sells the majority of its crude oil production to refining companies or midstream marketing companies at major market centers. Much of Continental's production is directly connected to pipeline gathering systems with the remaining product transported by truck either directly to a refinery or to a point on a pipeline system.[54]

Chesapeake Energy

Chesapeake Energy is an Oklahoma-based oil and gas exploration and production company that, until recently, had major holdings in Oklahoma and nationwide. In 2019, Chesapeake Energy produced an average of 8 thousand barrels of oil per day from its Oklahoma resources.[55] In late 2020, Chesapeake announced that it has sold its Mid-Continent assets to Tapstone Energy, another Oklahoma-based company.[56] However, because production will continue from these assets, they will continue to be included in this report; future versions will reference these assets as Tapstone Energy assets.

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[52] Devon Energy. *Devon Energy and WPX Energy Merger.* https://www.devonenergy.com/news/2021/Devon-Energy-and-WPX-Energy-Complete-Merger-of-Equals-Transaction (March 26, 2021).
[53] WPX Energy, Inc. *U.S. Securities and Exchange Commission Form 10-K: 2019*. https://www.sec.gov/ix?doc=/Archives/edgar/data/1518832/000151883220000006/wpx-20191231.htm. (May 17, 2021).
[54] Continental Resources. *U.S. Securities and Exchange Commission Form 10-K: 2020*. https://investors.clr.com/sec-filings?o=0 (April 19. 2020).
[55] Chesapeake Energy. *U.S. Securities and Exchange Commission 2019 Form 10-K*. http://investors.chk.com/sec-filings?o=50 (December 29, 2020).
[56] The Oklahoman. *"Tapstone Energy wins auction to obtain this well-known Oklahoma company's Mid-Continent assets." October 14, 2020.* https://oklahoman.com/article/5676201/tapstone-energy-wins-auction-to-obtain-this-well-known-oklahoma-companys-mid-continent-assets (June 18, 2021).

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Transportation & Storage Profile

As with the exploration and production segment, there are myriad companies with Oklahoma operations that specialize in transportation and storage of crude oil and other petroleum products. It would be impossible to profile them all, but a selection of some of the largest companies in this segment appear below.

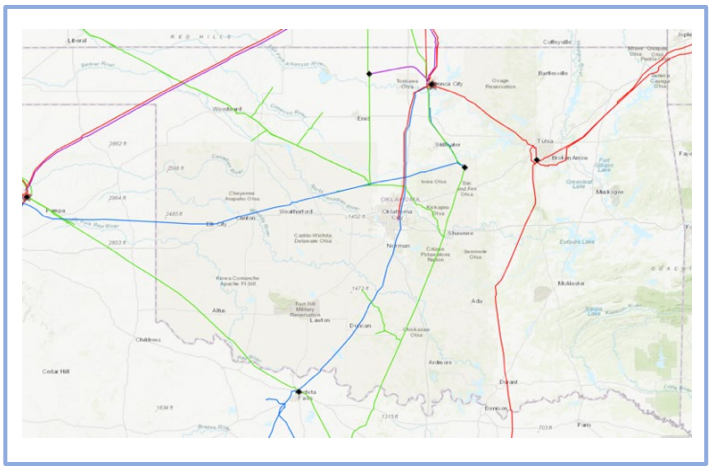
Phillips 66

Phillips 66, based in Houston, Texas, operates several major crude oil pipelines in Oklahoma: the Oklahoma Mainline, Cushing, and Line 0 pipelines. The Oklahoma Mainline stretches from Wichita Falls, Texas, to Ponca City with a capacity of 100 MMbbl/d, the Cushing pipeline stretches from Ponca City to Cushing with a 130 MMbbl/d capacity, and the Line 0 pipeline stretches from Cushing to Borger, Texas, with a capacity of 37 MMbbl/d.[57] Phillips 66 has two crude oil storage locations in Oklahoma, with 675,000 barrels of storage capacity at Cushing and 1.23 million barrels of storage at Ponca City.[58] In addition to its crude oil pipelines, Phillips 66 operates multiple petroleum products pipelines that carry product to points within or through Oklahoma. Table 10, above, summarizes Phillips 66's petroleum products pipelines that originate, terminate, or pass-through Oklahoma and Figure 18, left, shows a map of Phillips 66's crude oil and petroleum products pipelines in Oklahoma and the surrounding region. [59]

Table 10: Phillips 66 Petroleum Products Pipelines with Oklahoma Footprint

Pipeline	Origination	Terminus	Capacity (MMbbl/d)
Cherokee South	Ponca City	Oklahoma City	46
Cherokee North	Ponca City	Arkansas City, MO	57
Cherokee East	Medford	Mount Vernon, MO	55
Standish	Marland Junction	Wichita, KS	72
Gold Line Products System	Borger, TX	East St. Luis, IL	120
Explorer	Texas Gulf Coast	Chicago, IL	660

Figure 18: Phillips 66 Crude Oil and Petroleum Products Pipelines: Oklahoma and Surrounding Region



[57] Phillips 66. *Assets Map.* https://www.phillips66midstream.com/EN/Pages/assets.aspx (December 22, 2020).
[58] Phillips 66. *Terminals and Storage Locations.* https://www.phillips66midstream.com/EN/Pages/terminals.aspx (December 22, 2020).
[59] Phillips 66. *Pipelines: Petroleum Products.* https://www.phillips66.com/midstream/map (December 30, 2020).

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Magellan Midstream Partners

Magellan Midstream Partners is a Tulsa-based, publicly traded partnership that primarily transports, stores, and distributes refined petroleum products and crude oil.[60] Magellan holds both crude oil and refined products assets in Oklahoma. Figure 19, to the right, shows Magellan's crude oil assets, which include one crude oil terminal in Cushing with 13 million barrels of storage, as well as several crude pipelines.[61]

As shown in Figure 20, Magellan also owns three refined products terminals in Enid, Oklahoma City, and Tulsa that are connected to a number of Magellan interstate pipelines.[62]

Figure 19: Magellan Crude Oil Assets: Oklahoma and Surrounding Region

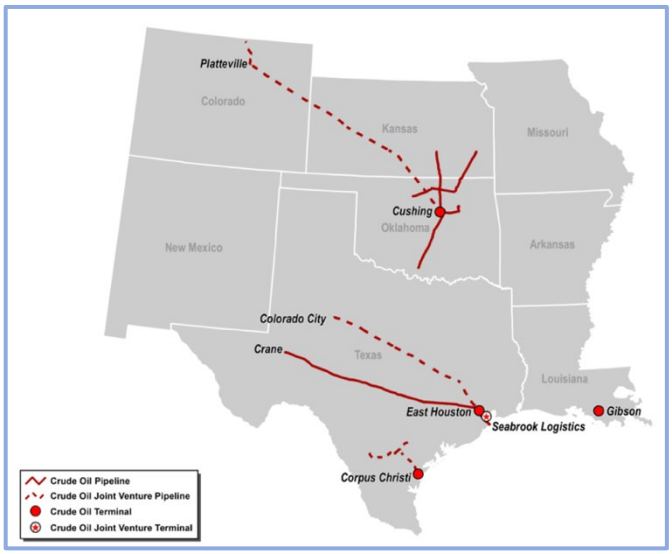
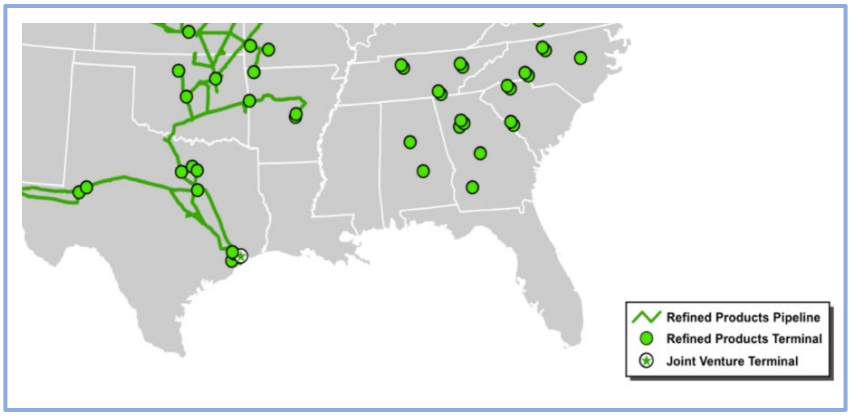


Figure 20: Magellan Refined Products Assets: Oklahoma and Surrounding Region



[60] Magellan Midstream Partners. *About us.* https://www.magellanlp.com/AboutUs/Default.aspx (December 22, 2020).
[61] Magellan Midstream Partners. *Crude Assets Map*. https://www.magellanlp.com/WhatWeDo/CrudeProducts.aspx (December 22, 2020).
[62] Magellan Midstream Partners. *Refined Assets Map.* https://www.magellanlp.com/WhatWeDo/RefinedProducts.aspx (May 22, 2020).

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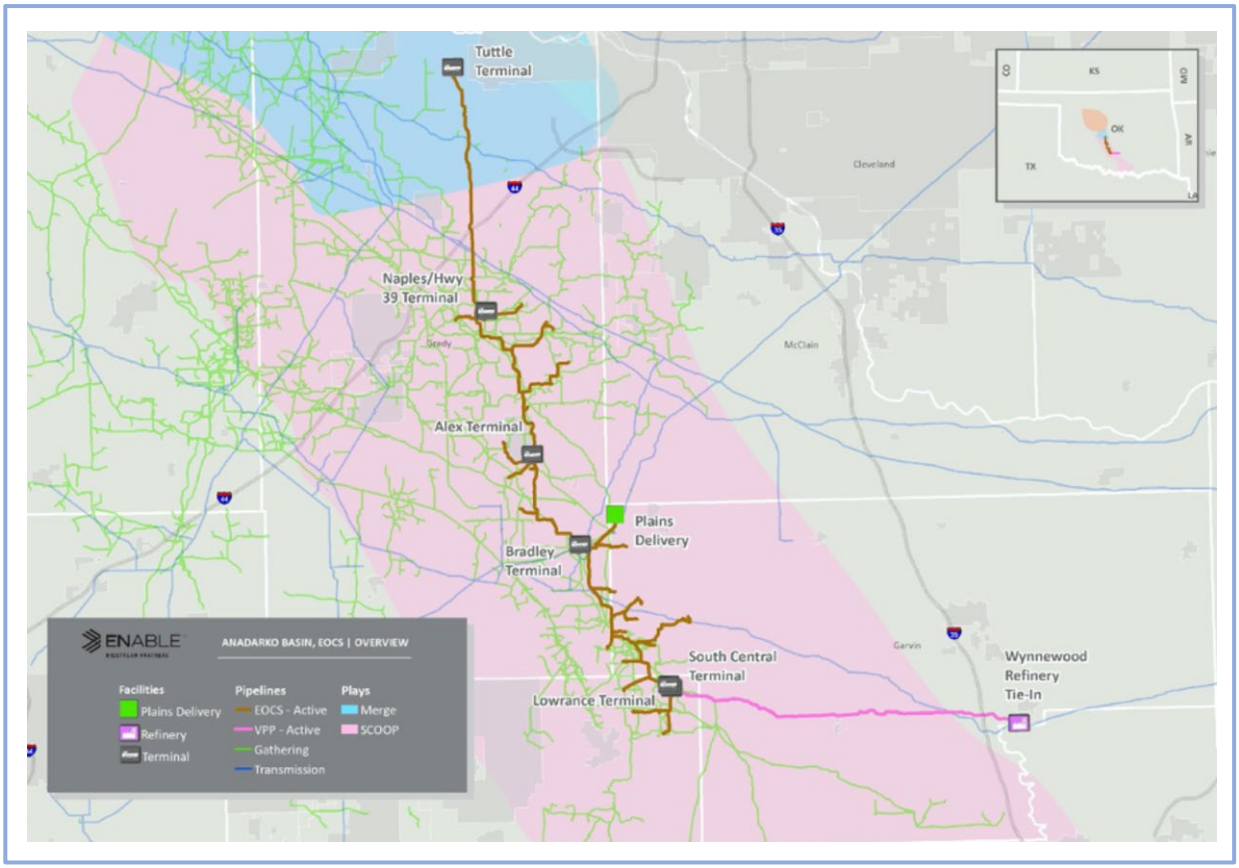
Enable Midstream Partners

Enable Midstream Partners is an Oklahoma City-based company formed in 2013. Enable is primarily owned by Oklahoma Gas & Electric and CenterPoint Energy. Its Oklahoma crude oil assets primarily serve the Anadarko Basin area. Operations in this area include gathering of crude oil and condensate from producers in the SCOOP and STACK plays (including the area where the SCOOP and STACK come together known as the Merge play). At the end of 2019, Enable served five crude producers and one refinery. Enable has approximately 175 miles of gathering lines in the Anadarko Basin which re-deliver crude oil to customers through interconnections to the Basin Pipeline, Red River Pipeline, and Wynnewood Refinery. [63] Figure 21 shows Enable's Oklahoma-based gathering system, terminals, and refinery tie-in points.[64]

Figure 21: Enable Crude Oil Asset Map



[63] Enable Midstream Partners. *U.S. Securities and Exchange Commission 2019 Form 10-K.* https://investors.enablemidstream.com/financials/sec-filings/default.aspx (June 21, 2021).
[64] Enable Midstream Partners. *Crude and Stabilization Overview.* https://www.enablemidstream.com/company/operations/crude-stabilization/ (December 30, 2020).

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Refining & Marketing Profile

Crude oil supplies that are not sent out of state are sent to Oklahoma's five major oil refineries which have a combined processing capacity of approximately 523,000 barrels/calendar day—roughly 3% of the total U.S. refining capacity. Table 11, below, lists these refineries, the largest of which is the Ponca City Refinery which is owned and operated by Phillips 66 Company. [65]

Refineries create petroleum products from crude oil that include gasoline, distillates such as diesel fuel and heating oil, jet fuel, petrochemical feedstocks, waxes, lubricating oils, and asphalt.[66] In the U.S. the most common petroleum product created from crude oil is gasoline. Figure 22, next page, shows the production percentages of various petroleum products for 2019 nationwide.[67]

Table 11: Crude Oil Refineries in Oklahoma

Company	Refinery Name	Location	Capacity (bbl/d)
Valero Refining Company, Oklahoma	Ardmore Refinery	Ardmore	86,000
Wynnewood Refining Company	Wynnewood Refinery	Wynnewood	74,500
Phillips 66 Company	Ponca City Refinery	Ponca City	207,000
HollyFrontier Corporation	Tulsa Refinery (West)	Tulsa	85,000
HollyFrontier Corporation	Tulsa Refinery (East)	Tulsa	70,300

Unsurprisingly, the price of motor gasoline in Oklahoma tracks alongside the per-barrel price of crude oil. Figure 23, also next page, lists the price of regular motor gasoline sold in Oklahoma from 2011 to 2020 which, over time, trended as consistently less expensive than the national average. The figure also demonstrates the relative volatility in gasoline prices.[68]

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[65] U.S. Energy Information Administration. *Capacity of Operable Petroleum Refineries by State as of January 1, 2020*. http://www.eia.gov/petroleum/refinerycapacity/table3.pdf (December 21, 2020).
[66] US. EIA. *Oil and Petroleum Products Explained.* https://www.eia.gov/energyexplained/oil-and-petroleum-products/ (December 22, 2020).
[67] U.S. EIA. *Petroleum Supply Annual, August 2020*. https://www.eia.gov/energyexplained/oil-and-petroleum-products/refining-crude-oil-inputs-and-outputs.php (December 22, 2020).
[68] GasBuddy. *Gas Price Charts.* http://www.gasbuddy.com/Charts (December 21, 2020).

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Figure 22: U.S. Refiner and Blender Net Production of Petroleum Products, 2019

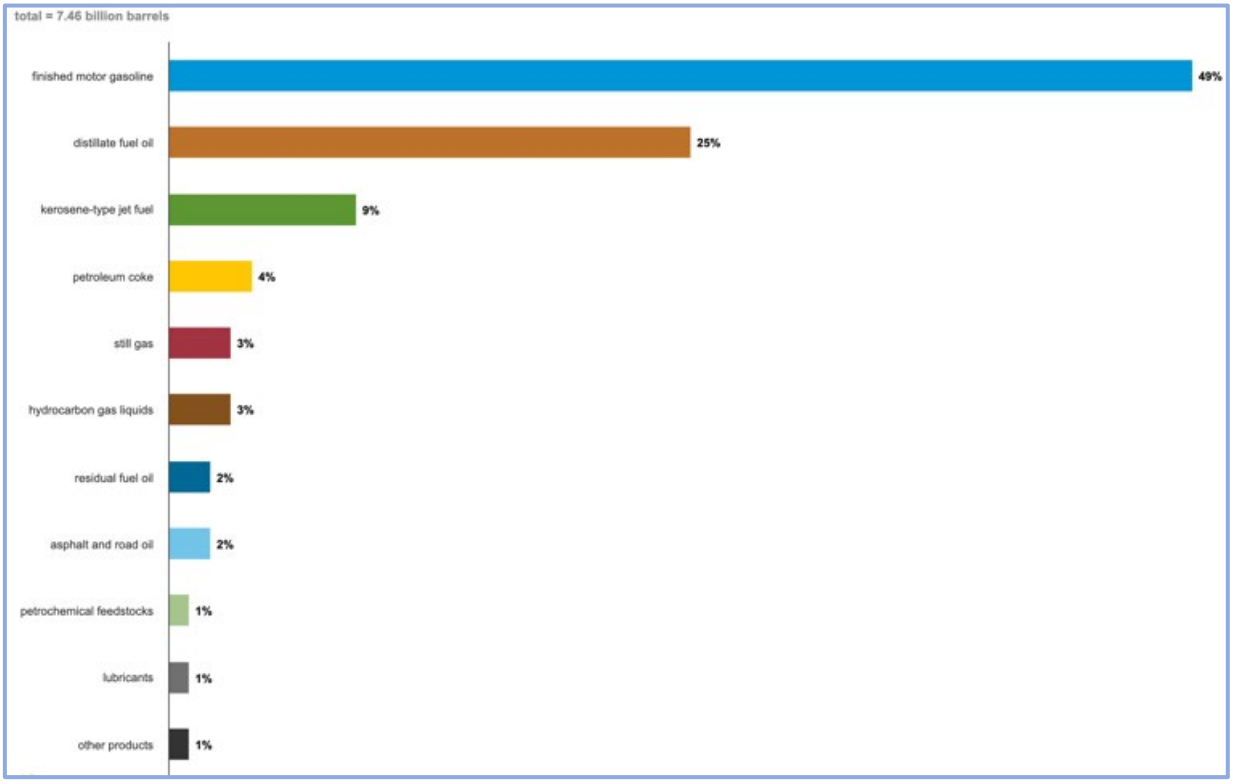
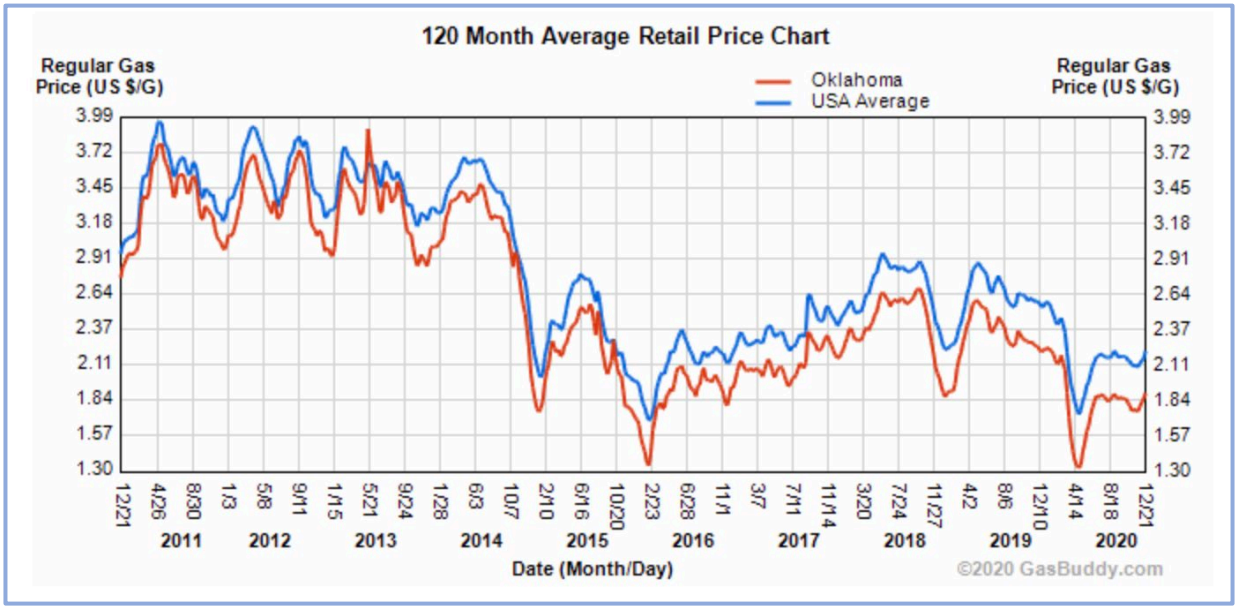


Figure 23: USA and Oklahoma Monthly Average Retail Gasoline Prices, 2011-2020



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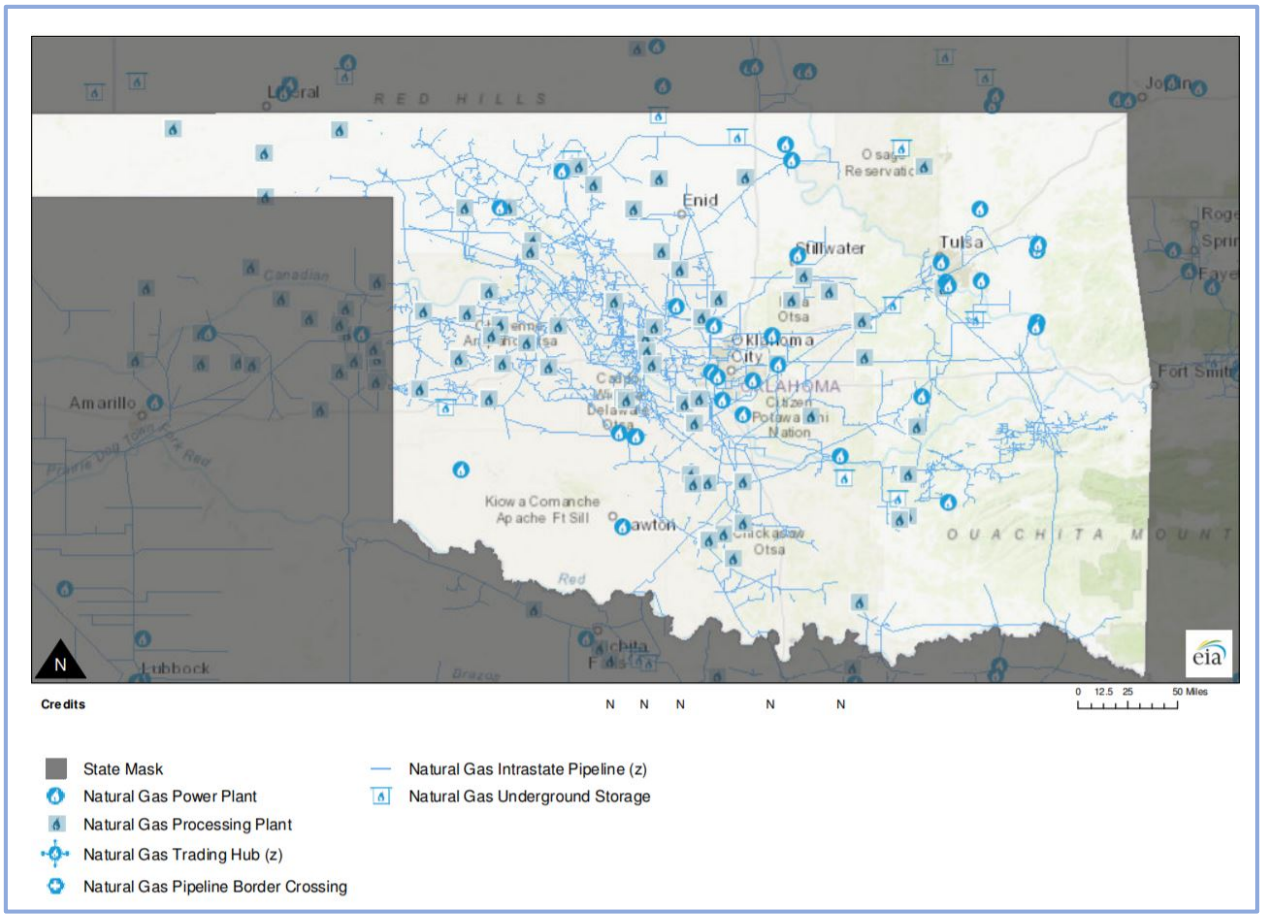
NATURAL GAS SUPPLY PROFILE

Natural Gas Infrastructure Overview

Natural gas infrastructure in Oklahoma consists of power plants, processing plants, pipelines, and storage facilities. Figure 24 depicts the location of other major natural gas infrastructure in Oklahoma. For the purposes of providing a clear figure, interstate pipelines were removed.[69]

Figure 24: State of Oklahoma: Natural Gas Infrastructure Map



[69] U.S. EIA. *Oklahoma Profile Overview 2020*. https://www.eia.gov/state/?sid=OK (October 12, 2020).

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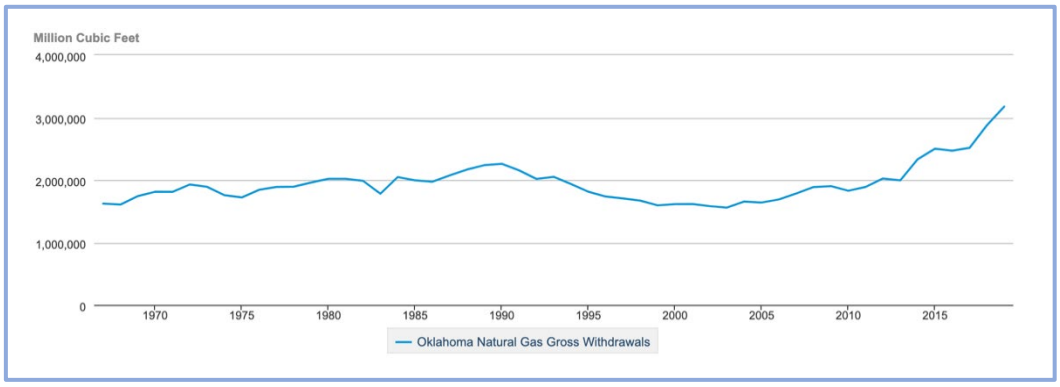
Natural Gas Supply Overview

Oklahoma is one of the top four natural gas producers in the United States and production typically accounts for almost one-tenth of the U.S. total production.[70] Likewise, Oklahoma has large reserves of coalbed methane in the Arkoma Basin and the Cherokee Platform in the eastern part of the state; however, extraction of those resources has decreased in recent years.[71] With this in mind, it is essential to remember that Oklahoma's natural gas production is critical not only for in-state consumption but for other regions of the country as well. In fact, Oklahoma produces nearly four times as much natural gas as it consumes. In 2019 Oklahoma had over 43,000 producing gas wells and an additional 21,000 gas-producing oil wells. In the same year, the state produced over 3,175,000 million cubic feet (Mcf) of gas.[72] The remaining supply is sent via pipeline to other markets, mainly through hubs in Kansas, Texas, and Arkansas.[73] Due in large part to its in-state production, Oklahoma benefits from low natural gas prices as compared to national average prices. In 2019, the city gate price in Oklahoma was $3.64/thousand cubic feet as compared to a national average of $3.81.[74]

Figure 25: State of Oklahoma: Natural Gas Production 1967-2019



As listed in Figure 25, above, the amount of natural gas that Oklahoma produces has varied over the last 40 years.[75] Gas production increased significantly in the 2010s because of advances in drilling and production technology such as new techniques in horizontal well stimulation. In addition, the Shale Act of 2011 allowed horizontal development in shale formations resulting in unprecedented oil and gas production in tight shale formations.

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[70] U.S. EIA. *Natural Gas Explained*. https://www.eia.gov/energyexplained/natural-gas/where-our-natural-gas-comes-from.php (December 23, 2020).
[71] U.S. EIA. *Coalbed Methane Production*. https://www.eia.gov/dnav/ng/ng_prod_coalbed_s1_a.htm (December 23, 2020).
[72] U.S. EIA. *Natural Gas Summary*. https://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_SOK_a.htm (December 23, 2020).
[73] U.S. EIA. *Oklahoma Energy Profile*. https://www.eia.gov/state/print.php?sid=OK#26 (December 23, 2020).
[74] U.S. EIA. *Natural Gas Prices*. https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm (December 23, 2020).
[75] U.S. EIA. *Oklahoma Natural Gas Gross Withdrawals*. https://www.eia.gov/dnav/ng/hist/n9010ok2a.htm (December 23, 2020).

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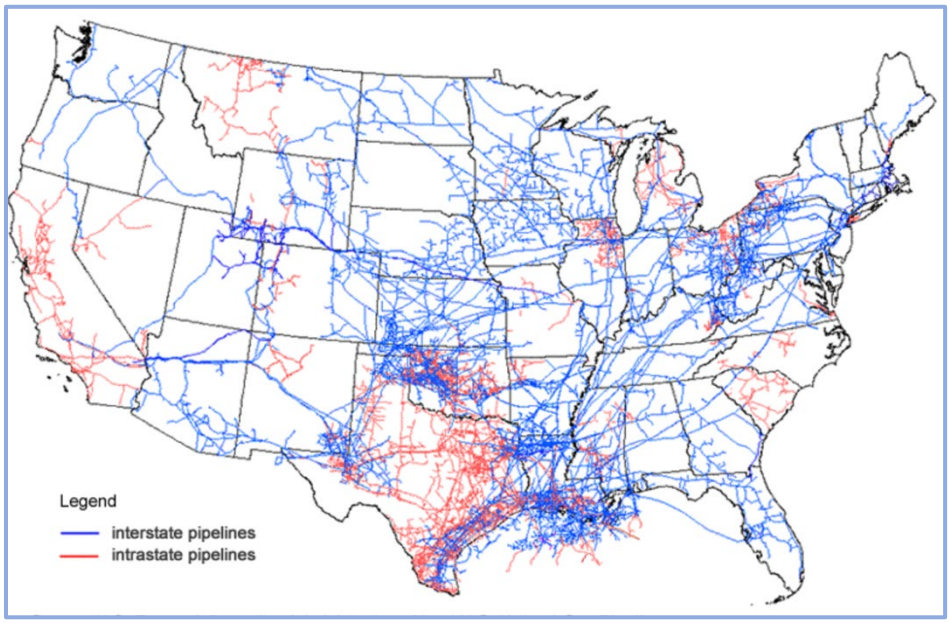
Regarding the future production of natural gas, Oklahoma had 37,035 billion cu. ft. of dry natural gas and 2,429 million barrels of natural gas plant liquids in known reserves in 2018. Additionally, as of September 2020, Oklahoma had 163,290 million cu. ft. of working gas in underground storage and, on an annual basis, injects more gas than it withdraws.[76]

The majority of natural gas is transported throughout Oklahoma via the complex web of pipelines listed below in Figure 26.[77]

Figure 26: U.S. Natural Gas Pipeline Map



The state of Oklahoma is not responsible for regulation of interstate pipelines within the state. The federal Pipeline and Hazardous Material Safety Administration (PHMSA) is responsible for administering the U.S. Department of Transportation's national regulatory program to ensure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. However, the Oklahoma Corporation Commission's (OCC) Pipeline Safety Division administers an intrastate pipeline regulatory program to assure the safe transportation of natural gas by pipeline. The Commission develops regulations and other approaches to assure safety in design, construction, testing, operation, maintenance, and emergency response to pipeline facilities. The Commission derives its authority over intrastate pipeline operations through state statutes and

[76] U.S. EIA. *Oklahoma Underground Natural Gas Storage by all Operators.* https://www.eia.gov/dnav/ng/ng_stor_sum_dcu_SOK_m.htm (December 23, 2020).
[77] U.S. EIA. *Natural Gas Explained.* https://www.eia.gov/energyexplained/natural-gas/natural-gas-pipelines.php (December 23, 2020).

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certification agreements with the U.S. Department of Transportation. The OCC's safety jurisdiction over pipelines covers over 50,000 miles of pipeline, more than 258 intrastate gathering, transmission, and distribution operators, and 33 intrastate hazardous liquid operators.[78]

Exploration & Production Supplier Profile

Continental Resources
As referenced above in the crude oil section, Continental Resources is an Oklahoma-based company with major oil and gas exploration and development holdings in Oklahoma and North Dakota. Within Oklahoma (Continental's South Region), the company primarily has leases in the SCOOP and STACK development areas. The SCOOP play extends across Garvin, Grady, Stephens, Carter, McClain, and Love counties. Most of Continental's leased acreage in the STACK play is in Blaine, Dewey, and Custer counties. In 2020, Continental produced over 423 million cubic feet of natural gas per day from the SCOOP play and more than 211 million cubic feet per day from the STACK play. The company also has significant future production ability in this region. As of the end of 2020, Continental had approximately 1.5 million MMcf of natural gas in proved developed and nearly 1.2 million MMcf of proved undeveloped reserves in its South Region.[79]

Ovintiv, Inc.
Based in Denver, Colorado, Ovintiv, Inc. is a leading production company, with global resources, focused on North America. Ovintiv's Oklahoma resources lie in several counties of the Anadarko Basin and produced an average 316 million cubic feet of natural gas per day in 2019. The company's leases include areas of Blaine, Canadian, Custer, Dewey, Grady, Kingfisher, Major, and McClain counties.[80]

Chesapeake Energy
Chesapeake Energy is an Oklahoma City-based company which, until recently, had major oil and gas exploration and production holdings in Oklahoma and nationwide. In 2019, Chesapeake produced an average of 57 million cubic feet of natural gas per day from its Mid-Continent resources.[81] However, as mentioned in the crude oil profile above, in late 2020 Chesapeake announced that it has sold its Mid-Continent assets to Tapstone Energy, another Oklahoma-based

[78] Oklahoma Corporation Commission. *Pipeline Safety.* https://oklahoma.gov/occ/divisions/transportation/pipeline-safety.html (June 21, 2021).
[79] Continental Resources. *2020 Annual Report.* https://investors.clr.com/annual-reports (April 19, 2020).
[80] Ovintiv, Inc. *U.S. Securities and Exchange Commission Form 10-K: 2019.* https://investor.ovintiv.com/sec-filings (December 21, 2020).
[81] Chesapeake Energy. *U.S. Securities and Exchange Commission 2019 Form 10-K.* http://investors.chk.com/sec-filings?o=50 (December 29, 2020).

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company.[82] Production will continue from these assets, they will continue to be included in this report; future versions will reference these assets as Tapstone Energy assets.

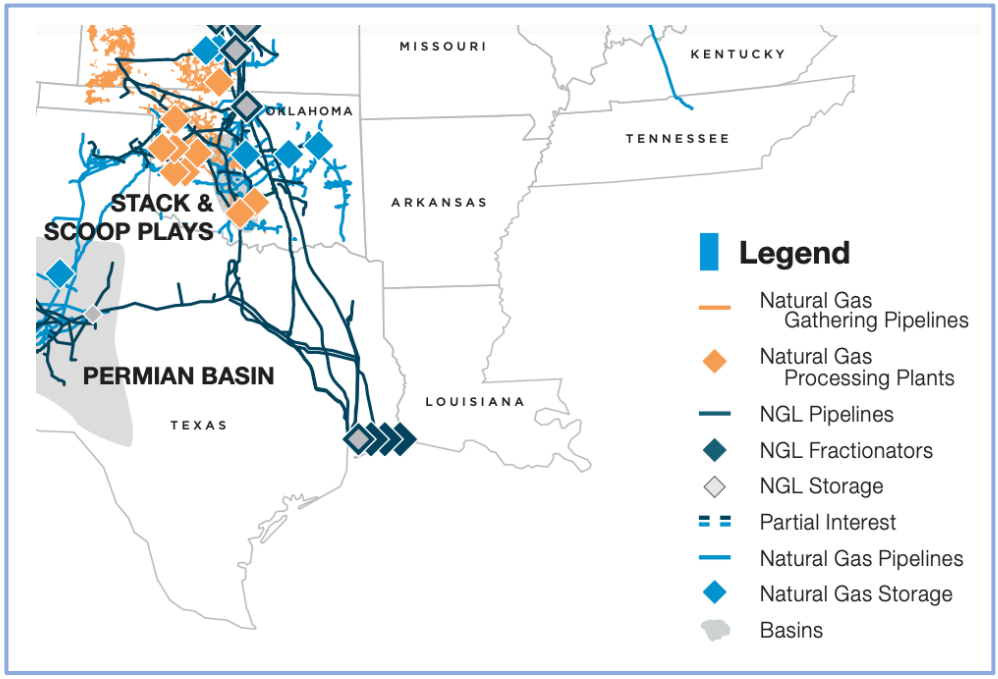
Transportation & Storage Profile

There are nearly 120 Oklahoma natural gas and hazardous liquid pipeline operators registered with in the National Pipeline Mapping System (NPMS).[83] NPMS offers a public pipeline viewer that shows pipeline locations by county. To access the viewer, visit https://pvnpms.phmsa.dot.gov/PublicViewer/. The profiles below provide an overview of selected pipeline operators with significant infrastructure in Oklahoma.

ONEOK

ONEOK is a Tulsa-based midstream provider that offers gathering, transmission, processing, and storage of natural gas and natural gas liquids. Figure 27 shows ONEOK's pipeline and storage map across Oklahoma and surrounding areas.[84]

Figure 27: ONEOK Pipeline and Storage Map: Oklahoma and Surrounding Region



[82] The Oklahoman. *"Tapstone Energy wins auction to obtain this well-known Oklahoma company's Mid-Continent assets", November 14, 2020.* https://oklahoman.com/article/5676201/tapstone-energy-wins-auction-to-obtain-this-well-known-oklahoma-companys-mid-continent-assets (June 21, 2021).
[83] National Pipeline Mapping System. *Find Who's Operating Pipelines In Your Area.* https://www.npms.phmsa.dot.gov/FindWhosOperating.aspx (December 31, 2020).
[84] ONEOK. *Fact Sheet*. https://www.oneok.com/-/media/oneok/press-kits/ir-fact-sheet.ashx?la=en&hash=C8A3CDFF9FC8BE4AC13BCD8AE27F25DB (June 21, 2021).

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ONEOK operates an intrastate pipeline system in Oklahoma. The transmission system has approximately 2,471 miles of transmission pipelines with a peak capacity of 2.1 billion cubic feet per day. This intrastate pipeline system is connected to six underground storage facilities, 35 processing plants, and 130 producing fields within the state. In addition, there are 12 interstate pipeline interconnects and six intrastate pipeline interconnects.[85]

ONEOK also provides gas storage services through approximately 47 Bcf of working gas storage capacity contained in four storage fields - Haskell, Osage, Edmond, and Depew – which are depleted gas reservoirs located in Oklahoma. These storage fields have total maximum daily injection and withdrawal capabilities of approximately 700 MMcf and 1,500 MMcf, respectively.[86] The company also owns ten natural gas processing plants with 1 billion cubic feet per day of processing capacity in the Mid-Continent region and has access to up to 200 million cubic feet per day of processing capacity in the Mid-Continent region through a long-term processing services agreement.[87]

Enable Midstream Partners

Enable Midstream Partners is an Oklahoma-City based company formed in 2013; Enable is primarily owned by Oklahoma Gas & Electric and CenterPoint Energy. Enable's natural gas services are located in the Anadarko and Arkoma Basins in Oklahoma. Enable's gathering and processing operations in the respective basins are shown in Figures 28 and 29, both on the next page.[88] In 2019, Enable served approximately 210 producers in the Anadarko basin's SCOOP, STACK, Granite Wash, Cleveland, Marmaton, Tonkawa, Cana Woodford, and Mississippi Lime plays. The company also served approximately 80 producers in the Woodford Shale play located in Arkoma basin. [89]

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[85] ONEOK. *Intrastate Pipelines.* https://www.oneok.com/customers/ngp (June 21, 2021).
[86] ONEOK. Natural Gas Pipelines. https://www.oneok.com/customers/ngp (December 20, 2020).
[87] ONEOK. *U.S. Securities and Exchange Commission 2019 Form 10-K.* https://ir.oneok.com/financial-information/sec-filings (December 30, 2020).
[88] Enable Midstream Partners. *G&P Overview*. https://www.enablemidstream.com/company/operations/gp/ (June 21, 2021).
[89] Enable Midstream Partners. *U.S. Securities and Exchange Commission 2019 Form 10-K.* https://investors.enablemidstream.com/financials/sec-filings/default.aspx (December 30, 2020).

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Figure 28: Enable Midstream Partners Arkoma Basin Gathering & Processing Map

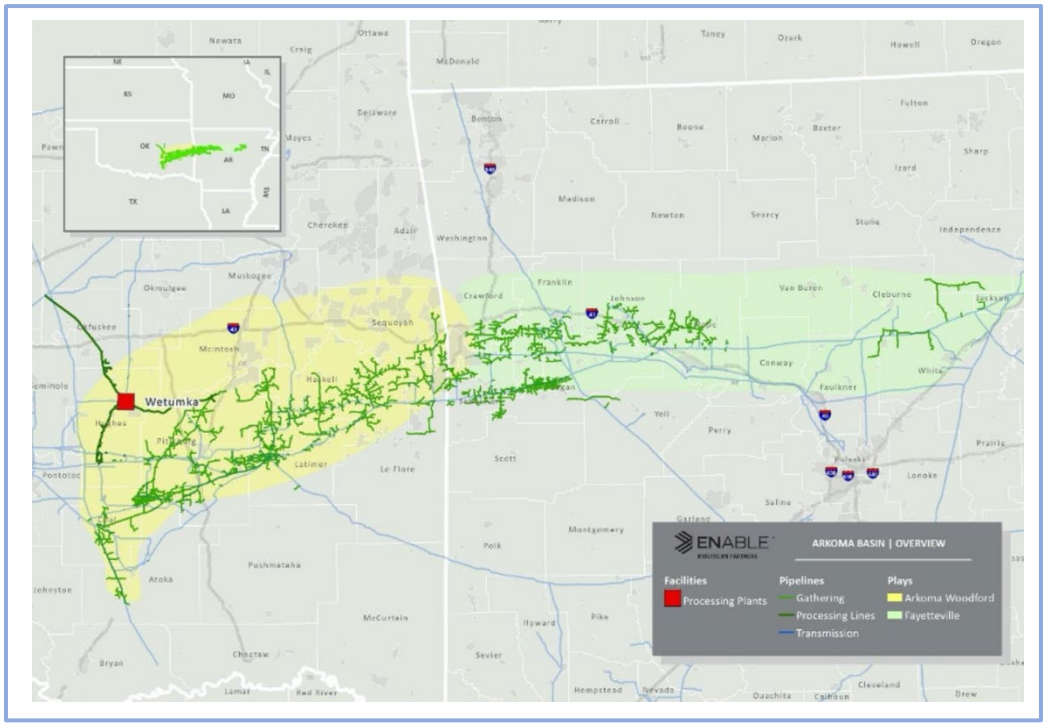
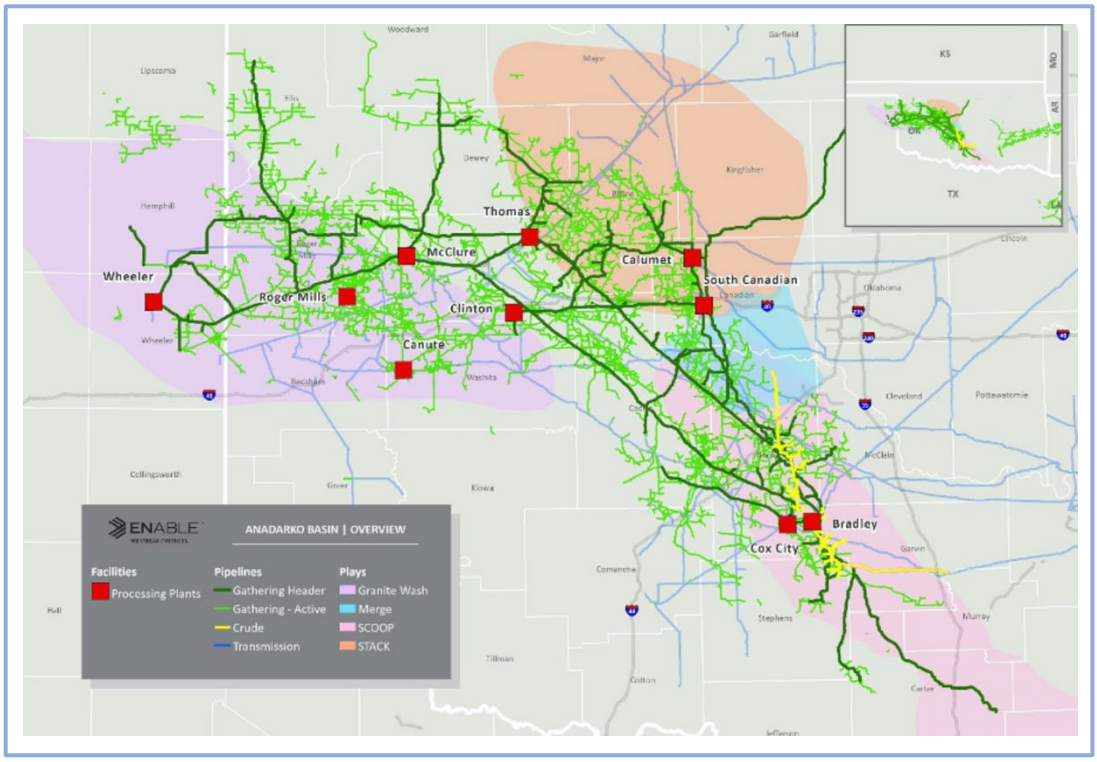


Figure 29: Enable Midstream Partners Anadarko Basin Gathering & Processing Map



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Natural Gas Utilities Distribution Profile

The six natural gas companies that provide retail (distribution) service to most of the state, and which are regulated by the state, are:

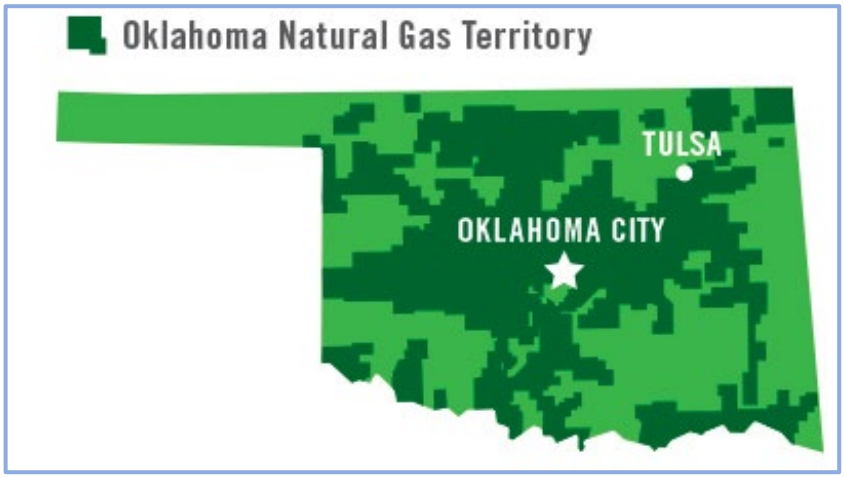
Arkansas-Oklahoma Gas Corporation
CenterPoint Oklahoma
Navitas Utility-Fort Cobb/LeAnn Gas
Oklahoma Natural Gas, a division of ONE Gas
Panhandle Natural Gas Incorporated
West Texas Gas Company

Of these regulated utilities, the two largest providers are Oklahoma Natural Gas and CenterPoint Oklahoma.

Oklahoma Natural Gas Company

Oklahoma Natural Gas Company is a division of Tulsa-based ONE Gas. ONE Gas is among the largest natural gas distributors in the United States, serving more than 2 million customers in Oklahoma, Kansas, and Texas. In Oklahoma, Oklahoma Natural Gas serves approximately 884,000 residential, commercial/industrial, and transportation customers (the vast majority of which are residential) and maintains 19,600 miles of transmission pipelines and distribution mains in the state.[90]

Figure 30: Oklahoma Natural Gas Company Service Territory Map



CenterPoint Oklahoma

CenterPoint Oklahoma is a natural gas distribution company that is part of CenterPoint Energy Resources Corp., a Houston, Texas-based domestic energy delivery company that includes electric transmission and distribution, natural gas distribution, competitive natural gas sales and services, interstate pipelines, and field services operations in multiple jurisdictions.

[90] Oklahoma Natural Gas Company. *About Us.* https://www.oklahomanaturalgas.com/corporate/aboutus (June 21, 2021).

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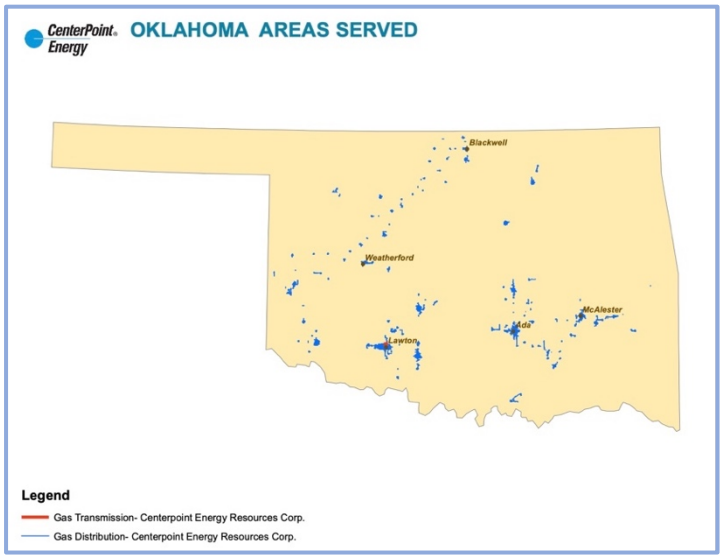
CenterPoint Oklahoma's operations are headquartered in Lawton, Oklahoma. The utility serves just over 99,000 customers, including approximately 88,300 residential customers and 10,800 commercial, industrial, and transportation customers.[91] CenterPoint Oklahoma's service areas are largely rural in nature and do not include either Oklahoma City or Tulsa. Figure 31 depicts CenterPoint's Oklahoma service territory.[92]

Figure 31: CenterPoint Oklahoma Service Territory



Other Regulated Gas Providers

In addition to Oklahoma Natural Gas and CenterPoint, four other small, regulated gas providers serve a limited number of Oklahoma customers.

- Arkansas Oklahoma Gas Corporation (AOG), based in Fort Smith, Arkansas, has 60,000 Oklahoma and Arkansas customers and serves 28 communities in Oklahoma.[93]
- Navitas Utility-Fort Cobb/LeAnn Gas, based in Eakly, Oklahoma, serves 48 small towns, communities, and rural counties throughout Oklahoma.[94]
- Panhandle Gas is based in Beaver, OK.
- West Texas Gas serves 12 incorporated towns in Oklahoma. [95]

Public Sector Utilities

State law does not allow the OCC to regulate any natural gas utility operated by a city. Instead, local governments and/or municipal boards regulate these city-operated utilities. In Oklahoma, at least 45 municipalities operate natural gas utilities. Those that have been identified through their participation in the Oklahoma Gas Association are listed on the following page.[96]

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[91] CenterPoint Energy. *2019 Annual Report.* https://investors.centerpointenergy.com/static-files/49b3aaf1-9a26-46ec-8d74-18a73c2da638 (December 28, 2020).
[92] Information provided by CenterPoint Oklahoma employees (September 2020).
[93] Arkansas Oklahoma Gas Corporation. *Service Territory.* https://www.aogc.com/ServiceTerritory (December 30, 2020).
[94] Navitas Utility. *Oklahoma Service Territory.* https://navitasutility.com/ok-services.html (December 30, 2020).
[95] West Texas Gas. *About Us.* http://www.westtexasgas.com/about-us/ (December 30, 2020).
[96] Membership information received from OMA staff on 1/5/2021 and stated as "accurate as of 12/31/2020".

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Afton Public Works Authority

Avant Utilities Authority

Billings Public Works Authority

Burbank Municipal Natural Gas Dept.

Burlington Municipal Natural Gas Dept.

Chelsea Gas Authority

Chouteau Public Works Authority

City of Guymon

City of Hooker

City of Kaw City

City of Yale

Cleveland Municipal Authority

Copan Light, Water & Gas System

Corn Municipal Natural Gas Dept.

Covington Municipal Natural Gas Dept.

Drumright Gas Authority

Fairland Gas Authority

Freedom Gas Distribution System

Geary Utility Authority

Grove Municipal Services Authority

Hardesty Municipal Natural Gas Dept.

Haskell Municipal Natural Gas Dept.

Jay Utility Authority

Jones City Gas Company

Keyes Utility Authority

Kiefer Public Works Authority

Mannford Public Works Authority

Minco Gas Authority

NE Oklahoma Public Facilities Authority

Oilton Public Works Authority

Orlando Public Works Authority

Pryor Municipal Utility Board

Ramona Public Works Authority

Ripley Public Works

Seiling Public Works Authority

Sperry Utility Service Authority

Taloga Municipal Natural Gas Dept.

Tonkawa Energy Services

Town of Cashion

Town of Fairfax

Town of Granite

Town of Hulbert

Town of Slick

Town of Texola

Tuttle Public Works Authority

Vici Public Works Authority

Wakita Utilities Authority

Wann Public Works Authority

Willow Natural Gas Dept.

Trade Associations & Other Stakeholders

In Oklahoma, a number of trade associations represent the natural gas industry. These organizations are responsible for training, regulatory issues, future planning, and industry relations. Although there are many organizations to which companies may belong, some of the major natural gas associations serving Oklahoma include:

American Gas Association (AGA)
Natural Gas and Energy Association of Oklahoma (NGEAO)
Oklahoma Gas Association (OGA)
Petroleum Alliance of Oklahoma

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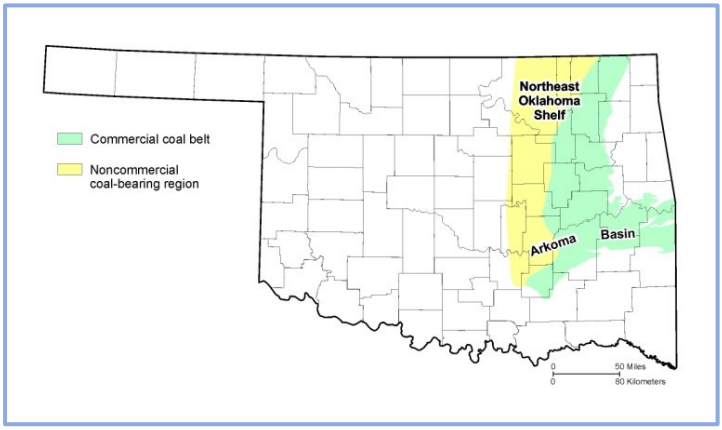
Energy Efficiency for Natural Gas

Both major natural gas providers in Oklahoma offer energy efficiency programs for natural gas. Oklahoma Natural Gas offers residential efficiency rebates for furnace, water heating, or space heating systems and CenterPoint Oklahoma offers a wide variety of both residential and commercial efficiency rebates as well as educational programs. In 2019, Oklahoma Natural Gas's programs saved over 365,000 Mcf across over 65,000 participants and[97] CenterPoint's programs saved a combined 92,072 Mcf across over 37,000 participants.[98]

COAL SUPPLY PROFILE

Oklahoma has a modest amount of coal deposits, ranking 22nd in the nation for coal production in 2019.[99] In 2019, Oklahoma coal mines produced approximately 227 thousand short tons of coal in 3 mines across 3 counties (Craig, Latimer, and Okmulgee).[100] As shown in Figure 32, Oklahoma's coal resources are located in the northeast corner of the state.[101]

Figure 32: State of Oklahoma: Coal Resource Map



Coal, primarily out of state coal, is the fuel source for approximately 9 percent of the electricity generation in the state, a percentage that has decreased markedly in the past decade.[102] The coal utilized for electricity generation in Oklahoma is primarily from Wyoming and delivered by railcar.[103]

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[97] Oklahoma Natural Gas Company. *2019 Demand Program Report.* https://oklahoma.gov/content/dam/ok/en/occ/documents/pu/energyefficiency/demand-program-annual-reports/ong-2019-demand-report.pdf (December 28, 2020).
[98] CenterPoint Oklahoma. *2019 Demand Programs Annual Report.* https://oklahoma.gov/content/dam/ok/en/occ/documents/pu/energyefficiency/demand-program-annual-reports/centerpoint-2019-demand-report.pdf (December 28, 2020).
[99] U.S. EIA. *State Total Energy Rankings, 2019.* http://www.eia.gov/state/rankings/?sid=US#/series/48 (December 22, 2020).
[100] U.S. EIA. *Coal Production and Number of Mines by State and Coal Rank, 2018.* http://www.eia.gov/coal/annual/pdf/table2.pdf (May 21, 2020).
[101] Oklahoma Department of Mines. *Oklahoma Coal.* http://mines.ok.gov/coal-and-coal-combustion (December 22, 2020).
[102] U.S. EIA. *Net Generation by State by Type of Producer by Energy Source, 1990-2019.* https://www.eia.gov/electricity/data/state/ (December 18, 2020).
[103] Oklahoma Department of Mines. *Coal and Coal Combustion*. https://mines.ok.gov/coal-and-coal-combustion (December 22, 2020).

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Oklahoma's coal industry is regulated by the Oklahoma Department of Mines. This department regulates the production of coal and enforces and implements various provisions of state and federally mandated programs in health, safety, mining, and land reclamation practices associated with surface and subsurface mining.[104]

With proper federal and state waivers in place, coal could have a potential to serve as a fuel extender in cases of severe shortage.

PROPANE SUPPLY PROFILE

Liquefied Petroleum Gas, also known as LP Gas or propane, is a source of heating fuel and transportation fuel in Oklahoma. Propane is a byproduct of both crude oil and natural gas production. The Oklahoma LP Gas Administration regulates the propane industry, enforcing safety codes and conducting investigations after accidents occur.

In 2019, propane was the primary heating source in 6.7 percent of Oklahoma homes.[105] The national average for this same year was 4.8%. This is largely due to the rural nature of much of Oklahoma that makes natural gas cost prohibitive as a fuel source. Propane is transported in pipelines or via truck for distribution to customers.

The National Propane Gas Association is the national trade association representing the U.S. propane industry. The Oklahoma Propane Gas Association is the statewide organization for propane gas retailers. Its sister organization, the LP Research, Marketing and Safety Commission offers programming and education to improve safety related to LP Gas.

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[104] Oklahoma Department of Mines. *Coal and Coal Combustion.* https://mines.ok.gov/coal-and-coal-combustion (December 20, 2020).
[105] U.S. EIA. *Oklahoma State Profile and Energy Estimates.* http://www.eia.gov/state/data.cfm?sid=OK#EnergyIndicators (December 20, 2020).

SEISMICITY PROFILE FOR OKLAHOMA

OVERVIEW

Earthquakes have the potential to impact Oklahoma's energy infrastructure. Some of the hazards related to earthquakes include ground shaking, liquefaction, lateral spreading, landslides, sloshing, elephant foot buckling, seiches, and fatigue. Brief explanations of each of these hazards are provided below. While many of these hazards are typically associated with large earthquakes (Magnitude (M) 6.0 and larger), the significant number of moderate (greater than M5.0) and small earthquakes seen in Oklahoma in recent years can also cause damage to energy infrastructure through ground shaking, sloshing, elephant foot buckling, and fatigue.

- **Ground Shaking:** Ground shaking is caused by seismic waves generated during earthquakes. Ground shaking during earthquakes can last from several seconds for smaller earthquakes to a few minutes for larger ones. The intensity of ground shaking typically reduces as the distance from the epicenter (the point on the earth's surface vertically above the point where an earthquake originates or the hypocenter) increases. Ground shaking is typically more hazardous to above-ground structures than buried structures due to independent movement in above-ground structures between the ground and the structure. Ground shaking due to moderate earthquakes has caused substantial damage to residential structures and minor damage to bridges in Oklahoma.[106]
- **Liquefaction:** Liquefaction occurs when water pressure in the pore spaces of loose, saturated, sandy/silty soils increases during ground shaking and turns these soils into thick liquids similar to quicksand. Liquefaction can lead to buildings sinking into the ground and buried pipelines and tanks floating to the surface. Two instances of minor liquefaction near the Arkansas River have been documented in Oklahoma.[107]
- **Lateral Spreading:** Lateral spreading occurs when soil masses on gentle slopes move due to ground shaking. Lateral spreading typically occurs when soft clays or liquefiable soils underlie a strong surface crust. Lateral spreading can cause extensive damage to buried pipelines.
- **Landslides:** Landslides during earthquakes occur when soil masses on steep slopes move downhill due to ground shaking. Landslides can cause extensive damage to both buried and above-ground structures on or near the slopes.

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[106] Harvey, P. S., Jr., Heinrich, S. K., & Muraleetharan, K. K. (2018). "A Framework for Post-Earthquake Response Planning in Emerging Seismic Regions: An Oklahoma Case Study." *Earthquake Spectra*, Earthquake Engineering Research Institute, 34(2), 503–525.

[107] Geotechnical Extreme Events Reconnaissance (GEER) (2016). "The Geotechnical Aspects of the September 3, 2016 M5.8 Pawnee, Oklahoma Earthquake." *Technical Report*.

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- **Sloshing:** Sloshing is agitation of liquids in storage tanks due to ground shaking. Sloshing can damage liquid storage tanks. Due to sloshing, the stored liquid can also overtop the tank. Sloshing can pose a hazard to Oklahoma energy facilities with large numbers of tanks such as the crude oil and petroleum storage facility at Cushing.
- **Elephant Foot Buckling:** Elephant foot buckling is the outward bulging of above-ground liquid storage tanks near the ground surface due to rapid increase in fluid pressure during earthquakes. Again, facilities such as Cushing with large numbers of liquid storage tanks are vulnerable to this hazard.
- **Seiches:** A seiche is a standing wave caused by an earthquake in an enclosed or partially enclosed body of water such as a lake, pond, or reservoir. This hazard poses a potential risk to Oklahoma's hydroelectric infrastructure near a dam or a reservoir.
- **Fatigue**: Fatigue occurs in components of structures that undergo large numbers of cycles of loads. An individual load cycle may not be large enough to cause a failure, but large numbers of small cycles can lead to fatigue failure. Due to large numbers of small and moderate earthquakes in Oklahoma, fatigue failure is a concern to Oklahoma energy infrastructure such as pipes, transmission towers, and storage tanks.

Earthquakes can be broadly classified into two types, natural and induced. Natural earthquakes are primarily caused by volcanic or tectonic activity. Earthquakes occurring from any man-made activity are classified as induced earthquakes. These man-made activities could include mining, blasting, and disposal of wastewater generated during oil and gas production into deep disposal wells. Oklahoma has experienced both natural and induced earthquakes. Seismicity-related natural earthquakes are discussed first and then seismicity related to induced earthquakes is discussed. Finally, the ODOT ShakeCast model is presented as a potential adaptable strategy for future seismicity monitoring and response in the energy sector.

NATURAL SEISMICITY

Oklahoma's natural seismicity is primarily defined by a collection of faults in the southwestern part of the state. Of these faults, the only fault deemed to be active is the Meers fault (see Figure 33 on the next page).[108] The U.S. Geological Survey (USGS) considers a fault that has moved in the past 10,000 years as an active fault. Oklahoma has, however, experienced natural earthquakes outside of this region in the past. For example, in 1952, El Reno experienced a M5.5 earthquake that caused wide-spread minor damage in El Reno and surrounding cities.[109] Approximately seven natural earthquakes have occurred since 1918 with magnitudes capable of causing even minor

[108] Luza, K.V., Madole, R.F., and Crone, A. J. (1987). *"Investigation of the Meers Fault, Southwestern Oklahoma."* Technical Report, Special Publication No. 87-1, Oklahoma Geological Survey.
[109] Oklahoma Historical Society. *Earthquakes.* https://www.okhistory.org/publications/enc/entry.php?entry=EA004 (February 9, 2021).

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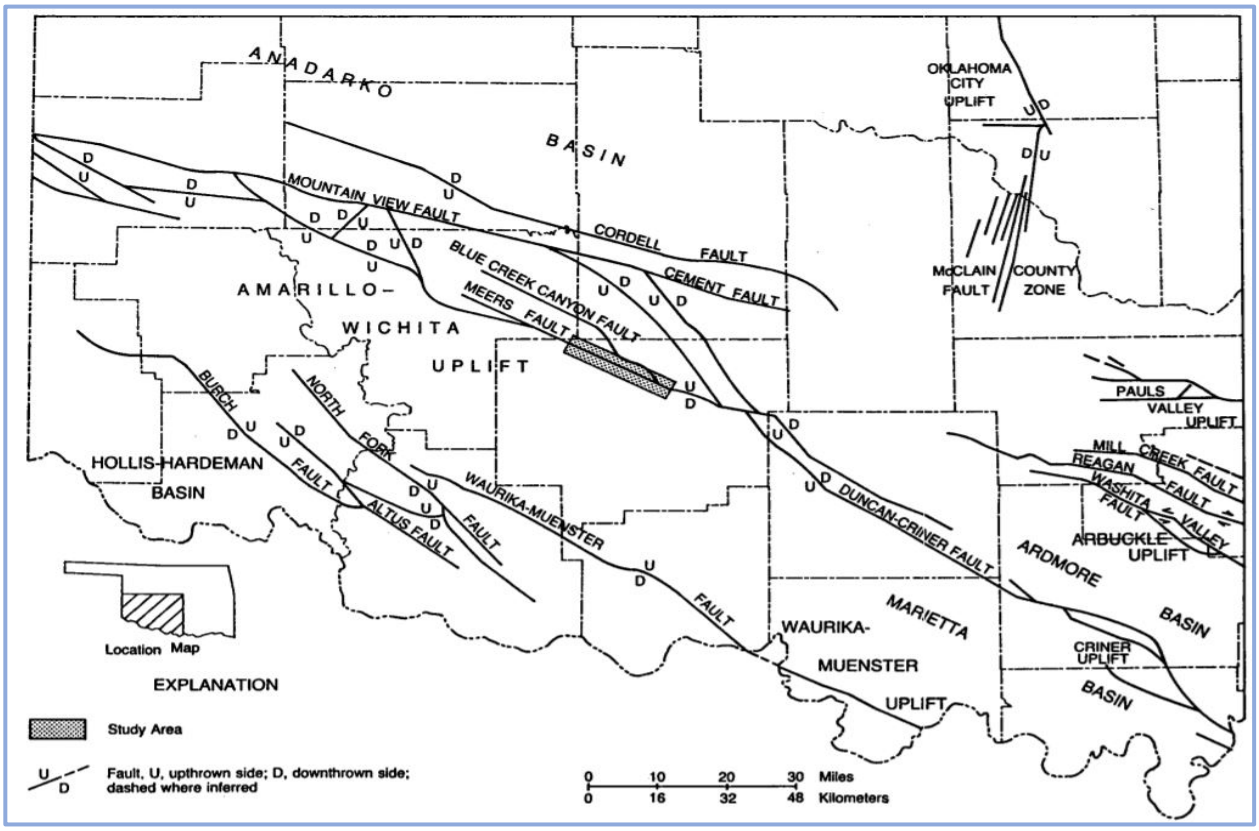
damage.[110] On average, natural seismic activity in Oklahoma results in about 1.5 M3.0 or greater earthquakes per year.[111]

Figure 33: Faults in Southwestern Oklahoma



Because only the Meers fault is considered an active fault, USGS develops natural seismic hazard maps for Oklahoma based on probabilistic seismic hazard analysis of activity on the Meers fault. Figure 34, next page, illustrates the Peak Ground Acceleration (PGA) (maximum acceleration on the ground surface) contours (as a percentage of gravitational acceleration of the earth, g) with a 2% probability of exceeding in 50 years (i.e., 2% probability of exceeding the given value at a location in 50 years) from the Meers fault.[112] PGA values are typically used as an indicator of

[110] Oklahoma Department of Transportation (ODOT). (2017). *Post-Earthquake Response Plan for Oklahoma's Bridges*, https://www.odot.org/pontis_files/Earthquake%20RespPlan.pdf (June 21, 2021).
[111] Andrews, R. D., and Holland, A. (2015). "Statement on Oklahoma Seismicity." Oklahoma Geological Survey, http://wichita.ogs.ou.edu/documents/OGS_Statement-Earthquakes-4-21-15.pdf (June 21, 2021).
[112] Petersen, M., Moschetti, M., Powers, P., Mueller, C., Haller, K., Frankel, A., Zeng, Y., Rezaeian, S., Harmsen, S., Boyd, O., Field, N., Chen, R., Rukstales, K., Luco, N., Wheeler, R., Williams, R., and Olsen, A. (2014). *"Documentation for the 2014 update of the United States national seismic hazard maps."* Technical Report, Open-File Report 2014-1091, U.S. Geological Survey.

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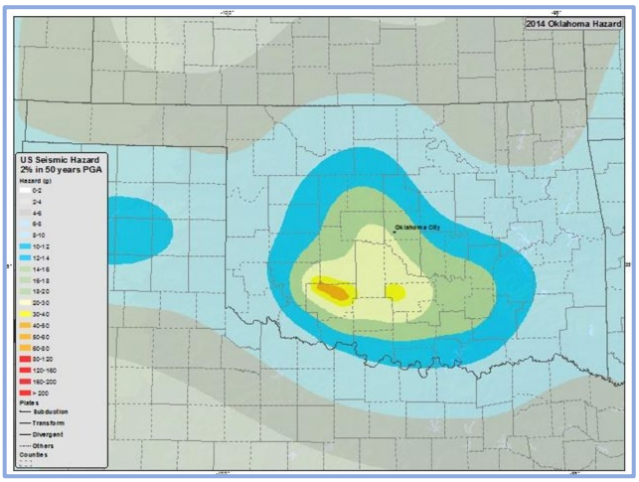
ground shaking intensity and can be related to seismic damage to structures. For example, in general, PGA values in the range of 0.3 to 0.5 g (30 – 50% of g) can be expected to cause major damage and the values less than 0.1 g (10 % of g) will likely result in minor or no damage.

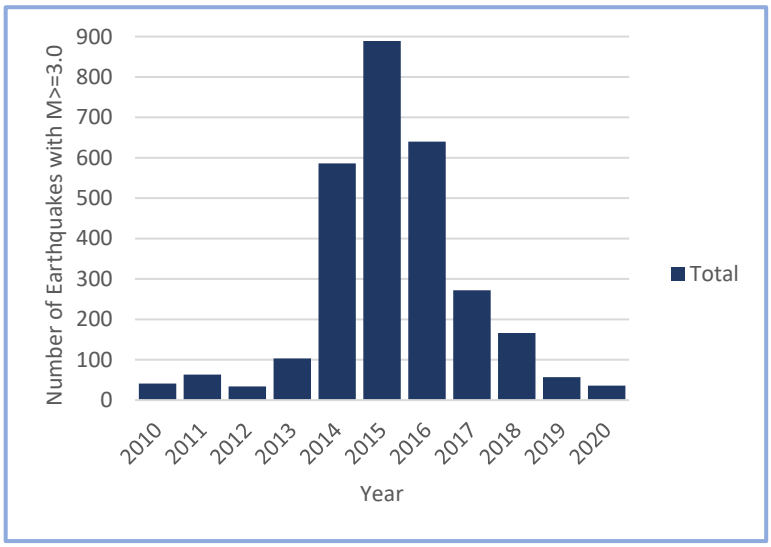
Figure 34: Natural Seismic Hazard Map for Oklahoma



INDUCED SEISMICITY

Starting in 2009, there was a dramatic increase in number of earthquakes in Oklahoma. In 2009 there were 20 M3.0 or greater earthquakes compared to an average of about 1.5 such earthquakes per year prior to that year. In 2015, Oklahoma experienced a peak of 889 M3.0 or greater earthquakes,[113] the largest number of earthquakes in Oklahoma in a single year. Oklahoma experienced its largest recorded earthquake on September 3rd, 2016, registering at M5.8 near Pawnee, Oklahoma. The number of earthquakes in Oklahoma with M3.0 or greater from January 1st, 2010, to December 31st, 2020, are shown in Figure 35.[114]

Figure 35: Number of Earthquakes in Oklahoma with a Magnitude Greater or Equal to 3.0: 2010-2020



Studies by Keranen et al.[115] have linked this increase in seismic activity in Oklahoma to wastewater injection in disposal wells. On April 21st, 2015, the Oklahoma Geological Survey (OGS) released a statement that the underground injection of wastewater associated with oil and gas production was likely tied to the swarm of

[113] U.S. Geological Survey. *Search Earthquake Catalog (2021).* https://earthquake.usgs.gov/earthquakes/search/ (February 9, 2021).
[114] U.S. Geological Survey. *Search Earthquake Catalog (2021).* https://earthquake.usgs.gov/earthquakes/search/ (February 9, 2021).
[115] Keranen, K. M., Savage, H. M., Abers, G. A., &Cochran, E. S. (2013). "Potentially induced earthquakes in Oklahoma, USA: links between wastewater injection and the 2011 Mw 5.7 earthquake." *Geology*, 41, 699–702.

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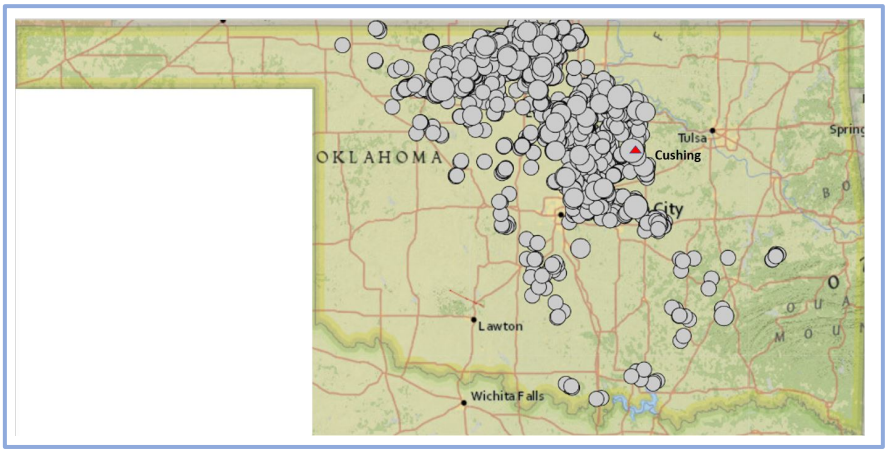
earthquakes that had hit Oklahoma.[116] With the support of the OGS, the OCC began implementing plans to reduce seismicity across the state of Oklahoma on May 11th, 2015.[117] This plan included well shutdowns along with reduced injection volume. Seismicity in Oklahoma has decreased following both the actions taken by the OCC and the reduction in production activities related to a reduction in oil prices in recent years. Due to continuously changing seismic activity, it is difficult to produce a seismic hazard map for induced seismicity in Oklahoma similar to the map shown in Figure 34 for natural seismicity. USGS, however, attempted to produce such a hazard map for a single year in 2016.[118] Such maps are no longer valid since the induced seismic activity has now significantly declined. The long-term impact of already injected wastewater to create earthquakes in Oklahoma is not fully understood and therefore induced earthquakes still have the potential to impact Oklahoma's energy sector from effects related to ground shaking, sloshing, elephant foot buckling, and fatigue.

The epicenters of earthquakes in Oklahoma from January 1st, 2010, to December 31st, 2020, are shown in Figure 36.[119] The concentration of earthquakes begins just east of Oklahoma City and stretches northwest to the northern border of the state. Cushing is located within this concentration of epicenters. As the effects of ground shaking and related effects are more pronounced near an epicenter of an earthquake, a future large, induced earthquake in the same vicinity of the past earthquakes as shown in Figure 36 has the potential to affect the facilities in Cushing significantly.

Figure 36: Epicenters of Earthquakes in Oklahoma: 2010-2020



[116] Oklahoma Geological Survey. *"Statement on Oklahoma Seismicity."* http://wichita.ogs.ou.edu/documents/OGS_Statement-Earthquakes-4-21-15.pdf (June 24, 2021).
[117] Oklahoma Corporation Commission, Oil and Gas Conservation Division. *OCC Directives Changing Disposal Well Operations in Earthquake Areas.* https://oklahoma.gov/content/dam/ok/en/occ/documents/ajls/news/archived-news/2015/05-11-15directives.pdf (June 24, 2021).
[118] Petersen, M. D., Mueller, C. S., Moschetti, M. P., Hoover, S. M., Rubinstein, J. L., Llenos, A. L., Michael, A. J., Ellsworth,W. L., McGarr, A. F., Holland, A. A., & Anderson, J. G. (2016). "2016 One-Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes." *Technical Report*, Open-File Report 2016-1035, U. S. Geological Survey.
[119] U.S. Geological Survey. *Search Earthquake Catalog.* *https://earthquake.usgs.gov/earthquakes/search/* (February 9, 2021).

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ODOT SHAKECAST: A MODEL FOR SEISMICITY TRACKING AND RESPONSE

The Oklahoma Department of Transportation (ODOT) has taken a proactive approach to inspect its bridges following earthquakes[120] and developed a detailed post-earthquake response plan for Oklahoma bridges.[121] The ODOT's bridge inspection system is based on USGS's ShakeCast,[122] but customized for Oklahoma bridges. Following an earthquake, ShakeCast automatically retrieves shaking intensities, compares these intensities to users' facilities' damage potential or fragility curves, and sends email notification of damage reports to responsible parties within 10 – 20 minutes following an earthquake. ODOT's post-earthquake response plan details items such as earthquake response protocols, response team qualifications and training, and corrective actions (bridge closures, temporary repairs, etc.). A future mitigation and response strategy for critical energy infrastructure could include adaptation of the system implemented by ODOT. Critical Oklahoma energy facilities, such as those in Cushing, could likely utilize a similar approach based on ShakeCast for tanks and other infrastructure and include this approach in a post-earthquake response plan to ensure consequences of damage can be minimized. This could also help assure that the damaged facilities can be brought back online rapidly following an earthquake.

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[120] Harvey, P. S., Jr., Heinrich, S. K., & Muraleetharan, K. K. (2018). *"A Framework for Post Earthquake Response Planning in Emerging Seismic Regions: An Oklahoma Case Study."* Earthquake Spectra, Earthquake Engineering Research Institute, 34(2), 503–525.

[121] Oklahoma Department of Transportation. *Post-Earthquake Response Plan for Oklahoma's Bridges.* https://www.odot.org/pontis_files/Earthquake%20RespPlan.pdf (June 21, 2021).

[122] Wald, D. J., Lin, K.-W., Porter, K., & Turner, L. (2008). "ShakeCast: automating and improving the use of ShakeMap for post-earthquake decision-making and response." *Earthquake Spectra*, 24, 533–553. doi:10.1193/1.2923924.

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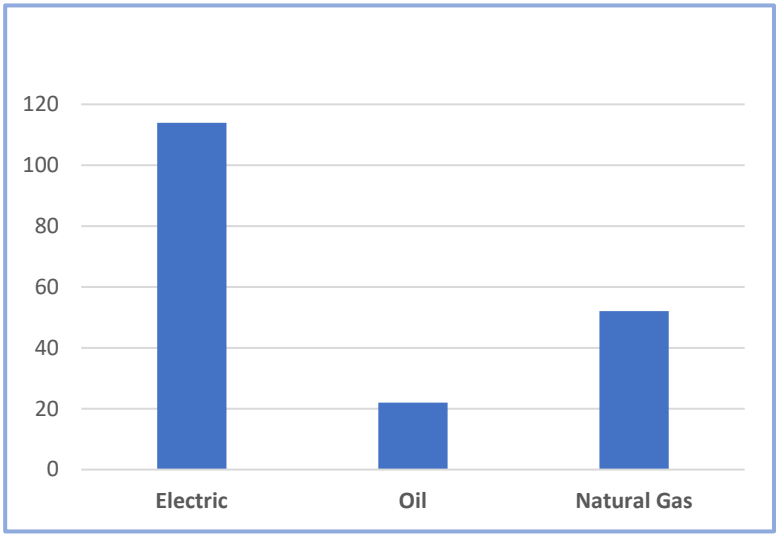
ENERGY VULNERABILITY ASSESSMENTS

This section provides information about events in Oklahoma that have historically caused energy disruptions and outlines potential or known vulnerabilities in Oklahoma's energy infrastructure that should be considered as part of energy planning and emergency response activities. This information is intended to acquaint officials and stakeholders with potential scenarios, patterns, trends, and frequencies of energy incidents in the state of Oklahoma and to provide a basis for risk scenarios.

HISTORICAL ANALYSIS OF ENERGY EMERGENCIES IN OKLAHOMA

To better understand and plan for likely emergency scenarios, a comprehensive history of Oklahoma's energy emergencies was compiled by the University of Oklahoma's National Institute for Risk & Resilience, which conducted a media analysis of reported energy incidents that occurred between January 2016 and December 2019. Oklahoma's two major newspapers—the Tulsa World and the Oklahoman—were used. In all, 188 unique events were documented with the characteristics listed in Figures 37 through 40.[123, 124] This analysis represents a full analysis of recent emergencies; for an analysis of the previous 4-year time period (January 2011 to December 2015) please refer to the 2016 Oklahoma Energy Assurance Plan. Overall results between these two time periods were consistent.

Figure 37: Number of Oklahoma Energy Incidents, by Sector, 2016-2019



As listed in Figure 37, shown above, electricity incidents are by far the most prevalent, making up 60.6% of the 188 events. Oil and natural gas incidents accounted for 11.7% and 27.7% of the emergency events, respectively. There were no reported events outside of these three categories.

[123] The Tulsa World. *Home.* https://tulsaworld.com (June 24, 2021).
[124] The Oklahoman. *Home.* https://www.oklahoman.com (June 24, 2021).

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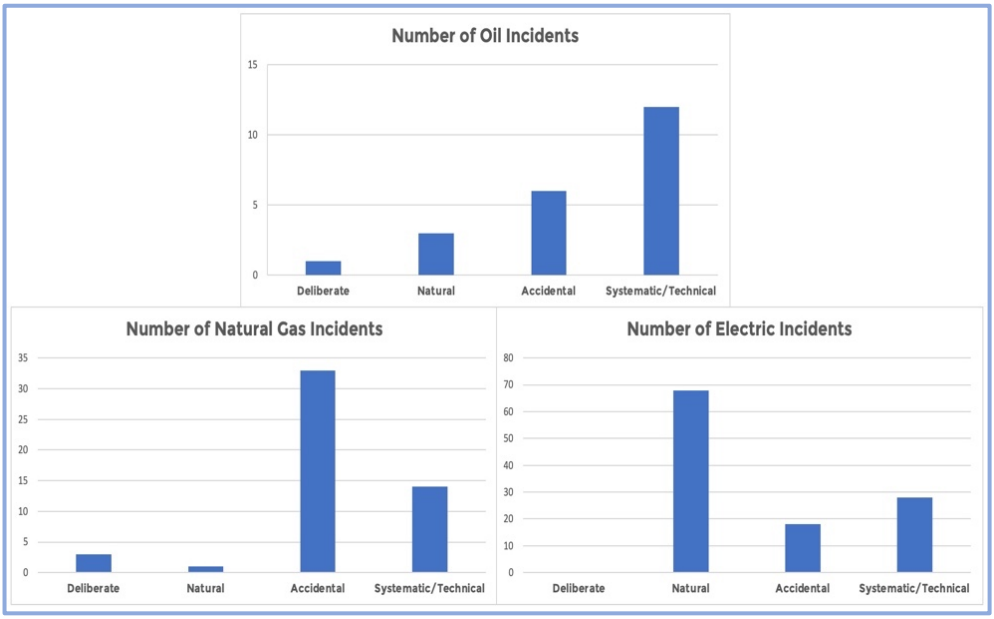
Figure 38 provides a brief look at the cause for each of the 188 energy incidents. Of the energy incidents with a reported cause, most were accidental or systemic/technical in nature. When looking at the oil sectors, most of the incidents were caused by accidents or systemic/technical failures. In the natural gas sector, the majority of incidents with a reported cause were accidental compared to the electricity sector where the majority of incidents were caused by natural disasters.

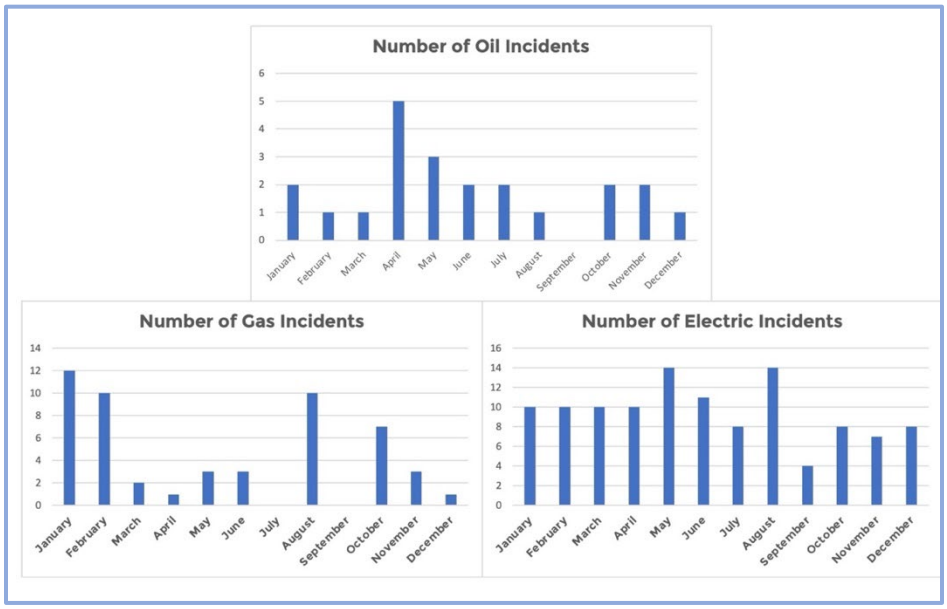
Figure 38: Number of Oklahoma Energy Incidents, by Sector and Reported Cause, 2016-2019



Next, Figure 39 breaks out each of these events by month. The analysis shows that there is no obvious monthly trend to the occurrence of oil incidents. There were no oil events for the months of September.

Next, the majority of natural gas incidents have occurred in January and February. In comparison, electric incidents are spread throughout the year, with noted peak months in May and August, with 14 incidents occurring in each month.

Figure 39: Number of Oklahoma Energy Incidents, by Sector and Month, 2016-2019



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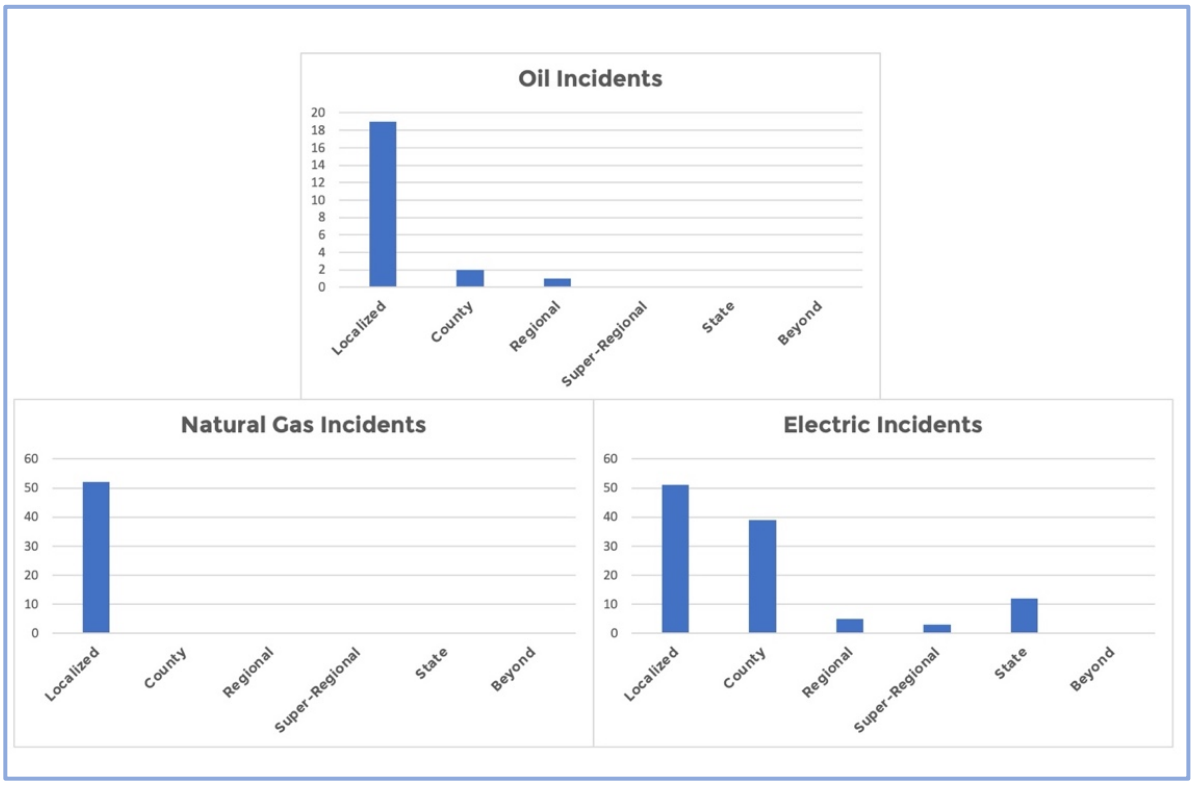
Finally, Figure 40, below, displays the scope of impact of each energy incident by sector. Incidents with no clear scope reported in the news article were not coded. There was only one incident from each the natural gas and oil categories with an unreported scope. These data reveal a distinctive pattern—natural gas and oil incidents tend to be localized in nature whereas electricity incidents

Figure 40: Number of Oklahoma Energy Incidents, by Sector and Reported Scope, 2016-2019



range from local to statewide in scope. This fact, combined with the previous analysis, indicates that electricity incidents are the most common type of energy emergency in Oklahoma and have the potential to affect the largest number of people. This makes electricity incidents of the highest consequence and probability in Oklahoma. In fact, U.S. Department of Energy reports indicated 12 electric events affecting Oklahoma over a five-year period rose to the standard of required federal reporting.[125] Under any of the following circumstances, an electric provider must file a report:

- Physical attack that causes major interruptions or impacts to critical infrastructure facilities or operations
- Cyber event that causes interruptions of electrical system operations

[125] U.S. Department of Energy. *Office of Electricity and Energy Reliability, Electric Disturbance Event Summaries, 2002-present.* http://www.oe.netl.doe.gov/OE417_annual_summary.aspx (March 6, 2020).

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- Complete operational failure or shutdown of the transmission and/or distribution electrical system
- Electrical System Separation (Islanding) where part/parts of a power grid remain operational in an otherwise blacked out area of the partial failure of an integrated electrical system
- Uncontrolled loss of 300 Megawatts or more of firm system loads for more than 15 minutes from a single incident
- Load shedding of 100 Megawatts or more implemented under emergency operational policy
- System-wide voltage reductions of 3 percent or more
- Public appeal to reduce the use of electricity for purposes of maintaining the continuity of the electric power system
- Physical attack that could potentially impact electric power system adequacy or reliability
- Vandalism which targets components of any security systems
- Cyber event that could potentially impact electric power system adequacy or reliability
- Loss of electric service to more than 50,000 customers for 1 hour or more
- Fuel supply emergencies that could impact electric power system adequacy or reliability

INFRASTRUCTURE STRENGTHS AND WEAKNESSES

Protecting the state's critical energy infrastructure can be key in preventing at least some energy emergencies and, to protect this infrastructure, an understanding of its inherent vulnerabilities is also critical.

The section below discusses strengths and weaknesses of Oklahoma's energy portfolio and infrastructure. As natural hazards present significant risks to Oklahoma's energy infrastructure, first an overview of natural hazards in Oklahoma is presented and then strengths and weaknesses of electric, natural gas, and crude oil/petroleum infrastructure are discussed. The primary basis for these discussions is the "State of Oklahoma Energy Sector Risk Profile"[126] published by the U.S. Department of Energy (U.S. DOE). The U.S. DOE produces this document following extensive analyses of available data sources and identifies significant natural hazards with the potential to cause disruption of the energy infrastructure.

Data presented in U.S DOE's Oklahoma Energy Sector Risk Profile, collected from the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS), indicate that the most common natural hazard in Oklahoma between 2009 and 2019 was Thunderstorm/Lightning. The second and third most common natural hazards were Earthquake and Flood, respectively. The three natural hazards that caused greatest overall property damage in

[126] U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability. *Oklahoma Energy Sector Risk Profile.* https://www.energy.gov/sites/default/files/2021-03/State%20of%20Oklahoma%20Energy%20Sector%20Risk%20Profile.pdf (June 16, 2021).

Oklahoma between 2009 to 2019 were Tornado, Thunderstorm/Lightning, and Winter Storm/Extreme Cold. Electric utilities in Oklahoma reported Weather/Falling trees as the leading cause for outages between the years 2008 and 2017. The Oklahoma Corporation Commission (OCC) has been working with electricity providers to reduce the number of incidents related to falling trees under OAC 165:35-25-15; additional discussion of vegetation management can be found in the chapter titled "Preparing for, Mitigating, and Responding to Energy Emergencies."[127]

In the past, Oklahoma has not experienced significant impact to natural gas infrastructure due to extreme cold, however, during an extended extreme cold weather spell in February 2021, natural gas supply was strained due to frozen natural gas wells combined with record demand[128] and Oklahoma's neighboring state, Texas, has seen significant impacts to natural gas production and delivery due to cold weather several times since the late 1980s. These historical events and Oklahoma's recent experience demonstrate that energy assurance planners should account for the possibility of cold weather to impact natural gas production and delivery in the future.

Electric Infrastructure Strengths and Vulnerabilities

Oklahoma's electricity infrastructure strengths include production capacity, geographical distribution of power plants, and diversity in heating sources. As indicated in the "Energy Profile for Oklahoma" chapter, Oklahoma's generation capacity exceeds its typical annual usage; the state also has multiple electric utilities that are members of the Southwest Power Pool (SPP). These features strengthen the state's ability to withstand temporary drops in generation by shifting resources to other generating facilities or drawing from out-of-state generation resources within SPP. The "Energy Profile for Oklahoma" chapter also contains a map of Oklahoma's electric infrastructure, showing good geographic dispersion of electric generation facilities throughout the state. This is a strength because localized events such as earthquakes and tornadoes are less likely to cause multiple generation facilities to be impacted simultaneously. The third strength of Oklahoma's energy infrastructure is the diversity in heating sources. As shown in Figure 3 in the "Energy Profile for Oklahoma" chapter, 39.5 percent of Oklahoma's home heating utilizes electricity. Natural gas accounts for 51 percent and the remaining 9.5 percent consists of propane and other heating sources. This diversity in home heating sources means that even a state-wide electric outage, while still significant, will not necessarily result in a complete outage in home heating.

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[127] Oklahoma Corporation Commission. *Okla. Admin. Code § 165:35-25-15.* https://casetext.com/regulation/oklahoma-administrative-code/title-165-corporation-commission/chapter-35-electric-utility-rules/subchapter-25-operations-requirements-for-utilities/part-3-reliability-of-service-and-reliability-program/section-16535-25-15-vegetation-management-plan (June 24, 2021).

[128] The Oklahoman. *"Oklahoma regulators open flow on wells to help address natural gas shortage".* https://www.oklahoman.com/story/business/columns/2021/02/20/oklahoma-regulators-open-flow-on-wells-to-help-address-natural-gas-shortage/330130007/ (June 25, 2021).

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Oklahoma's electricity infrastructure weaknesses are primarily due to natural hazards and their effect on above-ground transmission and distribution lines. For instance, Oklahoma experienced an unusually early ice storm October 26 - 28, 2020 when there was still significant foliage on trees that allowed ice accumulation to weigh down branches onto power lines. Independent of the falling tree limbs, power lines and power poles were also damaged by the ice leading to widespread outages. A secondary effect of the fallen tree limbs was the creation of traffic interruptions, complicating damage repair efforts. As discussed in the "Preparing for, Mitigating, and Responding to Energy Emergencies" chapter, Oklahoma has made efforts to clear vegetation surrounding power lines; however, even with these efforts Oklahoma infrastructure is frequently impacted by severe weather, ice storms, and fallen trees.

Another weakness is the age of Oklahoma's electricity infrastructure. OG&E, a major electricity provider in Oklahoma, has reported that 27 percent of outages not caused by weather are due to equipment failure.[129] The U.S. DOE reports faulty equipment/human error as the second leading cause of electricity outages in Oklahoma. Failures related to aging infrastructure include the failure of electrical equipment, such as transformers and switches, as well as structural failure of power poles.

Overall, many variables can threaten the complex web of electrical infrastructure which includes items such as generation facilities, transmission lines, substations, transformers, and dams. Threats to electric infrastructure might include:

- *Deliberate attacks* on the electrical system, which could come in many forms. Almost all electricity infrastructure represents potential targets. The intent of some attacks, such as terrorist actions, may be to disrupt electricity networks while others may be a result of vandalism or crime, such as copper theft, both of which could lead to system failures. Hard-to-replace components of the electric grid, such as the custom-built transformers that increase the voltage of electricity to levels suited for bulk transmission and then reduce voltage for distribution to customers, are particularly vulnerable. Very few of those transformers are manufactured in the United States and replacing them can take many months. Furthermore, as the electric grid becomes increasingly automated the power grid is susceptible to attacks from cyber terrorists. A complete discussion of cybersecurity issues can be found later in this section.
- *Natural disasters* pose a particularly high risk in Oklahoma. Local distribution infrastructure and transmission lines, in particular, are severely impacted by the ice storms, high winds, lightning, and tornados that routinely occur throughout the state. Other threats include floods (often exacerbated by drought conditions) which can damage all sorts of electric infrastructure and disrupt the hydroelectric system.

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[129] The Oklahoman. *"OG&E hopes a higher electric bill now could save consumers money in the future", February 25th, 2020*. https://www.oklahoman.com/article/5655826/oklahoma-gas-electric-hopes-a-higher-electric-bill-now-could-save-consumers-money-in-the-futre (June 21, 2021).

- *Accidents* pose an additional threat to electric infrastructure in Oklahoma. Transmission lines are particularly vulnerable and can often be damaged by local construction projects or transportation accidents.
- *Systemic threats* such as a prolonged supply disruption to the common feedstocks for electric generation (natural gas or coal) have the potential to disrupt electric providers' ability to meet consumer demand. Further, aging infrastructure can fail, potentially resulting in widespread or prolonged outages.

Natural Gas Infrastructure Strengths and Vulnerabilities

Similar to the electric infrastructure, it is important to consider both the strengths and potential threats to Oklahoma's natural gas infrastructure, which includes wells, transmission lines, gathering lines, distribution lines, and underground storage facilities.

Oklahoma's natural gas infrastructure is a key feature of Oklahoma's overall energy infrastructure. Oklahoma's natural gas strengths include production and storage capacities, underground transmission and distribution, and the geographic distribution of the processing plants. As indicated in the "Energy Profile for Oklahoma" chapter, Oklahoma produces four times as much natural gas as it consumes. In addition, the U.S. EIA indicates that in January 2021, Oklahoma had 86,495 MCF (or approximately 86 Bcf) of working gas in underground storage;[130] this in-state storage capacity serves as a strength during cold weather events where production may be temporarily limited.

A further strength of Oklahoma's natural gas infrastructure is its primarily underground location, offering the majority of natural gas infrastructure protection from the state's frequent severe weather events.

A third strength is the geographic distribution of natural gas processing plants throughout the state. As with the electric infrastructure, the natural gas infrastructure map shown in the "Energy Profile for Oklahoma" chapter indicates that the natural gas processing plants cover the entire state with some concentrations in western and southern Oklahoma. This prevents localized events, such as earthquakes and tornadoes, from impacting all processing plants simultaneously.

One of Oklahoma's natural gas infrastructure weaknesses is the potential for impacts from accidents or deliberate attacks on the many pipelines crisscrossing the state. The U.S. DOE reports that, between the years 1984 and 2019, the most frequent events affecting natural gas transmission and distribution pipelines were categorized as miscellaneous/unknown or outside force.[131] The

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[130] U.S. EIA. *"Oklahoma Natural Gas in Underground Storage (Working Gas) (Million Cubic Feet)".* https://www.eia.gov/dnav/ng/hist/n5020ok2m.htm (June 24, 2021).
[131] U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability. *"Oklahoma Energy Sector Risk Profile".* https://www.energy.gov/sites/default/files/2021-03/State%20of%20Oklahoma%20Energy%20Sector%20Risk%20Profile.pdf (June 21, 2021).

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U.S. DOE classifies "outside force" as those due to vehicular accidents, sabotage, and vandalism and "miscellaneous/unknown" as releases or failures resulting from any other cause not listed or of an unknowable nature.

Further, natural gas infrastructure has a vulnerability in the potential for natural gas wells or pipelines to freeze during extreme cold weather, as Oklahoma saw recently during the polar vortex weather event of February 2021. During this event, and potentially in any extended cold weather event, natural gas infrastructure production may suffer due to well heads or instrumentation freezing[132] while simultaneously consumption increases for home heating. These two factors combined resulted in a shortage of gas to meet immediate needs and therefore the second largest reported withdrawal of gas from underground storage in the United States on February 19th, 2021.[133]

In Oklahoma, natural gas pipeline operators have undertaken a process to self-identify their most vulnerable infrastructure and equipment. The list and location of this infrastructure is kept confidential by the operators, but the analysis is complete and on-hand in case of need. Overall, potential threats to this identified infrastructure might include:

- *Deliberate attacks* which could be realized too many portions of natural gas production facilities. Most of the wellheads are in remote areas and are largely unsecured. It is not uncommon for accidents to occur and rupture these wellheads. In addition, intentional damage by either terrorists or vandals could occur. A similar potential exists for the pipeline, processing facilities, pump stations, and ultimately the gas meters – all are potential targets for accident or intentional attacks.

- *Natural disasters* are highly probable events in the state. Oklahoma is regularly impacted by high winds, wildfires, tornados, and lightning which could damage surface infrastructure. Every 5-10 miles, a natural gas pumping station exists above-ground to re-pressurize the lines; these stations are often located in remote areas and are largely unprotected. In addition, the region is modestly seismically active, and the potential exists for damage to occur from a seismic event affecting either surface infrastructure or underground pipelines.

- *Accidents* such as accidental, third-party damage due to construction digging. According to the U. S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), there are currently 484 miles of natural gas transmission lines

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[132] The Oklahoman. *"Oklahoma regulators open flow on wells to help address natural gas shortage."* https://www.oklahoman.com/story/business/columns/2021/02/20/oklahoma-regulators-open-flow-on-wells-to-help-address-natural-gas-shortage/330130007/ (June 25, 2021).
[133] U.S. EIA. *"Cold weather results in near-record withdrawals from underground natural gas storage."* https://www.eia.gov/todayinenergy/detail.php?id=46916 (June 21, 2021).

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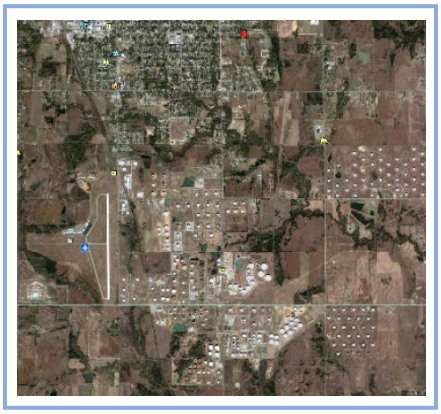
and 32,773 miles of gas distribution lines in Oklahoma,[134] and although this abundance of infrastructure makes supply far-reaching and reliable, it also increases the potential for accidents to occur.

- *Systemic threats* which include pipeline corrosion due to aging infrastructure, overall demand increases due to favorable pricing, or newly developed end uses for natural gas.

Crude Oil and Petroleum Products Infrastructure Strengths and Vulnerabilities

Oklahoma's crude oil and petroleum products infrastructure, which includes crude oil production rigs, storage facilities, pipelines, refineries, and fueling stations, face a variety of threats. In particular, Oklahoma is home to the Cushing Crude Oil Hub. This is a major hub in oil supply connecting the Gulf Coast to rest of the United States and Canada. Up to 75 percent of nation's crude oil passes through this junction, supplying significant amounts of oil to the eastern and midwestern portions of the United States; Cushing holds roughly 15 percent of the nation's crude oil storage capacity.[135] In addition to acting as a supply hub, Cushing is surrounded by several tank farms (see Figure 41), most of which are owned by major petroleum companies including BP, Enbridge Energy Partners, Plains All-American Pipeline, and SemGroup Energy Partners. When combined, the Cushing tank farms can store as much as 46.3 million barrels of oil at a time.[136] The major pipelines that supply Cushing include Spearhead (90,000 bbl/d), Pegasus (96,000 bbl/d), and Keystone (591,000 bbl/d).

Figure 41: Aerial View: Cushing Tank Farm



As with the natural gas infrastructure, one strength of Oklahoma's crude oil and petroleum pipeline infrastructure is its primarily underground location, protecting the infrastructure from severe weather incidents. However, Oklahoma's crude oil and petroleum energy infrastructure weaknesses include the geographical concentration in Cushing, potential deliberate attacks, train derailments, truck collision/rollovers, pipeline corrosion due to aging, and other equipment failure.

The geographical concentration of storage tanks and other infrastructure in Cushing makes it vulnerable to localized events such as earthquakes and tornadoes. As mentioned in the "Seismicity Profile for Oklahoma" chapter, Cushing lies within the epicenters of recent induced earthquakes

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[134] PHMSA. *PHMSA Annual Report: Oklahoma.* https://phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages (June 24, 2021).
[135] U.S. EIA. *Oklahoma State Profile and Energy Estimates.* https://www.eia.gov/state/?sid=OK (December 21, 2020).
[136] U.S. EIA. *Working Storage Capacity by PAD District as of March 31, 2016.* *http://www.eia.gov/petroleum/storagecapacity/table1.pdf* (March 6, 2020).

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in Oklahoma. Oklahoma's largest recorded earthquake (M5.8) occurred on September 3rd, 2016, in Pawnee, roughly 25 miles north of Cushing. The OCC has taken steps to reduce induced earthquakes in Oklahoma, however, should a major earthquake occur in or near Cushing it would cause major damage to Oklahoma's crude oil and petroleum energy infrastructure. In addition, the geographical concentration poses a prime target for deliberate attacks. Deliberate attacks on pipelines or storage tanks, while not frequent, can cause not only casualties and economic damage, but also severe environmental damage.[137]

Another infrastructure weakness in this sector is the necessary reliance on trucking for petroleum transport. The U.S. DOE reports that the event types causing the largest economic loss in petroleum transport in Oklahoma by rail and truck between 1986 and 2019 were classified as miscellaneous/unknown followed by derailment or collision/rollover and reports 1.59 incidents per year between the years of 1986 and 2019.[138]

Critically, Oklahoma's oil and petroleum infrastructure also suffers from the effects of aging. The U.S. DOE reports that the most common event types causing damage to pipelines are Corrosion and Equipment Failure, and half of Oklahoma's pipeline systems were constructed prior to 1970 or in an unknown year. The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides a public database which details incident reports filed each year. The information supports the U.S. DOE's findings that Corrosion and Equipment Failure are the leading causes affecting crude oil pipelines. PHMSA reports four (4) incidents of Corrosion and eleven (11) incidents of Equipment Failure in 2020. Incidents due to Corrosion and Equipment Failure will likely continue as the infrastructure ages.[139]

Overall, Oklahoma's crude oil and petroleum products infrastructure have the following vulnerabilities:

- *Deliberate attacks* could threaten all types of critical petroleum infrastructure. Oil production rigs, storage facilities, pipelines, and refineries are all vulnerable to deliberate attacks. First, crude oil is often stored in above-ground tanks at the production sites, tank farms, and refineries. In some cases, these tanks are largely unprotected. The state requires a 24-hour emergency number to be posted at each well site, but this is the only state asset protection requirement—additional protection measures are at the company's discretion. These isolated and unsecured tanks, while vulnerable, would pose little impact on the overall supply of energy to

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[137] Bajpai, S., and Gupta, J.P. (2007). "Securing oil and gas infrastructure." Journal of Petroleum Science and Engineering, 55(1-2), 174-186.
[138] U.S. Department of Energy. *State of Oklahoma Energy Sector Risk Profile.* https://www.energy.gov/sites/default/files/2021-03/State%20of%20Oklahoma%20Energy%20Sector%20Risk%20Profile.pdf (June 21, 2021).
[139] PHMSA. *Portal Access Page.* https://portal.phmsa.dot.gov/phmsapub/faces/PHMSAHome?req=-8084100732603776230&attempt=0&_afrLoop=1412065999719948&_afrWindowMode=0&_afrWindowId=vh9jytsu0&_adf.ctrl-state=q0w7a6scf_27 (June 21, 2021).

the state if they were to be damaged intentionally or otherwise. As at the Cushing Pipeline Hub or in the vicinity of refineries, some areas have high concentrations of tanks. These areas are more secure, but not completely. The state does require additional protective measures at disposal sites, such as gates, and cities can set more stringent measures if they choose for sites located within urban areas. In addition, according to the U. S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), there are currently 4,052 miles of crude oil pipelines in Oklahoma.

- *Natural disasters* also present a risk to crude oil and petroleum infrastructure. High winds and tornadic events could damage production and refinery operations, lightning could strike infrastructure like storage tanks leading to supply shortages, and seismic activity could potentially damage infrastructure.

- *Accidents* are potential risks, particularly for production and pipelines. In particular, accidental pipeline rupture due to unrelated construction digging can be common.

- *Systemic threats* such as the inability to increase crude oil production beyond the current reserves or refining capacity that may be unable to increase production to support anticipated increased future demands.

SECTOR INTERDEPENDENCIES

One of the greatest vulnerabilities when planning for energy emergencies is interdependencies, both within the energy sector between energy sources and between the energy sector and other industry sectors. In any type of energy emergency or supply disruption there can be downstream consequences that affect other areas of the economy and the response to the emergency itself. As illustrated in Figure 42 on the following page, interdependencies are complex and have impacts on critical infrastructure.[140]

[140] NASEO. *Role of Energy Resiliency in Emergency Response*. https://energywv.org/assets/files/Energy-Summit-Presentations/2018/6_Pillon.pdf (June 25, 2021).

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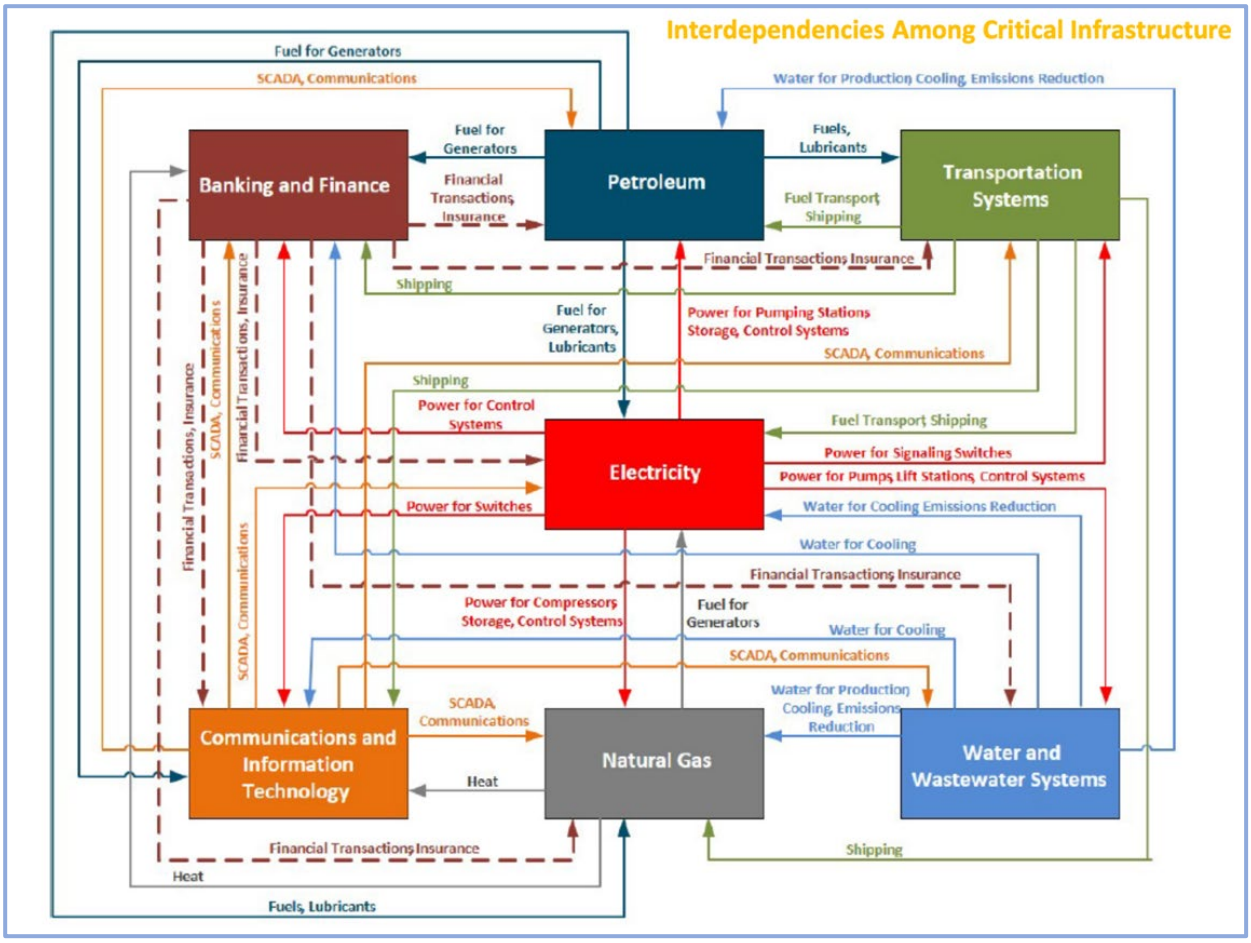
Figure 42: Interdependencies Among Critical Infrastructure



Given the complexity and many opportunities for interdependencies, it is wise to plan for scenarios in which energy shortages or emergencies impact other vital industries critical to restoration of normal conditions; this should include extremely severe or extended outages. Planners should begin by evaluating which interdependencies may be most likely or have the greatest impact within their jurisdiction. There are resources available to guide planners through an evaluative process for interdependencies. Planners are encouraged to review and utilize these resources and compare the results to existing plans to incorporate any needed additional redundancies, mitigations, or backups.[141] In addition, planners should exercise simulative scenarios that include interdependent

[141] U.S. Department of Commerce, National Institute for Standards and Technology. *NIST Special Publication 1190GB-5 Guide Brief 5 – Assessing Energy System Dependencies (December 2016).* https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190GB-5.pdf (May 24, 2021).

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system or cascading failures to identify weaknesses in existing plans and prepare for severe events.[142]

A few of interdependency scenarios that have or could affect Oklahoma are outlined below and are presented by sector.

Examples of interdependencies after an electric disruption may include:

- Failure of petroleum supply infrastructure to function when electric power is interrupted
- Outages or slowdowns at refineries and gas processing plants due to electric outages
- Outages of natural gas appliances as restoration of electrical service triggers pilot lights simultaneously and de-pressurizes gas lines
- Failure of water supply and purification systems to operate when electric power is lost
- Secondary utility system time-to-failure when back-up storage is exhausted
- Failure of information system networks, including wired and cellular telephones after an electrical outage
- Failure of 9-1-1 systems due to electrical outages
- Failure of environmental control systems after an electric disruption
- Failure of retail gas companies to pump gas, as they are dependent upon electricity for pump function

Looking to the future, Oklahoma energy assurance planners should analyze opportunities to lessen the interdependencies between the electric sector and other aspects of the economy or have contingency and redundancy plans in place to overcome the secondary consequences of an energy supply disruption or emergency.

First, certain changes to infrastructure that is reliant on electric power would reduce the kind of mutual dependencies that result in wider blackouts. For example, critical traffic signals could be equipped with battery backup to reduce the possibility that during an electric failure there will also be a loss of traffic control. Similarly, small generators could be placed in areas where power is needed for pumping water as many rural Oklahoma customers utilize well water pumped with electric motors and may lose water service when their electricity fails. In addition, the location of large fueling stations can be pre-identified so that in case of electric failure—and therefore gasoline pump failure—large battery-powered generators can be quickly delivered to these sites in order to ensure fuel availability for emergency responders and critical needs. During restoration efforts, electric utilities should work collaboratively with natural gas providers to cooperatively bring

[142] The President's National Infrastructure Advisory Council. *Surviving a Catastrophic Power Outage: How to Strengthen the Capabilities of a Nation. (December 2018).* https://www.cisa.gov/sites/default/files/publications/NIAC%20Catastrophic%20Power%20Outage%20Study_FINAL.pdf (May 24, 2021).

small sections of electric customers back online so that gas lines are not suddenly de-pressurized as electric-start pilot lights on furnaces all re-light simultaneously.[143]

To prevent failure of land line telecommunication systems, providers rely on back-up batteries located at their central offices. In the case of cellular communications, battery-powered backup generators are utilized at cell towers for short-term outage situations. These towers can also be re-charged using mobile generators. In addition, larger cellular providers and private companies offer Cellular on Wheels (COWs), a vehicle-mounted cellular tower that can be moved from location to location as needed. An alternative to a COW is a Cell on Light Truck (COLT), which is a cell tower incorporated into a light truck. More information on COWs and COLTs can be found in the Department of Homeland Security's *Portable Cellular Systems Applications Note*.[144] For longer-term outage situations, fuel-based generators can be installed but it is unknown how widely these are utilized by telecommunications providers in Oklahoma.[145]

Finally, the natural gas system is equipped with compressor pumps that run on natural gas instead of electricity so that the system can survive an extended blackout.

Downstream consequences of a natural gas disruption may include:

- Loss of electricity generation due to lack of fuel availability
- Loss of a primary home heating source in the state
- Loss of fuel source for Compressed Natural Gas (CNG) vehicles, which may particularly affect municipal and state fleets as well as private fleets

Just as electric disruptions can lead to natural gas disruptions, the inverse can be true. If natural gas supplies are disrupted, as was seen due to freezing wellheads and pipelines during the February 2021 Polar Vortex event, electric generating facilities, residential natural gas appliances, and CNG stations may lose access to sufficient natural gas fuel to maintain full or even partial output. Opportunities to lessen this interdependency could include increased natural gas storage for electric generation facilities or weatherization of natural gas infrastructure to prevent freezing.

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[143] Cooperation is critical because when gas lines suddenly lose pressure, the natural gas utility may need to go door-to-door to manually check each residence's appliances, since all gas-powered appliances can be affected if a gas line loses pressure.

[144] U.S. Department of Homeland Security. *Portable Cellular Systems Application Note. (July 2014).* https://www.dhs.gov/sites/default/files/publications/Port-Cell-Sys_AppN_0714-508.pdf (May 24, 2021).

[145] As the general public and emergency responders rely heavily on cellular communications, how carriers prepare for power outages can be a critical piece of knowledge. Today, many cellular towers have battery-powered backup-power systems that work for eight to 12 hours. Emergency responders should be aware of these potential limitations when planning for communications strategies amongst themselves after electricity outages, and the public should be aware of the potential for extended cellular outages should backup generation not be available.

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Downstream consequences of a petroleum disruption may include:

- Transportation disruptions if fuel shortages persist; these disruptions may affect not only Oklahoma but states that rely on Oklahoma's exported petroleum for their own supplies
- Disruptions to deliveries of propane by truck to rural customers, thereby creating a secondary energy shortage
- Inability of diesel-fueled generators to function as backup power sources for critical infrastructure such as hospitals or cellular towers

To reduce downstream consequences from petroleum disruptions, states should encourage diversity in fuel sources for the transportation sector, perhaps exploring compressed natural gas, biodiesel, or electric vehicle opportunities for trucking, fleet, and emergency response vehicles so that, in extended disruptions, fuel deliveries can still occur and emergency response can continue in at least some capacity.[146]

[146] National Association of State Energy Officials. *Integrating Alternative Fuel Vehicles in Energy Assurance Planning: Information, Examples and Data Resources to Guide States. (September 2015).* https://www.naseo.org/data/sites/1/documents/publications/Integrating-Alternative-Fuel-Vehicles-in-Energy-Assurance.pdf (May 24, 2021).

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ENERGY INFRASTRUCTURE MODEL SCENARIOS

OVERVIEW

By focusing on either a scenario that has occurred with historical frequency, or a scenario that may be low probability but of high consequence, this section provides a model within each major sector that may strain Oklahoma's energy infrastructure. The specifics of Oklahoma's infrastructure strengths and weaknesses are discussed in previous sections. Based on the available data published by the U.S. DOE in its state risk profile, as well as utilizing other sources for information on infrastructure strain for each infrastructure sector, the most critical scenario is discussed.

Infrastructure strain occurs under myriad circumstances. For stakeholders and planners interested to model scenarios specific to their unique circumstances, if details of all the components of an infrastructure system are known, modeling of the systems can be performed using software already available or under development. For example, the Federal Emergency Management Agency (FEMA) provides a tool known as HAZUS that estimates risk to infrastructure systems from earthquakes, floods, tsunamis, and hurricanes.[147] For Oklahoma scenarios, both the flood and earthquake modules may be pertinent for planners who would like to select or already know the specific inputs into infrastructure strain that they would like to test and model. Another tool currently under development at Colorado State University, known as IN-CORE, provides resiliency measures for a wide range of systems and events including buildings, water, and electric power systems subjected to events such as earthquakes, tsunamis, tornadoes, and hurricanes.[148] An alternative approach is to employ investment-oriented models which focus on how resilience within an energy system can be enhanced.[149]

ELECTRICITY: WINTER ICE STORM SCENARIO

One of the most common scenarios that strain Oklahoma infrastructure is a winter ice storm. Recently, Oklahoma experienced an unusually early ice storm in October 2020 that left 400,000 homes and businesses without power at its peak.[150] As mentioned in the Strengths and Weaknesses

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[147] U.S. Federal Emergency Management Agency. *Hazus*. https://www.fema.gov/flood-maps/products-tools/hazus (June 21, 2021).
[148] Colorado State University, Center for Risk-Based Community Resilience Planning. *(IN-CORE)* http://resilience.colostate.edu/in_core/ (June 21, 2021).
[149] See, for example, Aldarajee, A. H., Hosseinian, S. H., & Vahidi, B. (2020). A secure tri-level planner-disaster-risk-averse replanner model for enhancing the resilience of energy systems. *Energy*, *204*, 117916. https://www.sciencedirect.com/science/article/pii/S0360544220310239 (June 21, 2021).
[150] The Weather Channel. *"More Than 40,000 Still Without Power 10 Days After Oklahoma Ice Storm."* https://weather.com/news/news/2020-11-06-power-outages-oklahoma-ice-winter-storm#:~:text=The%20weather%20system%2C%20named%20Winter,storm's%20impacts%2C%20according%20to%20OG%26E (June 21, 2021).

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section, the primary weakness of Oklahoma's electricity infrastructure is the use of above-ground transmission and distribution lines, with distribution lines particularly vulnerable to ice accumulation and falling trees, especially when combined with the high winds that frequently accompany Oklahoma storms. Oak Ridge National Laboratory recently released an analysis of electric infrastructure vulnerability models with predictive analysis for various weather impacts; ice combined with wind commonly results in line damage and failure.[151] Further, winter storms generally affect large areas causing power outages in multiple cities. The wide geographic dispersion of damage coupled with poor road conditions during storms complicates efforts of electric utilities to repair damage. Specific damage from this scenario event can include broken power poles and power lines, buckled high power transmission towers, tripped circuit breakers due to electrical short circuits, and blown transformers over a wide area. This scenario may be further complicated if the ice storm is accompanied by particularly low temperatures, as occurred in the February 2021 Polar Vortex event in Oklahoma and Texas. At these near-or-below zero temperatures, electric generating facilities themselves may be compromised, if the infrastructure is not insulated, with expected effects to include frozen pipelines that deliver natural gas to the electric generation facilities, frozen instrumentation at the facilities, or icing on wind turbine blades that prevent a delivery of reliable or full electric output.

Although very rare, planners must at least consider the consequences for low-probability high-consequence events and can look to illustrative examples from outside Oklahoma to anticipate and understand the heaviest possible impacts. For example, one of the worst natural disasters in Canadian history happened in 1998 during the ice storm in Quebec and Ontario, when these regions received 1-3 inches of freezing rain that accumulated as ice on electric infrastructure.[152] The impacts were catastrophic, with some towers buckling under ice accumulations that exceeded their design loads, and impacts ranging from damage to high-voltage transmission lines, to utility poles, distribution lines, and thousands of other structures. Again, while a scenario like this may be extremely unlikely, planners must at least consider scenarios that fall outside the normal parameters for Oklahoma severe ice storms and strain infrastructure beyond its normal limits.

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[151] Oak Ridge National Laboratory. *"Extreme Weather and Climate Vulnerabilities of the Electric Grid: A Summary of Environmental Sensitivity Quantification Methods."* https://www.energy.gov/sites/prod/files/2019/09/f67/Oak%20Ridge%20National%20Laboratory%20EIS%20Response.pdf (June 21, 2021).

[152] Kerry, M., Kelk, G., Etkin, D., Burton, I., and Kalhok, S. (1999). "Glazed Over: Canada Copes with the Ice Storm of 1998." Environment: Science and Policy for Sustainable Development, 41(1), 6-11, DOI: 10.1080/00139159909604608.

NATURAL GAS: POLAR VORTEX

As mentioned above, in February 2021, Oklahoma experienced a significant polar vortex event that impacted the natural gas sector. During the event, a critical shortage of natural gas supply occurred, prompting the state regulatory body, the Oklahoma Corporation Commission, to take the rare step to temporarily lift caps on natural gas production.[153] Similar failures were also reported in Texas during this cold weather spell with both well freeze-offs and processing plant freeze-offs occurring.[154] As natural gas is a significant fuel source for electric power plants in Oklahoma and regionally, the natural gas fuel shortages heavily impacted electric production. Oklahoma is part of the Southwest Power Pool (SPP), and SPP's capacity to generate electricity from gas-fired generators fell by nearly 50 percent during this event because operators could not obtain the natural gas required to run their power plants.[155] As a result, SPP enacted rolling outages and curtailments for member utilities, including Oklahoma Gas & Electric and Public Service Company of Oklahoma.

In general, and in addition to the well and processing plant freeze-offs Oklahoma experienced in February 2021, extreme cold weather can also cause damage to natural gas pipelines.[156] Some of these potential damages that should be considered as part of planning processes include pipe breakage due to frost heave, damage to above-ground pipeline components due to snow and ice accumulation, damage from thermal stresses due to extreme cold temperatures, and damage from expansion of freezing water within components.

The cold weather Oklahoma experienced in February 2021 is historically rare, but the Southwest U.S. has seen weather events similar to the February 2021 polar vortex. For instance, the 2011 Southwest cold weather event caused rolling outages due to cold-related natural gas failures within Texas's ERCOT system. As reported by FERC and NERC in their after-action report and analysis, specific effects included frozen sensing lines, frozen equipment, frozen valves, and low

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[153] The Oklahoman. *"Oklahoma regulators open flow on wells to help address natural gas shortage."* https://www.oklahoman.com/story/business/columns/2021/02/20/oklahoma-regulators-open-flow-on-wells-to-help-address-natural-gas-shortage/330130007/ (June 25, 2021).
[154] ICF. *"February 2021 polar vortex sends Texas natural gas markets spinning."* https://go.icf.com/rs/072-WJX-782/images/ICF%20-%20February%202021%20polar%20vortex%20sends%20Texas%20natural%20gas%20markets%20spinning.pdf (June 21, 2021).
[155] The Oklahoman. *"Southwest Power Pool Briefs Regulators on its February Storm Response."* https://www.oklahoman.com/story/business/2021/03/26/southwest-power-pool-explains-oklahoma-severe-weather-outages/4706876001/ (June 21, 2021).
[156] Pipeline and Gas Journal Online. *"Cold Weather Can Play Havoc On Natural Gas Systems."* https://pgjonline.com/magazine/2015/january-2015-vol-242-no-1/features/cold-weather-can-play-havoc-on-natural-gas-systems (June 21, 2021).

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temperature equipment cutoff limits, among other effects.[157] Given that natural gas infrastructure has historically been significantly impacted in Oklahoma and surrounding areas due to extended low temperatures, these experiences provide important case studies for future planning needs.

CRUDE OIL/PETROLEUM: CUSHING EARTHQUAKE

Oklahoma experienced its largest recorded earthquake on September 3rd, 2016, a M5.8 earthquake located in Pawnee, approximately 25 miles north of Cushing. More information on Oklahoma seismicity vulnerabilities can be found in the "Seismicity Profile for Oklahoma" chapter of this report. Cushing is a critical location for Oklahoma seismic vulnerabilities as it serves as the major crude oil trading hub connecting the Gulf Coast to the rest of the United States and Canada. The U.S. Geological Survey (USGS) places portions of Oklahoma, including the area surrounding Cushing, in the mid-range risk category for earthquakes.[158]

Should an earthquake equal to or greater in magnitude than the Pawnee earthquake occur with its epicenter directly at Cushing, the effects could be felt nationwide due to the potential for infrastructure damage disrupting the flow of oil in and out of the Cushing facility. During a major earthquake (magnitude 6.0 or higher), USGS indicates that damage would be "considerable in specially designed structures"[159] and specific oil and gas infrastructure damage could include: broken pipe connections, damage to tank walls and foundations, elephant foot buckling, and sloshing. More information on these hazards can be found in the "Seismicity Profile for Oklahoma" chapter. Historical evidence from other large earthquakes validates the predictions that petroleum and crude oil storage facilities may be critically impacted. For example, during the 1983 Coalinga M6.5 earthquake in California, severe damage to above-ground crude oil storage tanks occurred.[160] Damage that occurred during the 1983 Coalinga earthquake can be used to simulate a high consequence scenario at Oklahoma's Cushing facility.

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[157] Federal Energy Regulatory Commission and North American Electric Reliability Corporation. *"Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011: Causes and Recommendations."* https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf (June 21, 2021).
[158] U.S. Geological Survey. *2018 Long-term National Seismic Hazard Map.* https://www.usgs.gov/media/images/2018-long-term-national-seismic-hazard-map (June 21, 2021).
[159] U.S. Department of Energy. *"United States Fuel Resiliency: Volume II, U.S. Fuels Supply Infrastructure Vulnerability to Natural and Physical Threats."* https://www.energy.gov/sites/prod/files/2015/04/f22/QER%20Analysis%20-%20United%20States%20Fuel%20Resiliency%20Volume%20II.pdf (June 21, 2021).
[160] George C. Manos, Ray W. Clough, 1985. "Tank damage during the May 1983 Coalinga earthquake." https://onlinelibrary.wiley.com/doi/abs/10.1002/eqe.4290130403?casa_token=j4hBzmmpLkIAAAAA:6ALYlja_PMZfiRmeUmIJzvV99siMCOmZxbegzr8fiu3gnkaAorpZF_12XjTsVusWByDhYtV7mWlsMusC (June 21, 2021).

CYBERSECURITY PLANNING

In Oklahoma today, energy generation, production, and control systems are in most cases digitally automated. Innovations such as the SmartGrid in the electric sector and remote meter reading, service connections, and cutoffs in the natural gas industry allow utilities to increase speed of response, allow more customer choice, and reduce costs. Despite these significant advantages, these "smarter" systems also present new challenges. As energy generation and control systems become more digitally automated, their critical electronic systems, including communications systems, sensors, and controls become increasingly vulnerable to outside attack or inadvertent disruption from accidents or natural causes (weather). In the past, when interrupting the production and flow of energy required physical damage, today the same or even greater effects can be achieved either through physical damage that affects electronic networks or by electronically intercepting and altering electronic signals and information.

Today, cyber-attacks occur daily across industries. These attacks can include numerous types of malware, ransomware, denial-of-service attacks, phishing, and many other intrusions. These attacks can range from small scale to large. Just recently, the SolarWinds malware attack, known as the largest cyberattack to date, affected over 100 private sector entities and a dozen government agencies. This attack used a routine software update to insert malicious code into SolarWinds' popular Orion software program.[161] Critical energy infrastructure was also victim to a recent ransomware attack when the Colonial Pipeline, a primary gasoline and jet fuel pipeline serving the East Coast, was taken offline as a result of a ransomware attack.[162] Service was interrupted for days, leading to consumers hoarding gasoline, causing major gasoline shortages across that region, and causing airlines to change flight routes in order to fulfill fueling needs.[163]

To respond to increasing cyber threats, many industry standards, processes, and guidelines have been developed to help energy providers address issues of cybersecurity. Below are numerous authorities, reference points, and guidelines for best practice in cybersecurity planning and response for the energy sector.

Over fifteen years ago, the Energy Policy Act of 2005 created mandatory cybersecurity standards, which were developed by the North American Electric Reliability Corporation (NERC), however these enforceable standards only apply to the electric and nuclear industries. In time, as the issue

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[161] Reuters. *"SolarWinds hack was 'largest and most sophisticated attack' ever: Microsoft president." (February 14, 2021).* https://www.reuters.com/article/us-cyber-solarwinds-microsoft/solarwinds-hack-was-largest-and-most-sophisticated-attack-ever-microsoft-president-idUSKBN2AF03R (June 21, 2021).

[162] Cybersecurity and Infrastructure Security Agency. *Alert (AA21-131A). DarkSide Ransomware: Best Practices for Preventing Business Disruptions from Ransomware Attacks.* https://us-cert.cisa.gov/ncas/alerts/aa21-131a (May 18, 2021).

[163] CNN.com. "*Colonial Pipeline attack: A 'wake up call' about the threat of ransomware."(May 16, 2021).* https://www.cnn.com/2021/05/16/tech/colonial-ransomware-darkside-what-to-know/index.html (June 21, 2021).

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of cybersecurity has become ever more critical, the federal government has created additional resources to ensure that both public and private entities across all sectors are ready to meet the challenges of a digital age. For instance, in February 2013, President Obama signed an Executive Order focusing on improving critical infrastructure cybersecurity requiring the National Institute of Standards and Technology (NIST) to develop a Cybersecurity Framework that includes standards, methodologies, procedures, and processes that align policy, business, and technological approaches to address cyber risks. The Executive Order also created a Voluntary Critical Infrastructure Cybersecurity Program for utilities, transportation, and telecommunications firms to adopt the cybersecurity standards outlined in the Cybersecurity Framework.[164] A year later, the Cybersecurity Enhancement Act of 2014 reinforced NIST's role in developing the Framework. The most current version of the Framework was released in April 2018, Version 1.1.[165]

Section 9 of President's Obama original 2013 Executive Order also prompted the Department of Homeland Security and Department of Energy to jointly undertake an assessment of electricity disruption incident response capabilities. Issued in 2017, the report found that "the U.S. is, in general, well prepared to manage most electricity disruptions, though there are particular areas where catastrophic considerations and emerging threats reveal capability gaps against cyberattacks."[166]

Next, the Cybersecurity Information Sharing Act of 2015 (Public Law 114-113)[167] required the federal government to develop processes to collect, evaluate, and share information about cyber threats. A major purpose of this legislation was to encourage information sharing by addressing the challenge of liability and public disclosure for corporate entities that may have been victims of a cyber-attack. Often, if an entity has a cybersecurity breach, it is reluctant to share that information with federal partners if it might expose them to a competitive disadvantage or criminal liability. This legislation allows companies to share information without opening them up to freedom of information inquiries and offers liability protection when information about cyber threats is shared with DHS.

Several years later, in 2017, President Trump furthered the federal government's role in preparing the nation to address issues of cybersecurity when he issued Executive Order (EO) 13800: Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure, which directed federal agencies to assess their capabilities to support cyber risk management for critical

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[164] Exec. Order No. 13636, 78 Fed. Reg. 11737 (Feb.19, 2013).
[165] National Institute of Standards and Technology. *Cybersecurity Framework Version 1.1.* https://www.nist.gov/cyberframework/framework (April 30, 2021).
[166] U.S. Cybersecurity and Infrastructure Security Agency. *Section 2(E): Assessment of Electricity Disruption Incident Response Capabilities. (August 2017).* https://www.cisa.gov/sites/default/files/publications/EO13800-electricity-subsector-report.pdf (June 21, 2021).
[167] U.S. Cybersecurity and Infrastructure Security Agency. *Cybersecurity Information Sharing Act of 2015.* https://www.cisa.gov/sites/default/files/publications/Cybersecurity%20Information%20Sharing%20Act%20of%202015.pdf (May 4, 2021).

infrastructure owners and operators, and also to partner with the nation's energy sector to assess the grid's capabilities during prolonged power outages resulting from cyber-attacks.[168] Then, in 2019, President Trump issued Executive Order 13873 that tasked the U.S. Department of Energy and Department of Homeland Security to secure U.S. energy infrastructure by assessing any foreign hardware, software, or services that could present vulnerabilities for the U.S.[169]

Most recently, and in response to the Colonial Pipeline ransomware attack, President Biden issued Executive Order 14028, which outlines new response mechanisms for U.S. cybersecurity.[170] This EO is intended to remove barriers to information sharing, implement stronger cybersecurity standards in the federal government, standardize responses to cyber incidents, improve detection, and improve remediation capabilities.[171]

HIGHLIGHTED FEDERAL AGENCIES SUPPORTING CYBER PLANNING

Although cybersecurity planning crosses many federal agencies, this section will highlight three major federal players in coordinating the nation's cybersecurity planning. First, the U.S. Department of Energy is the Sector-Specific Agency for the energy sector, coordinating response under ESF-12 in the National Response Framework. A second major federal partner in cybersecurity is the U.S. Department of Homeland Security (DHS), and a third is the Cybersecurity and Infrastructure Security Agency (CISA).

U.S. DOE: CESER

Established in 2018, the U.S. Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) exists to provide

> *"capabilities and support to energy sector partners to advance critical energy infrastructure security and resilience from all-hazards and manages key DOE authorities and responsibilities. These include serving as the Sector-Specific Agency (SSA) for the energy sector, as the coordinating agency for Emergency Support Function (ESF) #12-Energy under the National Response Framework."*

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[168] National Archives. *Exec. Order No. 13800, 82 Fed. Reg. 22391 (May 11, 2017).* https://www.federalregister.gov/documents/2017/05/16/2017-10004/strengthening-the-cybersecurity-of-federal-networks-and-critical-infrastructure (June 21, 2021).

[169] National Archives. *Exec. Order No. 13873, 84 Fed. Reg. 22689 (May 15, 2019).* https://www.federalregister.gov/documents/2019/05/17/2019-10538/securing-the-information-and-communications-technology-and-services-supply-chain (June 21, 2021).

[170] National Archives. *Exec. Order. No. 14028. 86 Fed. Reg. 26633. (May 12, 2021).* https://www.federalregister.gov/documents/2021/05/17/2021-10460/improving-the-nations-cybersecurity (June 21, 2021).

[171] The White House. *Fact Sheet: President Signs Executive Order Charting New Course to Improve the Nation's Cybersecurity and Protect Federal Government Networks.* https://www.whitehouse.gov/briefing-room/statements-releases/2021/05/12/fact-sheet-president-signs-executive-order-charting-new-course-to-improve-the-nations-cybersecurity-and-protect-federal-government-networks/ (May 18, 2021).

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In January 2021, CESER released its Blueprint,[172] which outlines five goals and multiple objectives that will guide its response to pressing security issues nationwide. The goals that will direct CESER's activities are:

1. Advance cyber discovery, vulnerability assessment, and rapid risk mitigation.
2. Pursue game-changing R&D and technology transition.
3. Build capacity in the energy sector to understand risks, assess priorities, and identify cost effective security and resilience improvements.
4. Enhance sector-wide situational awareness to inform decision-making in the energy sector.
5. Coordinate effective and efficient emergency response and recovery efforts.

DHS: NCCIC

The U.S. Department of Homeland Security operates one of the key resources for cybersecurity planning and defense, the National Cybersecurity and Communications Integration Center (NCCIC). Under PPD-41, referenced in the Legal Authorities section of this Plan, the NCCIC is the lead office for asset response after cyber incidents.[173] Although the NCCIC has six functional branches, stakeholders may be the most familiar with the Industrial Control Systems Cyber Emergency Response Team (ICS-CERT), which provides expertise to incident response efforts and synthesizes information to alert and warning products. An overview of all the activities that fall under the NCCIC is encapsulated in the presentation referenced in the footnote.[174]

CISA

In 2018, President Trump signed the Cybersecurity and Infrastructure Security Agency (CISA) Act of 2018 into law, establishing CISA.[175] The CISA is tasked to receive, evaluate, and provide information about U.S. critical infrastructure vulnerabilities and to develop and execute plans to increase readiness to prevent and respond to cyber and physical threats to U.S. critical infrastructure. As a result, CISA offers a wide range of services and tools for risk assessment, trainings, and communication of information specifically focused on cyber but also physical security of critical infrastructure. Oklahoma is in CISA Region 6. Among many, one of CISA's activities is to assist partners in utilizing NIST's Cybersecurity Framework to better manage their

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[172] U.S. Department of Energy Office of Cybersecurity, Energy Security and Emergency Response. *CESER Blueprint (January 2021).* https://www.energy.gov/sites/prod/files/2021/01/f82/CESER%20Blueprint%202021.pdf (May 4, 2021).

[173] U.S. Department of Homeland Security. *DHS Role in Cyber Incident Response.* https://www.cisa.gov/sites/default/files/publications/DHS%20Cyber%20Incident%20Response%20Fact%20Sheet%20v15%20-%20508%20Compliant.pdf (May 4, 2021).

[174] National Cybersecurity & Communications Integration Center. *Overview.* https://csrc.nist.gov/csrc/media/events/ispab-october-2012-meeting/documents/ispab_oct2012_lzelvin_nccic-overview.pdf (May 4, 2021).

[175] U.S. Government Publishing Office. *Cybersecurity and Infrastructure Security Agency Act of 2018.* https://www.govinfo.gov/content/pkg/PLAW-115publ278/pdf/PLAW-115publ278.pdf (June 24, 2021).

cyber risks.[176] A complete listing of CISA services, including links to access information, can be found in the CISA Catalog located at: https://www.cisa.gov/sites/default/files/publications/FINAL_CISA%20Services%20Catalog%20v1.1_20201029_508_0.pdf.

HIGHLIGHTED STATE AGENCIES SUPPORTING CYBER PLANNING

Oklahoma Office of Emergency Management and Homeland Security (OEMHS)
The Oklahoma OEMHS has a cybersecurity advisor that works in conjunction with the state's information security officer to plan for and address cyber threats to state agency systems. OEMHS also funds the state's Information Fusion Center, housed at the State Bureau of Investigation.[177] The Fusion Center serves as the data collection site for the state and can analyze crimes for trends and understand threats. While the Fusion Center is not dedicated solely to cyber threats, it provides a communication tool to share information and situational reports to private sector partners.

Finally, OEMHS participates in the Risk Assessment Program under which a CISA Protective Service Advisor has been assigned to the state and offers every public and private agency a free risk assessment on how to respond to disaster. During the assessment, entities can discuss needs, including cyber needs, and after the full assessment, entities receive a confidential report.

Oklahoma Office of Management and Enterprise Services (OMES)
OMES is the state's lead agency responsible for protecting networks and the state's digital assets. OMES also provides cybersecurity for all state agencies through the state's Cyber Command, which conducts annual information security assessments, the results from which are reported to the Governor and Legislature. [178] Finally, OMES operates the Oklahoma Information Sharing and Analysis Center (OK-ISAC). OK-ISAC exists to provide real-time monitoring, vulnerability identification, incident response, and threat intelligence to its members. Membership includes multiple Oklahoma organizations, business leaders, and cybersecurity professionals. [179] A full membership list for OK-ISAC is available at https://cybersecurity.ok.gov/content/current-members. Any organization may request access.

Oklahoma's lead agencies for cybersecurity receive information through a variety of sources, including the Federal Bureau of Investigation, E-ISAC and MS-ISAC, membership organizations, and critical infrastructure owners and operators.

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[176] U.S. CISA. *Resources: Cybersecurity Framework.* https://us-cert.cisa.gov/resources/cybersecurity-framework (May 4, 2021).
[177] Oklahoma Information Fusion Center. *Home*. https://fusion.osbi.ok.gov/ (May 5, 2021).
[178] Oklahoma Office of Management and Enterprise Services. *Oklahoma Cyber Command*. https://cybersecurity.ok.gov/content/annual-information-security-risk-assessment-statutory-it-reports-and-information-security (May 5, 2021).
[179] Oklahoma Office of Management and Enterprise Services. *OK-ISAC.* https://cybersecurity.ok.gov/OKISAC (May 5, 2021).

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REPORTS AND BEST PRACTICE RESOURCES FOR CYBER PLANNING

Over time, and as standards and regulations continue to develop, there have been a number of additional resources developed for use within the critical infrastructure and energy sectors. Oklahoma energy producers, owners, distributors, and stakeholders should familiarize themselves with these resources and, if they do not already utilize planning and assessment tools in planning processes, evaluate if adding these capabilities could strengthen their organization's preparation for cyber events.

The U.S. Department of Energy has created a cybersecurity capability maturity model (C2M2**),** available for download,[180] which allows stakeholders across the energy industry to assess their cybersecurity capabilities and prioritize their actions and investments to improve cybersecurity. The C2M2 combines elements from existing cybersecurity efforts into a common tool that can be used consistently across the industry. It was developed as part of a White House initiative led by the Department of Energy in partnership with the Department of Homeland Security (DHS) and involved close collaboration with industry, other Federal agencies, and other stakeholders. As the model has been available since 2014, an update to a new Version 2.0 is currently underway, as of this writing it has not been released. There are also specific C2M2 models available for the electric[181] and oil and natural gas[182] sectors. Oklahoma entities may benefit from utilizing the C2M2 process as a resource as they seek to strengthen their cybersecurity protocols and readiness.

Other resources currently available to the energy industry to help with cybersecurity planning include:

- The U.S. DOE-issued Electricity Subsector Cybersecurity Risk Management Process (RMP) Guideline.[183] This helps utilities better understand their cybersecurity risks, assess severity, and allocate resources more efficiently to manage those risks.
- The 2018-published U.S. DOE Multiyear Plan for Energy Sector Cybersecurity which outlines DOE's partnerships in cyber and its goals for addressing cybersecurity.[184]

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[180] U.S. Department of Energy, Office of Cybersecurity, Energy Security and Emergency Response. *Cybersecurity Capability Maturity Model Version 1.1. (February 2014).* https://www.energy.gov/sites/prod/files/2014/03/f13/C2M2-v1-1_cor.pdf (June 21, 2021).
[181] U.S. Department of Energy, Office of Cybersecurity, Energy Security and Emergency Response. *Electric Subsector Cybersecurity Capability Maturity Model Version 1.1. (February 2014).* https://www.energy.gov/sites/prod/files/2014/02/f7/ES-C2M2-v1-1-Feb2014.pdf (June 21, 2021).
[182] U.S. Department of Energy, Office of Cybersecurity, Energy Security and Emergency Response. Oil and *Natural Gas Subsector Cybersecurity Capability Maturity Model Version 1.1. (February 2014).* https://www.energy.gov/sites/prod/files/2014/03/f13/ONG-C2M2-v1-1_cor.pdf (June 21, 2021).
[183] U.S. Department of Energy. *Electricity Subsector Cybersecurity Risk Management Process*. http://energy.gov/sites/prod/files/Cybersecurity%20Risk%20Management%20Process%20Guideline%20-%20Final%20-%20May%202012.pdf (June 21, 2021).
[184] U.S. Department of Energy. *MultiYear Plan for Energy Sector Cybersecurity.* https://www.energy.gov/sites/prod/files/2018/05/f51/DOE%20Multiyear%20Plan%20for%20Energy%20Sector%20Cybersecurity%20_0.pdf (May 4, 2021).

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- The National Governors Association white paper on State Strategies for Enhancing Cybersecurity in the Electric Sector.[185] This white paper outlines seven actions Governors can take to enhance electric infrastructure security, protect information, and provides additional resources.
- The National Governors Association Resource Center for State Cybersecurity.[186]
- The National Association of Regulatory Utility Commissioners (NARUC) Cybersecurity Manual containing five main components including a strategy development guide, questions for utilities,[187] a preparedness evaluation tool,[188] a tabletop exercise guide,[189] and a glossary.[190]
- The Department of Homeland Security's Cybersecurity Resources Roadmap which is targeted to assist small and midsize businesses.[191]

COMMUNICATION AND INFORMATION SHARING IN CYBERSECURITY

Effective cyber defense and response require significant communication and information sharing, as well as best practice implementation, and numerous initiatives exist that aim to increasing bi-directional information flows. This section is intended to ensure that Oklahoma energy stakeholders are aware of the breadth of initiatives targeted at information sharing such that they can avail themselves of the maximum resources to assist them in cyber planning and response. While the initiatives below are not an exhaustive list, they constitute some of the major efforts to increase communication between the public and private sectors and increase national readiness to combat cyber threats.

A primary information sharing initiative for governmental agencies is the Multi-State Information Sharing and Analysis Center (MS-ISAC) run by the Cybersecurity and Infrastructure Security Agency (CISA). The MS-ISAC offers government entities real time monitoring of cyber events and is a "central resource for gathering information on cyber threats to critical infrastructure and two-way sharing of information between and among public and private sectors in order to identify, protect, detect, respond and recover from attacks on public and private critical

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[185] National Governors Association. *Smart & Safe: State Strategies for Enhancing Cybersecurity in the Electric Sector.* https://www.nga.org/wp-content/uploads/2019/04/NGA-Smart-Safe-State-Strategies-for-Enhancing-Cybersecurity-in-the-Electric-Sector.pdf (May 4, 2021).
[186] National Governors Association. *Resource Center for State Cybersecurity*. https://www.nga.org/statecyber/ (May 4, 2021).
[187] Available at https://pubs.naruc.org/pub/3BACB84B-AA8A-0191-61FB-E9546E77F220 (June 21, 2021).
[188] Available at https://pubs.naruc.org/pub/3B93F1D2-BF62-E6BB-5107-E1A030CF09A0 (June 21, 2021).
[189] National Association of Regulatory Utility Commissioners. *NARUC Tabletop Exercise Guide*. https://pubs.naruc.org/pub/615A021F-155D-0A36-314F-0368978CC504 (May 5, 2021).
[190] National Association of Regulatory Utility Commissioners. *NARUC Cybersecurity Manual*. https://www.naruc.org/cpi-1/critical-infrastructure-cybersecurity-and-resilience/cybersecurity/cybersecurity-manual/ (May 4, 2021).
[191] U.S. Department of Homeland Security. *Cybersecurity Resources Road Map. (July 2018).* https://us-cert.cisa.gov/sites/default/files/c3vp/smb/DHS-SMB-Road-Map.pdf (May 5, 2021).

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Infrastructure." Numerous Oklahoma agencies are members of MS-ISAC including the Office of Secretary of State, Health Care Authority, Information Fusion Center, State Election Board, State Senate, and Tax Commission. There are also a large number of local governments, tribal governments, educational entities, and school districts in the state with MS-ISAC membership.[192] Any state, local or tribal government, or non-profit supporting state, local, or tribal governments, can apply for MS-ISAC membership.

CISA also offers Automated Indicator Sharing (AIS), which provides real-time exchange of machine-readable cyber threat indicators and defensive measures to help protect participants of the AIS community. Private sector entities; federal departments and agencies; state, local, and tribal governments; information sharing and analysis centers (ISACs); and others are all members of the AIS community. Participants can share cyber threat and response measures with others to limit impacts from cyber events and recover more quickly. Information about joining AIS as a participant can be found at https://www.cisa.gov/ais.

Private sector entities also operate Information Sharing and Analysis Centers (ISACs) which are private, sector specific organizations designed to collect, analyze, and disseminate information about sector-specific cyber threats; these organizations also interact with CISA. Particular ISACs of interest for Oklahoma's energy sector include the following:

- Electricity (E-ISAC): www.eisac.com
- Oil and Natural Gas (ONG-ISAC): www.ongisac.org/
- Downstream Natural Gas (DNG-ISAC): www.dngisac.com/

There is also a National Council of ISACs that provides information on cross-sector collaborations for information sharing. More information is available at www.nationalisacs.org.

CYBERSECURITY MEASURES IN OKLAHOMA'S ELECTRIC SECTOR

Oklahoma's major electric and gas utilities are devoting significant resources to planning for and implementing cybersecurity strategies and are integrating these strategies as central in their corporate policies.

Oklahoma Gas & Electric Company

Oklahoma Gas & Electric (OG&E), the state's largest electric utility, has an overall cybersecurity plan in place which is layered and based on industry standards (NERC CIP, NIST, ISO). The utility has an internal Corporate Security Team, Cyber Security Team, and Physical Security Team that regularly test the utility's physical and cyber defense strategies, and also conduct security

[192] U.S. CISA. *MS-ISAC Members.* https://www.cisecurity.org/ms-isac/ms-isac-members/ (May 5, 2021).

assessments at least annually to ensure that if a cyber-attack did occur that the utility could restore operations.

The standing security teams in place have identified OG&E's most critical substations for keeping electricity on and their focus is on protecting these assets both physically and from a cybersecurity standpoint. To prevent incidents, the teams monitor proactively for potential threat conditions, including working with the U.S. Department of Energy, and perform threat and vulnerability analyses to evaluate different standards and select the appropriate controls.

As an example of its commitment to cybersecurity issues, OG&E has developed a Critical Operations Protection (COP) program, which is a cybersecurity protection safeguard specifically for smart grid deployment. The COP program protects the inner workings of the smart grid systems to ensure that hackers are unable to disturb the national electric grid by simultaneously turning off power to many customers. This plan has been reviewed by the U.S. Department of Energy.

Finally, OG&E works with an electric utility smart grid consortium to discuss common industry security issues, and to direct third-party vendors on what new cybersecurity measures to implement and to review annual 3rd party security testing of the layering approach.

If a cyber event were to occur, as a part of OG&E's compliance with NERC Critical Infrastructure Protection Reliability Standards, OG&E notifies NERC, applicable Governmental Agencies, and other potentially impacted electric entities. These requirements are incorporated in OG&E's policies and Incident Response Plans. OG&E also has Business Recovery and Business Continuance plans to address the potential loss of systems, facilities, and the availability of people to run its critical systems. Additionally, OG&E has Privacy and Confidentiality policies and practices associated with the exfiltration of sensitive information including data that has been designated as protected customer information.

Public Service Company of Oklahoma

Public Service Company of Oklahoma (PSO), a division of the national corporation American Electric Power (AEP), utilizes AEP-wide policies in its approach to cybersecurity. AEP's cybersecurity approach is based on a philosophy that every information asset within the organization must be reviewed and secured in accordance with its criticality and impact to the corporation's overall operations. AEP policies are built around national and international standards (NIST, ISO) and utilize a layered approach to security. AEP maintains a dynamic cybersecurity testing program which tests systems against cyber threats. AEP also emphasizes company-wide staff training with annually required cybersecurity training for all employees as well as quarterly events on timely topics. The company reviews its policies and procedures to ensure that they are up to date and protect its assets against ever-evolving threats.

AEP approaches cybersecurity from both an engineering and operations approach. First, engineering staff reviews all technologies before production and with each new version to

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determine the appropriate balance of security is within business requirements, and then design solutions based on these assessments. Operations staff monitors and controls security once a technology is in production, including log management, day-to-day monitoring, intrusion detection/prevention, and proactive analysis of malcode to reduce the risk of threats affecting AEP assets.

AEP also hosts a Cybersecurity Operations Center—a joint operation between AEP and Lockheed Martin—to identify and evaluate risks across utilities and report these so that others can take preventative actions. Finally, AEP contributes as a member of a cybersecurity consortium consisting of 6 major utilities that work with third-party vendors to help identify new cybersecurity procedures and techniques.

In the event of a cybersecurity incident, AEP has a mature, documented, and tested Cyber Incident Response process, which includes personal contacts with federal agencies such as the Department of Homeland Security, Department of Energy, FBI, ES-ISAC, and others. AEP is also required to notify its customers if it believes that customer data has been accessed as part of the cyber incident.

Western Farmers Electric Cooperative

Cooperative electric providers are also emphasizing cybersecurity protocols. At Western Farmers Electric Cooperative (WFEC), a dedicated security operations team, which includes a cybersecurity group, monitors WFEC systems and prevents intrusions using the cooperative's written security policy. These protocols are fully compliant with NERC Critical Infrastructure Protection Reliability Standards. The cooperative also uses third-party vendors to conduct annual cyber vulnerability assessments and participates in Department of Homeland Security and FBI briefings to assist it in monitoring for potential threats.

Further, the cooperative has initiated an information protection program, which identifies, marks, and stores separately that information classified as sensitive and confidential. Access is limited, and any employee with access receives annual training on appropriate handling of critical information.

In addition to these preventative measures, WFEC has written a Cyber Emergency Response Plan, which is tested annually. This plan ensures that should a cyber-attack occur, the cooperative could recover and ensure reliability of service for its member customers.

Grand River Dam Authority

Publicly owned utilities are also making investments in cybersecurity. The Grand River Dam Authority has cyber and physical security policies in place to protect the reliability of the services it provides and the equipment it uses to provide them. Because GRDA manages a part of the *Bulk Electric System*, these systems that support reliability of the grid must be protected against physical and cyber damage. To do this, GRDA incorporates industry best practices as well as NERC CIP (Critical Infrastructure Protection) reliability standard requirements into its security and reliability

processes. Its policies address steps taken for protection, support, and disaster recovery for its critical cyber systems.

GRDA completes frequent reviews to identify its critical locations and equipment and applies enhanced physical and cybersecurity controls to these assets to protect them from physical or cyber-attacks, corruption, or loss. GRDA's cybersecurity teams continuously receive training on current cybersecurity issues and techniques and participates in federal cybersecurity information and alerting systems hosted by NERC, the U.S. DOE, and the FBI.

GRDA physical and cybersecurity teams test security controls on a regular basis, always looking for ways to better protect the utility's systems. Backup systems and incident response plans are tested, and improved upon, when possible, to streamline their responses to problems when they occur. As the cyber threat matrix changes, GRDA makes changes to how it defends against and responds to both physical and cybersecurity risks. This "continuous improvement" approach to both physical and cybersecurity is always evolving to meet the emerging threats to reliability.

Finally, GRDA participates in industry cybersecurity conferences, working groups, and peer sharing events to stay informed of security risks. These knowledge sharing opportunities ensure the utility can incorporate industry reliability and security best practices as they develop.

Southwest Power Pool (SPP)
As discussed in the "Energy Profile for Oklahoma" chapter, Regional Transmission Organizations (RTOs) now play a critical role in electricity delivery; in Oklahoma this function is performed by the Southwest Power Pool for its 14-state membership. SPP sets the cybersecurity protocol for the multi-state system under FERC supervision. Within SPP, the Security Advisory Group is tasked with advancing both physical and cyber security for systems under the SPP footprint and membership is comprised of representatives from member companies. Under its charter, this group provides expertise and best practice, as well as incident reporting and information dissemination, to SPP and serves as a liaison between SPP and national oversight groups such as FERC and other regulatory bodies.[193]

CYBERSECURITY MEASURES IN THE NATURAL GAS SECTOR

Oklahoma Natural Gas Company (ONG)
On the natural gas side, Oklahoma Natural Gas Company, a division of ONE Gas has had a cybersecurity plan in place for several years using national standards (NIST, ISO) to create a security framework that includes a dozen security domains. These domains include areas such as risk management, information and asset management, and threat and vulnerability

[193] Southwest Power Pool, *Security Advisory Group Scope Statement. (January 2021).* https://spp.org/documents/64052/secag%20scope.pdf (May 5, 2021).

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management. The plan formulates specific responses for various escalating scenarios that employees can implement should a cyber event occur.

As part of its cybersecurity planning, ONG has conducted risk assessments on its electronic assets and, if necessary, has put additional physical security in place to protect these assets. The utility also emphasizes a layering approach for electronic security and utilizes this approach when storing, encrypting, and accessing data.

Finally, ONG also participates in the American Gas Association and the Interstate Natural Gas Association of America, both of which have security working groups.

CenterPoint Energy

CenterPoint Energy has an established cybersecurity policy and a set of practices that include customer data protection. The utility also maintains a dedicated corporate staff with primary responsibility for cybersecurity and requires additional professional certifications for those staff assigned to critical infrastructure assets. CenterPoint's cybersecurity strategy relies on strategic layering and redundancy approaches to ensure protection against attack and continuity of service should a cyber-attack occur.

The development of CenterPoint's practices involved extensive collaboration with its suppliers, industry associations, regulatory groups, and various branches of the federal government. Examples of these are the American Gas Association (AGA), the Interstate Natural Gas Association of America (INGAA), the National Institute of Standards and Technology (NIST), the U.S. Department of Energy, the FBI, the Department of Homeland Security, and various national laboratories. In addition, the U.S. Department of Energy has reviewed and approved CenterPoint's cybersecurity strategy.

Since cyber security threats are constantly changing and evolving, CenterPoint has also partnered with third-party vendors to provide outside expertise that improves the company's cybersecurity incident response capabilities. As part of these efforts, third-party vendors have conducted penetration testing on CenterPoint's system.

CenterPoint places a particular emphasis on staff training as a deterrent to cyber incidents. Within 30 days of employment, and as an annual education requirement, employees complete and are tested on a Security Awareness Course covering both physical and cybersecurity. The utility also conducts Simulated Phishing Tests periodically in conjunction with annual IT Security Audits.

In the event of a cyber incident, CenterPoint has detailed response plans in place. If the event involves a service interruption, the utility will utilize its operational response plans, which include communications between local, state, and federal jurisdictions, to restore service. This includes notification to the Department of Homeland Security, Department of Energy, Transportation Security Administration, AGA, INGAA, and Edison Electric Institute. If computer systems were compromised, the utility has the capability to operate its system manually until electronic systems

are restored. In addition, if customer data were compromised, the utility would notify its customers through its cybersecurity insurance policy provider and would also notify local, state, and federal consumer-focused agencies.

The service restoration process would differ depending on the type of cyber incident but could require isolation of the computer systems from the impacted physical asset(s) via termination of communications and/or isolation of the system. The service restoration would involve manual operation efforts until the recovery of the computer systems. The computer systems restoration would involve a restore from CenterPoint's back-up and recovery procedures; however, an extremely sophisticated compromise from an advanced persistent threat may require assistance from ICS-CERT as well as highly specialized resources from the computer software provider and other specialized cyber resources provided by consultant experts.

RESPONSE AND COMMUNICATIONS AFTER CYBER EVENTS

A full discussion of the response mechanisms and communications channels for all types of energy emergencies can be found in the Energy Emergencies Communications Procedures and Mitigating, Tracking, and Responding to Energy Emergencies sections of this plan. It is, however, important to recognize that in the aftermath of a cyber event many electronic communications channels between a utility and emergency planners and responders may be compromised or severed. Due to this, alternative methods of communication should be identified as part of each organization's planning process. It is important to note that all the major electric and natural gas providers in Oklahoma are registered to use the Government Emergency Telecommunications Service (GETS).[194] Participation in this service will help utilities maintain communications channels in the event of an emergency. Cyber events also increase the potential for automated controls to be compromised and therefore restoration may be delayed if manual controls must be utilized to respond to the effects of a cyber event.

In addition, to be fully prepared to respond to a potential cyber event, it is advisable for state emergency planners and utility regulators to meet at least annually with energy providers to ensure that updates to their cyber security plans are captured and that newly released recommendations or regulations are included in these plans.

[194] U.S. Cybersecurity and Infrastructure Security Agency. *Government Emergency Telecommunications Service (GETS).* https://www.cisa.gov/government-emergency-telecommunications-service-gets (May 5, 2021).

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ENERGY EMERGENCY RESPONSIBILITIES

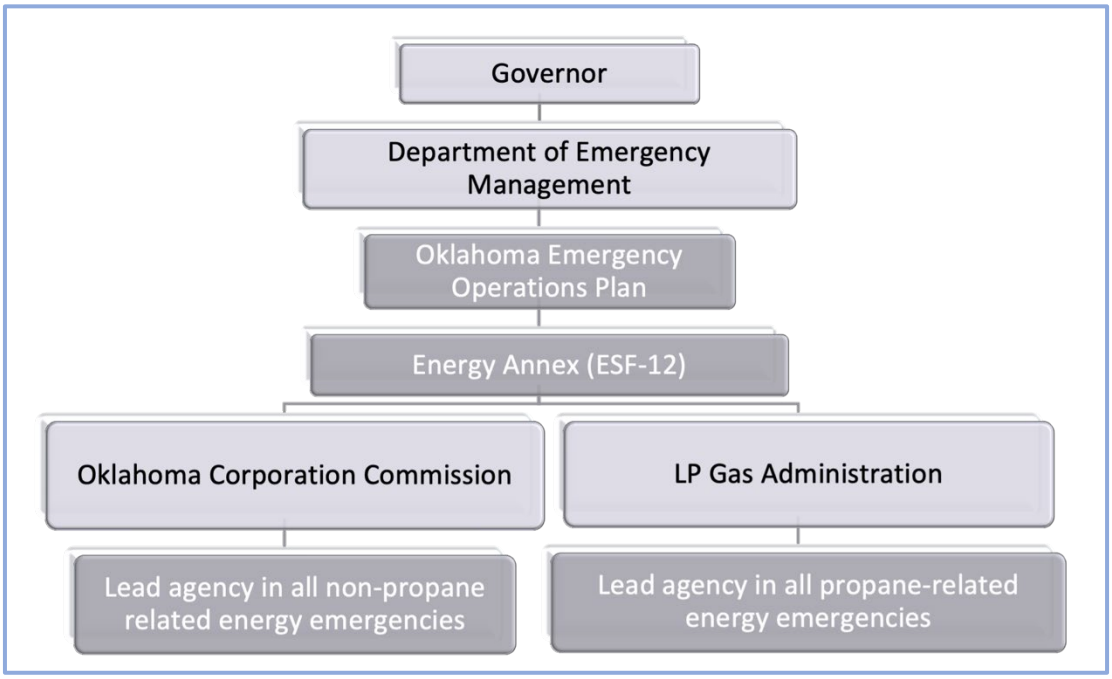
PUBLIC SECTOR STAKEHOLDERS

This section of the plan identifies the principal governmental agencies and their assigned roles in responding to an energy emergency. These roles, jurisdictions, and responsibilities are derived from both federal and state emergency response frameworks. At the federal level, *Emergency Support Function* (ESF-12-Energy) under the *National Response Framework* (NRF) delineates the relevant actors and their responsibilities.[195] In the state of Oklahoma, these responsibilities are spelled out in the *Energy Annex* (ESF-12) of the *Oklahoma Emergency Operations Plan*.[196]

State Agencies

There are a number of state agencies which have responsibilities for preventing and responding to energy emergencies. Figure 43 depicts the flow of responsibility, and the section below outlines the specific roles of each agency.

Figure 43: Responsibility for Energy Emergency Response in Oklahoma



[195] U.S. Department of Homeland Security, Federal Emergency Management Agency. *National Response Framework Emergency Support Function 12-Energy Annex*. https://www.fema.gov/sites/default/files/2020-07/fema_ESF_12_Energy-Annex.pdf (June 24, 2021).
[196] Oklahoma Department of Emergency Management. *Oklahoma Emergency Operations Plan. Revised October 2019.* https://oklahoma.gov/content/dam/ok/en/oem/documents/state-eop-101219.pdf (June 24, 2021).

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Governor's Office

As is the case in all states, the Governor, and the Governor's office, is ultimately responsible for ensuring the health, safety, and general welfare of Oklahoma residents. This responsibility includes responding to energy emergencies. The involvement of the Governor in energy assurance will vary depending on the severity of the emergency. If an energy emergency poses an imminent threat (Level 3 or Level 4) to the residents of Oklahoma, the Governor will become directly involved in the emergency response. The actions of the Governor will also vary on a case-by-case basis. During less severe disruptions, the Governor may simply want to remain informed about events as they unfold. In more severe emergencies, the Governor can activate the Oklahoma Emergency Operations Plan (EOP) and declare a State of Emergency (which frees up state assets and allows for the temporary suspension of energy laws/regulations that may impede an effective emergency response). The Governor may also elect to coordinate a cross-state response with other Governors, should the emergency impact citizens across state lines. Additionally, the Governor can ask the President to declare a State of Emergency[197] which can provide state agencies with access to federal resources. Regarding the Phases of Energy Emergency Management (Figure 44), most of the Governor's involvement will come in Phase III, the response phase.

Oklahoma Department of Emergency Management (OEM)

As specified in the state's EOP, OEM is the primary emergency response agency in the state of Oklahoma. Accordingly, OEM is intimately involved in responding to all types of energy emergencies that occur within the state's borders. In particular, the Director of OEM serves as the Governor's Authorized Representative which enables him/her to act on behalf of the Governor when coordinating (as necessary) with the Department of Homeland Security and FEMA for all federal assistance requirements. Likewise, OEM organizes and manages the state Emergency Operations Center (EOC) which is a centralized facility to be utilized by the government for direction, control, and coordination in an emergency. Finally, OEM is responsible for communicating and coordinating with city and local governments in the event of an energy emergency. With regard to the Phases of Energy Emergency Management (Figure 44), OEM's involvement will cut across each phase, but will be most prominent during Phase III, the response phase.

Training is an ongoing activity coordinated through OEM, sometimes held in conjunction with federal agencies such as FEMA and the Department of Homeland Security. Through the use of tabletop exercises and other activities, OEM and its coordinating agencies demonstrate the ability to activate and staff the Emergency Operations Center (EOC), identify and implement the appropriate response to the emergency situation, and provide information to the public through the Emergency Alert System and public inquiry hotline. The state EOC also can coordinate incident management with field-incident command utilizing a virtual environment through WebEOC.

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[197] Public Law 93-288.

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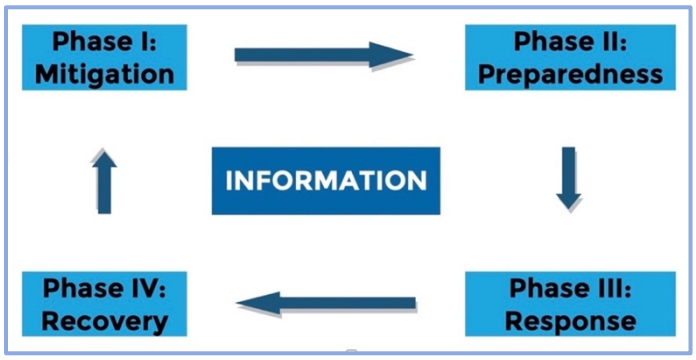
Governmental agencies at all levels and spokespersons for the involved industries coordinate responses and develop effective public information messages. Management of response activities for emergencies follow procedures outlined in the National Response Framework under the National Incident Management System (NIMS); field-level management of events utilizes the Incident Command System (ICS) to assure continuity across response and incident support partners.

Oklahoma Corporation Commission

As specified in the Oklahoma EOP (ESF-12) and represented in Figure 43, the Oklahoma Corporation Commission (OCC), which is responsible for regulating public service companies (businesses whose services are considered essential to public welfare), is the lead (or coordinating) agency for all energy emergencies except those incidents related to Liquefied Petroleum Gas (also known as LP Gas or propane). As the lead agency for most energy emergencies, the OCC is involved in all four Phases of Emergency Management, represented in Figure 44.

Figure 44: The Four Phases of Energy Emergency Management



Oklahoma is unique in that the OCC regulates the widest breadth of industries of any public utility commission in the nation. The OCC regulates public service companies in the electric and natural gas industries as well as pipeline safety, oil and gas exploration and production, railroad crossing safety, and aspects of both telecommunications and trucking. Because of its wide purview and the interconnected relationships between these industries, the OCC is singularly qualified to serve as the lead in responding to energy emergencies and coordinating with OEM, and all energy-related stakeholders, to restore normal energy operations to the state. As the state agency most involved with energy regulation, the Commission has a permanent seat at the table within the EOC from where it may communicate directly with the state's public utilities, operators of fuel supply outlets, and oil and natural gas companies.

- *Phase I: Mitigation*
  - During Phase I of emergency management, which the Oklahoma EOP identifies as the *Mitigation* phase, and which corresponds closely to the NASEO *Monitor and Alert* phase of guidelines for energy assurance, the OCC monitors the flow of energy throughout the state. This task is divided into two different schemes—one for monitoring service interruptions and one for monitoring the supply and demand dynamics that interact to generate supply shortages. Regarding the monitoring of interruptions, the OCC is in constant contact with energy companies that are legally required to notify the OCC of unplanned service interruptions (OAC 165:35-19-4

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for electric utilities; OAC 165:45-21 for natural gas utilities; OAC 165: 65-9-2(1) for water utilities; and OAC 165:55-25 for telecommunications). If an energy company does not report an outage, the OCC can instead receive information from OEM, which receives information about service interruptions from local emergency managers.
    - Also, during Phase I, OCC acts as the lead agency to develop and update any energy emergency plans and procedures; maintain or update energy transportation pipeline maps; maintain a directory of energy suppliers' emergency liaison personnel; and maintain restoration of service plans for regulated electric, natural gas, phone, and water.
- *Phase II: Preparedness*
    - Having noticed early signs of what might become an energy emergency, the OCC intensifies its data and information collection efforts in Phase II, which aligns with NASEO's *Assess and Determine Action* phase of guidelines for energy assurance. With regard to service interruptions, this involves communication with additional sources and potentially sending local agents to the field in an attempt to collect more information. This information is then communicated to the governmental agencies following the channels listed in Energy Emergency Communications Procedures section of this plan.
    - The Oklahoma EOP enumerates required Phase II activities to include organizing and training personnel into emergency response teams (located at both the state Emergency Operations Center and incident locations); training designated personnel under emergency procedures; participating in state and local emergency preparedness exercises; and ensuring that procedures are in place to document actions taken and costs incurred during emergency operations.
- *Phase III: Response*
    - If an energy emergency is severe enough to warrant government action, Phase III of Emergency Management is initiated, where the governmental agencies begin response measures. This phase aligns with the *Actions and Feedback* phase of NASEO's energy assurance guidelines. Specifically, the OCC acts as the lead agency to coordinate the following responsibilities (specified in ESF-12 of the Oklahoma EOP):
        - Establish contact with disaster scenes and have designated personnel report to the state Emergency Operations Center and incident site. The OCC liaison reports to the state EOC. The Oklahoma Association of Electric Cooperatives also sends a liaison to the EOC.
        - Survey the disaster area, evaluate the situation, and submit a report to the EOC that includes the damage to immediate and long-term energy needs.
        - Coordinate public and private utility companies to determine if repair efforts will be adequate or whether assistance from federal or state resources will be required. OAEC will respond to an energy emergency according to its March 2016 Mutual Aid Plan. The three largest Oklahoma electric

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providers are governed by state law and each file a disaster response plan with OCC.
    - Initiate necessary actions to request state or federal assistance, if required.

- *Phase IV: Recovery*
    - During the Recovery Phase, the state EOP asks OCC to serve as the lead to coordinate public, private, and volunteer activities for repairs to area utility activities. The agency will also coordinate the determination of long-term energy requirements for the affected area and initiate long-term recovery plans. This EOP phase is closely aligned with NASEO's *Review Lessons Learned* phase of its guidelines for energy assurance. At this point, OCC reviews its reports of the damaged utilities, the requests for damage repair assistance, the repairs completed, and the extent to which their responses facilitated or inhibited the alleviation of the emergency. Then, the OCC participates in an "After Action Report Meeting", which is organized by OEM to review the emergency as a whole, and initiates needed changes or improvements to emergency operations plans.
    - During emergencies involving LP Gas and propane, the LP Gas Administration will become the lead agency.

Additional Supporting Agencies and Organizations

Due to the inherent complexity associated with energy emergencies, a number of other state agencies and non-governmental organizations play an essential supporting role in each of the four emergency phases.

With regard to the response itself (Phase III), the EOP (ESF-12) lists the following supporting groups and the type of assistance provided by each identified agency:

- American Red Cross (ARC)
    - Provide support as necessary to victims during response and recovery phases, including setting up shelters in areas where utility service has been interrupted
- Department of Environmental Quality (DEQ)
    - Provide guidance and support to the response and recovery of material associated with hazardous material incidents (except as provided by the OCC) in accordance with state regulations
- Department of Health (OSDH)
    - Provide damage assessment assistance to the state, county, and local jurisdictions with respect to health care facilities and their energy needs. The OSDH will also provide support as necessary to ARC and other voluntary organizations for immediate needs of victims (i.e., those on life support systems) and continue long-term support of victims during recovery efforts.
- Department of Human Services (OKDHS)

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    - Provide support as necessary to ARC, and other voluntary organizations for immediate needs of victims (i.e., those on life support systems) and continue long-term support of victims during recovery efforts
- Department of Public Safety (DPS)
    - Provide support as required
- Department of Transportation (ODOT)
    - Provide support as required
- LP Gas Administration
    - Will become the lead agency for energy emergencies involving liquefied petroleum. Additionally, the LP Gas Administration will assist with rerouting and redistribution of LP gas resources as requested
- Oklahoma Military Department
    - Utilize its forces to assist ODOT in making emergency repairs to roads, bridges, public buildings, or other public facilities in disaster areas which are essential to the health, safety, and welfare of the public and the transportation of energy-related materials
- Oklahoma Office of Homeland Security (OKOHS)
    - Provide support as required; see reference above to August 2020 restructuring under OEM
- Oklahoma State Bureau of Investigation (OSBI)
    - Provide support as requested
- Oklahoma Water Resources Board (OWRB)
    - Gather information on damage to dams and associated power generation plants throughout the affected area. The OWRB will also gather information on damage to structures that are within the regulatory floodplains in the affected areas
- Oklahoma Association of Electric Cooperatives
    - Provide support as required
- Oklahoma Telephone Association
    - Provide support as required
- Oklahoma Municipal Alliance (formerly the Municipal Electric Systems of Oklahoma)
    - Provide support as required.
- Regulated Investor-owned Utilities
    - Provide support as required

Oklahoma Department of Mines

It is important to also note that, although it is not listed with formal responsibilities in the state's Emergency Operations Plan, the Oklahoma Department of Mines holds responsibility for overseeing the state's coal industry, including receiving reports of mine accidents or supply interruptions.

Other Sheltering Agencies

Additionally, outside of formal ESF-12 responsibilities, yet still a vital component, many other social service agencies hold responsibilities for response during energy emergencies. If the energy emergency requires sheltering for victims, many nonprofits and faith-based organizations offer food and shelter. In times of need, Oklahoma Emergency Management coordinates with Oklahoma Voluntary Organizations Active in Disasters (OK VOAD)[198], which is an umbrella agency whose purpose is to bring together organizations to foster more effective response to the people of Oklahoma in times of disaster. OK VOAD agencies are The American Red Cross, The Salvation Army, Food banks, volunteer centers, and most of the faith-based groups who have disaster work as part of their mission.

Local Agencies

As of this writing, by law, all incorporated jurisdictions in Oklahoma are required to develop an emergency management program and each county is required to have a qualified emergency management director. The Oklahoma Emergency Management Association is made up of Emergency Managers from across the state with a mission to minimize the effects of an attack, mitigate technological and natural disasters, and to coordinate emergency response and disaster recovery operations. The emergency managers for each county are also in regular contact with the state's OEM.

Federal Agencies

The U.S. Department of Energy is the lead federal agency when Department of Homeland Security DHS/FEMA activates ESF-12 in the National Response Framework at the federal level. As specified in ESF-12, the DOE is responsible for:

- Serving as the focal point for issues and policy decisions relating to energy response and restoration efforts
- Assessing energy system damage and monitoring repair work
- Collecting, assessing, and providing information on energy supply, demand, and market impacts
- Contributing to situation and after-action reports
- Identifying supporting resources needed to restore energy systems
- Deploying DOE response teams as needed to affected area(s) to assist in response and restoration efforts
- Reviewing and sponsoring the energy industry's requests for Telecommunications Service Priority (TSP) assignments to provision new services.

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[198] Oklahoma Voluntary Organization Active in Disaster. *Home*. https://voadoklahoma.wpengine.com/ (June 24, 2021).

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Likewise, DOE maintains the following capabilities to meet ESF requirements:

- Collects, and reports to Congress, information filed by electric energy generators, transmitters, and distributors on loss of firm load, system voltage reductions or public appeals, bulk system operational actions, and fuel supply emergencies
- Assists in the development of state and local energy recovery priorities
- Assists affected energy stakeholders in dealing with the FEMA by coordinating with publicly owned electric, gas, and lifeline utilities in applying for FEMA cost sharing for repairs
- Assists affected energy stakeholders in obtaining repair crews and materials from outside the affected areas
- Acts as an ombudsman in conjunction with state energy and emergency agencies to obtain electric power
- Gives restoration priority to communications, public works (water, sewage), and ancillary energy facilities (e.g., fuel transportation/distribution systems, pipeline pump stations, refineries)
- Handles requests for unique department assets to support an energy emergency response
- Maintains the DOE Emergency Operations Center (EOC), which is open twenty-four hours a day, seven days a week. The EOC can be reached by telephone Voice: (202) 586-8100, FAX: (202) 586-8485, or by E-mail at hqdoe@oem.doe.gov.

In support of DOE, a number of other federal agencies are authorized by the NRF to provide assistance during an energy emergency. These agencies include:

- Department of Agriculture (USDA)
- Department of Commerce (DOC)
- Department of Defense (DOD)
- Department of Homeland Security (DHS)
- Department of the Interior (DOI)
- Department of Justice (DOJ)
- Department of Labor (DOL)
- Department of State (DOS)
- Department of Transportation (DOT)
- Environmental Protection Agency (EPA)
- Nuclear Regulatory Commission (NRC)
- Tennessee Valley Authority (TVA)

In general, these agencies are responsible for supporting both the DOE and state governments in responding to energy emergencies. For example:

- USDA provides technical support and damage assessments/restoration information on electric generation, transmission, and distribution pertaining to Rural Development (RD) systems, as well as assessing overall impacts and needs of these systems. Also facilitates identifying federally subsidized housing available to house response personnel during emergencies.
- DOC provides data that assists in understanding emergency threats and monitoring the international flow of oil. The National Oceanic and Atmospheric Administration (NOAA) is part of DOC. NOAA provides up-to-the-minute tracking for hurricanes, wildfires, winter storms, and other weather-related emergencies including weather-related warnings and messaging systems.

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- EPA may need to be contacted if waivers are sought for fuels that do not meet national and local air quality requirements. A fuel waiver can be issued only when the criteria specified in the Clean Air Act Section 211(c)(4)(C) have been met. In general, these criteria allow a fuels waiver only to address a temporary emergency fuel supply shortage that exists throughout a state or region that was caused by an unusual situation such as a natural disaster, and that could not have been avoided by prudent planning. EPA also assists with identifying critical water and wastewater systems that may require priority power restoration in an emergency.
- DOT has several sub-agencies that may relate to an energy emergency, including:
  - Pipeline and Hazardous Materials Safety Administration (PHMSA)
  - Federal Highway Administration (FHWA)
  - Federal Maritime Administration
  - Federal Motor Carrier Safety Administration
  - Federal Aviation Administration (FAA)

In addition, new requirements have recently been added instructing the Federal Communications Commission (FCC) to give priority to certain restoration activities, such as those conducted by FEMA.

INDUSTRY STAKEHOLDERS

The state's EOP ESF-12 names four energy industry support groups for energy emergency situations: regulated investor-owned utilities; the Oklahoma Association of Electric Cooperatives (OAEC); the Oklahoma Telephone Association; and the Oklahoma Municipal Alliance (formerly the Municipal Electric Systems of Oklahoma (MESO)). The section below outlines their respective roles.

Regulated Investor-Owned Utilities
All regulated investor-owned utilities in Oklahoma are legally required to notify the OCC of unplanned service interruptions (OAC 165:35-19-4). In addition, each utility must file a Restoration of Service Plan with OCC. A detailed discussion of these measures can be found in the Energy Emergency Communications Procedures section of this plan.

In an energy emergency, further responsibilities for utilities include active communication with the OCC in terms of status updates on outages, damage reports, and damage repair assistance to other utilities as requested by the OCC.

Oklahoma Association of Electric Cooperatives
The Oklahoma Association of Electric Cooperatives (OAEC) is a statewide association of local electric distribution and generation/transmission cooperatives. OAEC has 30 members, 27 of which are based in Oklahoma and three of which are based out-of-state (Arkansas Valley, Ozarks Electric, and Golden Spread) but with Oklahoma membership and/or service components. Of the

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total 30 members, three are generation and transmission (G&T) cooperatives, and the remainder are distribution cooperatives. OAEC allows its members to collectively perform services which would not be practical or economical for each individual cooperative to perform alone, such as providing safety and loss control programs and coordinating mutual aid disaster planning.

In an energy emergency, OAEC leadership will serve as a liaison group and communicate with OCC and OEM to provide information about its members' outages, restoration of service updates, and any mutual aid activities.

Oklahoma Telephone Association
The Oklahoma Telephone Association represents local exchange carriers around the state. The Telephone Association's main support role as it pertains to energy emergencies is to provide information regarding its members' telephone outages to the OCC and OEM, and to coordinate mutual aid activities between member companies that may be experiencing outages. Non-member companies may report this information independently.

Oklahoma Municipal Alliance (formerly Municipal Electric Systems of Oklahoma (MESO))
Oklahoma Municipal Alliance (OMA) is a statewide trade association for Oklahoma's 63 municipally owned electric distribution utilities which serve over 400,000 Oklahoma residents. Like the other support groups, OMA coordinates mutual aid services and agreements for its member utilities and, in the event of an energy emergency, serves as a contact organization for state officials to provide information on member outages and restoration updates.

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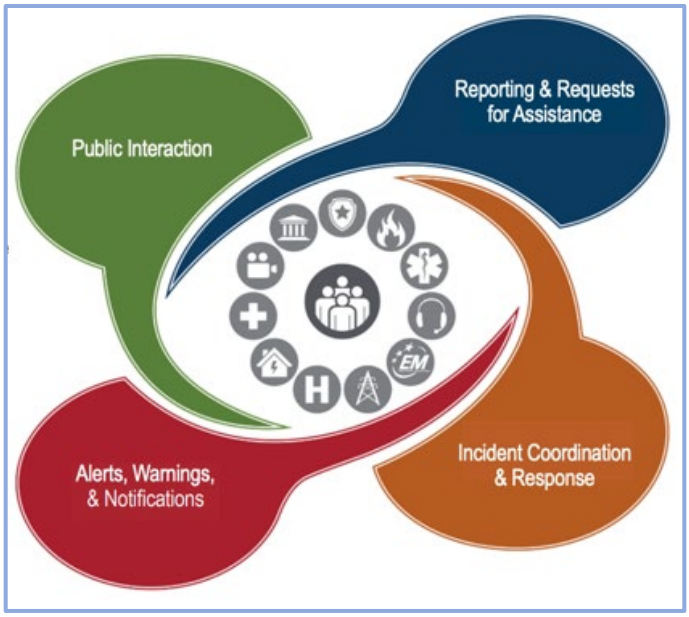
ENERGY EMERGENCY COMMUNICATIONS PROCEDURES

To withstand the potential for multi-pronged and complex events that engage multiple partners in effective response, resilient energy emergency communications procedures should be designed around the concept of a communications ecosystem.

Figure 45: Emergency Communications Ecosystem



As defined by the National Emergency Communications Plan, an emergency communications ecosystem is comprised of four key elements: Reporting and Requests for Assistance; Incident Coordination and Response; Alerts, Warnings, and Notifications; and Public Interaction.[199] The graphic to the right illustrates this concept and captures the interactive relationships between the multitude of emergency response stakeholders and the overlapping incidence of the four key elements. Oklahoma's energy emergency communication procedures follow this four-pronged structure.

REPORTING AND REQUESTS FOR ASSISTANCE

Reporting of timely and accurate information, as well as well-defined paths for assistance requests, are critical parts of energy assurance in Oklahoma. As displayed in Figure 46, which depicts the typical flow of information in an energy emergency, most of the information about energy disruptions and emergencies is reported to state officials by energy companies and/or local emergency managers and responders. Within the state government, there are two hubs that receive this reported information or requests for assistance—either the OCC (in non-propane emergencies) or LP Gas Administration (propane/liquefied petroleum emergencies only), and OEM.

[199] National Emergency Communications Plan. *NECP Slick Sheet 2019.* https://www.cisa.gov/sites/default/files/publications/19_0924_CISA_ECD-NECP-Slick-Sheet_1.pdf (May 10, 2021).

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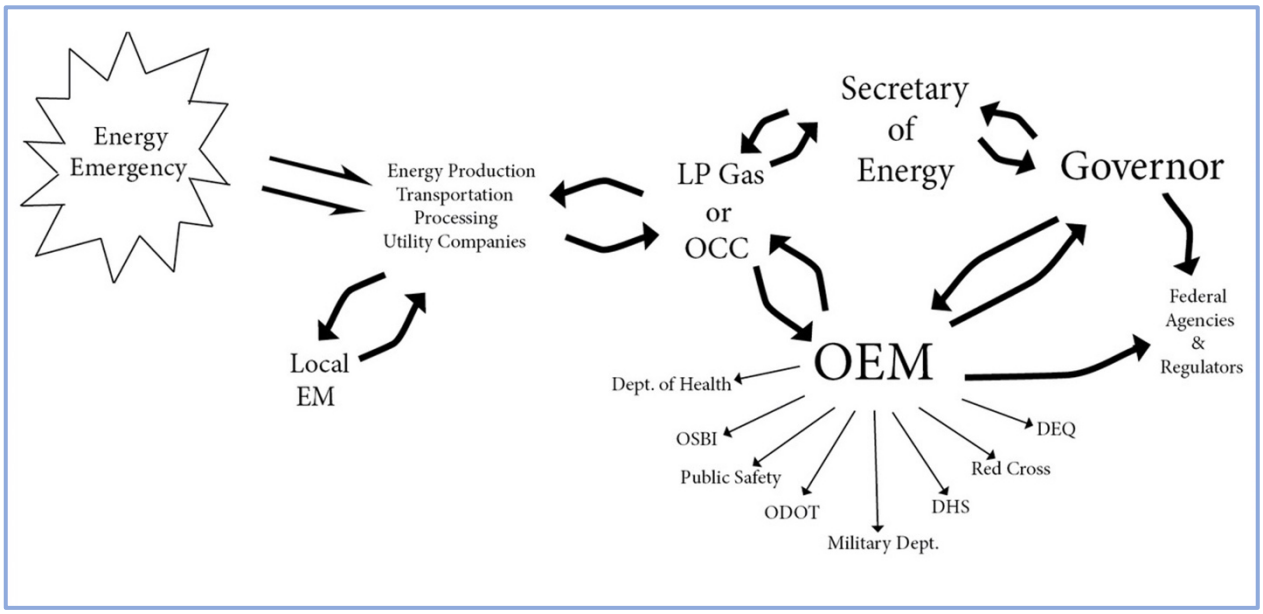
Figure 46: The Flow of Information During an Energy Emergency in Oklahoma



First, regulated energy providers in Oklahoma are required by the Oklahoma Administrative Code (OAC 165:35-19-4 Restoration of Service (Electric) /165:45-9-2.1 (Gas)) to provide Restoration of Service plans annually to the Director of the Corporation Commission's Consumer Services Division; these plans must outline detailed steps for responding to outages and must include detailed contact lists for each regulated company including a minimum of two 24-hour-a-day contacts. Once each company's plan is received, the Public Information Officer of the Corporation Commission maintains these plans and acts as the point of contact for utilities that are required to report unplanned outages. Upon receiving any report of outage or emergency from an energy provider, the OCC's Public Information Officer (PIO) is responsible for contacting any state and local agencies that might be affected. Further coordination is enabled because the OCC PIO has access to proprietary databases used by utilities that indicate electric outages. These proprietary databases show more granulated information than what is available on the public-facing outage maps hosted on electric utility websites.

For emergencies with potential environmental impacts, OCC field inspectors keep the PIO informed. For example, if an oil well blowout should occur, an OCC field inspector will also contact the OCC PIO who will coordinate with the regulatory team in addition to a representative from the energy producer.

In addition to tracking electric and gas outages, it is important to track the flow of energy via pipelines throughout the state of Oklahoma. Accordingly, the OCC has created an additional set of rules to govern the actions to be taken by energy providers in the event of a pipeline incident. OAC 165:20-5-1 requires telephonic notice to the OCC Pipeline Safety Department no more than two hours following any pipeline incident that involves release of gas from a pipeline and either a

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death, personal injury requiring hospitalization, damage of $5,000 or more, or any other event that is significant in the judgment of the operator.

However, as mentioned in previous chapters, not all energy providers in Oklahoma are regulated and therefore some are not required to report outages or incidents. In these cases, communication depends heavily on relationships; the OCC PIO maintains a strong network, particularly with electric cooperatives and municipal electric providers, to coordinate and get needed data to effectively manage energy emergencies. The importance of strong professional networks in Oklahoma cannot be overstated and is a key factor in the state's previous success in managing energy incidents.

As shown in Appendix A, all state agencies with lead or support roles in ESF 12 under the state's Emergency Operations Plan also maintain public contact numbers that any member of the public can use to report energy emergencies to authorities or request assistance from the agency.

Finally, Oklahoma has two individuals who serve as Energy Emergency Assurance Coordinators—these individuals, who each have planning and/or response responsibilities during energy emergencies—are registered on a password-protected ISERnet website hosted by the U.S. Department of Energy, which allows Oklahoma's key energy emergency planners to receive energy updates from federal agencies and communicate information to other states and the federal government when authorized by the Governor, Director of OEM, or other key state decision makers. These two individuals are the Public Information Officer at the Corporation Commission and the Director of Programs-Planning at the state Energy Office.

INCIDENT COORDINATION AND RESPONSE

Once OCC receives information about any energy incident, the agency is responsible for relaying the appropriate information about electric outages, pipeline incidents, or other energy emergencies to OEM, to other energy companies, and to a list of potentially affected state agencies/organizations. OEM, when it receives information from local emergency managers, communicates it to the OCC, the Governor's office, and back to the local governments that are affected. Should the energy emergency warrant federal involvement, the Governor's office (or the Director of OEM) is responsible for communication with the federal government.

After being notified that an emergency has occurred, OEM will activate the Emergency Operations Center (EOC) and Joint Information Center (JIC). In the past, all coordination occurred in a physically secure bunker or field office location, but OEM has recently begun providing a webEOC which has been tested during the COVID-19 pandemic. Although the physical locations will remain a primary mechanism of incident coordination and response, the webEOC provides a new opportunity and needed redundancy for individuals assigned to the EOC to assist with incident coordination without always requiring their physical presence in the bunker.

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The resource requirements for incident coordination, which include staff, equipment, office supplies, and facilities, should be tailored to the type and magnitude of the emergency prompting the response. Depending on the nature of the emergency, all or some of the listed resources may be required. To determine the resource requirements, the *State of Oklahoma Joint Center Operations Guide* will provide JIC logistics, job descriptions, and training requirements for each function outlined in the guide.

To ensure the correct individuals are included in the incident response team, contact information, including personal email addresses, work, home, and cell phone numbers, for each of the entities with support functions under ESF 12 can be found in the Oklahoma Energy Emergency Contact list. This list is maintained and updated by the OCC Public Information Officer/Liaison to OEM. As new energy incidents present themselves, all of the people/entities who are contacted during the event are added to the contact list. The list is updated every year by the OCC to ensure that the content is accurate.

For incident coordination and response to be successful during an energy emergency, it is critical that utilities maintain contact between their on-the-ground crews, the utility offices, and state and local officials. To assist in this, all major utilities in Oklahoma, including energy utilities, have registered to use the Government Emergency Telecommunications Service (GETS).

GETS provides emergency access and priority processing in the local and long-distance landline networks during times of emergency when the system is congested and the probability of completing a call over normal means has significantly decreased. GETS allows users to communicate over existing paths with a high likelihood of call completion during the most severe conditions of high-traffic congestion and disruption. The service that is accessed through a universal access number and Personal Identification Number (PIN) card verification methodology.[200] GETS has a companion service for wireless calls from cellular phones, the Wireless Priority Service (WPS), which offers similar priorities as GETS does but for calls placed on wireless networks. There is a separate registration requirement for WPS, and it functions as a free add-on to a subscriber's wireless account.[201] For any Oklahoma entities needing additional training or assistance in utilizing these services, training videos[202] are available at www.cisa.gov/pts-videos.

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[200] Cybersecurity and Infrastructure Security Agency. *Government Emergency Telecommunications Service (GETS).* https://www.dhs.gov/government-emergency-telecommunications-service-gets (May 11, 2021).
[201] Cybersecurity and Infrastructure Security Agency. *Wireless Priority Service (WPS).* https://www.cisa.gov/wireless-priority-service-wps (May 11, 2021).
[202] Cybersecurity and Infrastructure Security Agency. *National Emergency Communications Plan (September 2019).* https://www.cisa.gov/sites/default/files/publications/19_0924_CISA_ECD-NECP-2019_1_0.pdf (June 21, 2021).

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ALERTS, WARNINGS, AND NOTIFICATIONS

As part of incident management and response, redundant and diverse alert and warning systems will ensure that as wide an audience as possible receives time-sensitive notifications related to the energy emergency including evacuation notices, weather warnings, and more. This portion of the emergency communications ecosystem is tightly entwined with public interaction; in many cases these aspects are underway simultaneously and have overlapping roles. However, this aspect of the ecosystem is intended to specifically address instructional messages that direct protective action.[203]

One method Oklahoma emergency responders utilize to distribute warnings and other messages for protective action is the Integrated Public Alert and Warning System (IPAWS).[204] Currently, 19 entities in Oklahoma, including the Office of Emergency Management, are authorized to send messages via IPAWS.[205]

The state also offers the OKEmergencyApp[206], which sends emergency updates to either Android or Apple cellular devices and enables citizens to upload damage photos and view emergency information on maps.

Finally, Oklahoma Wireless Information Network is a forty-three site public safety radio communications network that provides coverage to 70 percent of Oklahoma's population and includes more than 520 agencies and 40,000 radios.[207]

In addition to specific platforms that push out alerts and warnings, emergency response professionals at all levels utilize broadcast and social media to disseminate protective warnings. Emergency planners should be particularly cognizant when issuing warnings and protective alerts that these warnings and protective alerts may need to be broadcast to Limited English Proficient (LEP) speakers, and planners and responders should consider bi-lingual risk communication, with a particular emphasis on Spanish speakers. Emerging research suggests that not only are broadcasts in Spanish within Oklahoma needed to help LEP populations take correct protective actions during

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[203] Cybersecurity and Infrastructure Security Agency. *National Emergency Communications Plan (September 2019).* https://www.cisa.gov/sites/default/files/publications/19_0924_CISA_ECD-NECP-2019_1_0.pdf (June 21, 2021).
[204] Federal Emergency Management Agency. *Integrated Public Alert and Warning System*. https://www.fema.gov/emergency-managers/practitioners/integrated-public-alert-warning-system (May 10, 2021).
[205] Federal Emergency Management Agency. *Alerting Authority. Organizations With Alerting Authority Completed*. https://www.fema.gov/sites/default/files/documents/fema_aa-complete_06-2021.pdf (June 24, 2021).
[206] Oklahoma Office of Emergency Management. *OKEmergency App.* https://oklahoma.gov/oem/programs-and-services/okemergency-app.html (May 11, 2021).
[207] Oklahoma Wireless Information Network. *About us.* https://www.ok.gov/okwin/About_Us/index.html (May 11, 2021).

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emergencies, but that there is also a need to ensure that translated warnings are correctly understood.[208]

PUBLIC INTERACTION

ESF-15 of the Oklahoma Emergency Operations Plan provides the framework for Oklahoma's public information program protocol to be followed during all types of emergencies[209] and designates OEM as the state coordinating agency with support from all state agencies, boards, commissions, and voluntary organizations.

The primary purpose of the public information function is to provide and maintain operational consistency throughout the state of Oklahoma in the form of emergency information by providing accurate information to legislative and congressional delegations and through community relations. Uniform information coordination with these groups will help Public Information Officers (PIOs) for State, County, and Municipal entities to provide information to the citizens in a responsive, well-managed manner during emergencies and disasters. Each of the PIOs is responsible for speaking about their agency's involvement in managing an energy emergency.

First, as an ongoing measure to stay prepared for emergency communications, PIOs and key operations officials typically meet monthly to share information and OEM staff have served as instructors in basic FEMA communications courses, providing them wide and frequent networking and communications exposure statewide. During the COVID-19 pandemic, state agencies have maintained communications opportunities, pivoting to a virtual environment. In lieu of monthly PIO meetings, OEM has hosted weekly calls with emergency management stakeholders, and maintains a SharePoint site that includes discussion boards and resources where professionals can post questions and interact. This site provides a platform to address and correct misinformation, distribute social media graphics templates to other agencies, and provides a virtual platform to maintain communication and interaction when in-person meetings are more challenging. Additionally, state agency communications professionals have been aided by the Lt. Governor's state branding rollout process, which established a Microsoft Teams group that has resulted in another avenue for agency communications officials to interact and stay in touch on a variety of topics.

During an emergency, in order to ensure the continued flow of information, the OCC's Public Information Officer remains in contact with the applicable state agencies and utilities during energy outages and, based upon these updates, will periodically release reports on the status of the outage.

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[208] American Meteorological Society. "*Hazardous Weather Communication En Espanol: Challenges, Current Resource, and Future Practices". (April 2021)*. https://journals.ametsoc.org/view/journals/bams/102/4/BAMS-D-20-0249.1.xml (June 24, 2021).

[209] Oklahoma Department of Emergency Management. *State of Oklahoma Emergency Operations Plan. (October 2019).* https://oklahoma.gov/content/dam/ok/en/oem/documents/state-eop-101219.pdf (June 21, 2021).

During statewide emergency operations, OEM has the primary responsibility for providing emergency public information and general information, with the Director of OEM responsible for all educational and informational programs conducted to exercise energy emergency responses. To accomplish this responsibility, the Director of the OEM will appoint or designate a state Emergency Information Officer to direct these activities. It is the responsibility of this Officer to prepare and release emergency information as provided by the OEM Director and/or the Governor, as the Governor's Office serves as the focal point of communication with the public. Accordingly, the OEM PIO will work closely with the Governor's Press Secretary to assure that the Governor has timely access to accurate information. Status reports are released daily, or whenever a significant change in the condition of the outage occurs, which means multiple reports could be released in a single 24-hour period. The OCC's Public Information Officer, when appropriate, will provide updates to the media (social, print, television, and radio) so that the general public is informed as to the status of the outages and the progress of restoration efforts.

The state Emergency Information Officer will prepare a broad scope of information to be provided to the OEM Director and/or Governor. The state Emergency Information Officer will also prepare a broad scope of information for use by the news media. The pertinent information and situation reports will be prepared, with the OEM Director's approval, for the Governor, the Emergency Alert System, or other news media as appropriate. In close coordination with the Governor's Press Secretary and involved agency PIOs, this group will approve, coordinate, and release all emergency information from state agencies and serve as the focal point for all inquiries by the media.

It is the state Emergency Information Officer's responsibility to provide the public, via the news media, accurate and timely information about emergency and disaster response and recovery operations. This will reduce or eliminate inaccurate information that may arise and ensure vital emergency and disaster information is delivered to the citizens of the state of Oklahoma.

Relevant agency PIOs should be present at any and every event that might attract media attention or that would serve as an opportunity to get information to disaster victims and to publicize the local and state emergency or disaster message. The early activation and deployment of a PIO, along with other key response personnel, as part of emergency operations field deployments or as part of the preliminary damage assessment team and other pre-declaration activities, is vital to effectively alleviate concerns about local and state government responsiveness and to provide individuals with accurate information during every step of the process.

If a Presidential Declaration has been made, the JIC will be expanded to include Federal resources such as FEMA and the U.S. Army Corps of Engineers. With an expanding JIC established, field PIOs must continue their visibility in the affected communities, especially where Disaster Service Centers have been established. The JIC then becomes the central point for media access to the latest developments and emergency information for all participating agencies. The JIC supports field PIO operations by providing updated information about current policies and issues regarding response and recovery operations.

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PIOs in the JIC work closely with elected officials, response agencies, and emergency managers. JIC PIOs are responsible for establishing daily news briefings for key disaster officials; writing and disseminating news releases to appropriate media outlets; monitoring and analyzing television, radio, and newspaper disaster-news coverage and providing this information to the JIS; and providing multilingual media support operations for the disaster as appropriate to the community need.

Private entities in Oklahoma's energy sector also maintain their own protocols through Incident Command Systems for alerts and notifications to both emergency responders and customers. Most electric and natural gas utilities offer public-facing outage maps on their websites, and use social media, including Twitter, Facebook, Instagram, LinkedIn and/or NextDoor, to disseminate information. Post topics on social media could include:

- Weather updates/How to prepare for a storm
- How to report outages/contact us
- Damage assessments
- Safety information (avoid downed lines, generator information, etc.)
- Estimated restoration times (once available)
- Updates on crew work and work processes
- Answers to common outage questions

Private entities typically employ an external affairs officer that communicates information and alerts to emergency managers and state officials as well as coordinating the private entity's external response.

Additional discussion of specific actions taken within the energy sector during response to energy emergencies can be found in the "Preparing for, Mitigating, and Responding to Energy Emergencies" chapter of this Plan.

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PREPARING FOR, MITIGATING, AND RESPONDING TO ENERGY EMERGENCIES

Oklahoma energy assurance requires a two-pronged approach: preparative and preventative measures that help ensure a stable energy supply and avoid incidents and emergencies, but also mitigation and response strategies to manage energy demand and restore energy flows quickly if and when disruptions occur. As already described in earlier sections of this plan, the energy landscape in Oklahoma includes multiple sectors and myriad stakeholders, and each sector and energy emergency is unique. Creating an exhaustive list of preventative measures and response strategies would be nearly impossible. However, after conducting an historical analysis of Oklahoma's vulnerabilities (see chapter titled "Energy Vulnerability Assessments"), a literature review of best practices in emergency preparation and response, and after extensive engagement with dozens of Oklahoma energy stakeholders, we have evidence of the types of scenarios most likely to affect our state and can discuss and provide examples for how the various sectors approach prevention of, and response to, these types of emergencies.

This chapter describes the current plans, activities, requirements, and protocols Oklahoma energy stakeholders have in place to prevent and mitigate risk from, as well as respond to, emergency situations. Appendix E provides additional information about implementation for a variety of response options to possible Oklahoma scenarios. This appendix should be treated like a "menu" of response options from which to select and implement, rather than a list of standard operating procedures. The list is divided into sector-specific response options. Within each sector, there are two types of response options: the first type of response is designed to manage the supply of energy; the second type of response is designed to manage the demand for energy. Some responses may be appropriate for more than one energy sector; those instances are noted.

As with all emergencies, it is critical to treat every energy emergency as a unique circumstance. A high level of resilience requires that officials tailor their actions to prepare for and respond to the incident at hand rather than selecting a generic action plan that may have worked in the past under different circumstances. When deciding which preventative and response options should be employed, government officials and energy stakeholders must examine the potential for, severity, scope, and duration of the emergency as well as the resources available to officials based on situational and often complex interdependencies.

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ELECTRICITY

> *"Resilience is not just about lessening the likelihood that…outages will occur. It is also about limiting the scope and impact of outages when they do occur, restoring power rapidly afterwards, and learning from these experiences to better deal with events in the future."*[210]

A fundamental component of any energy assurance plan is how to prevent *and* recover from electric interruptions, damage, or emergencies. In Oklahoma's electric sector, investor-owned utilities, electric cooperatives, and municipal electric providers have designed and implemented detailed plans to address prevention and recovery while also working closely with state agencies and regional groups that regulate and oversee a variety of inspection, maintenance, and response programs. When implemented correctly, these regulations, plans, and programs can prevent outages or—when they do occur— lessen the area affected and/or time needed for restoration of service.

Preparation and Preventative Measures

To thoroughly plan for and prevent energy emergencies, reliability remains the key metric both for preventing and minimizing disruptions. Reliability planning occurs at the generation, transmission, and distribution levels, within investor-owned utilities, cooperatives, municipal utilities, and within regional organizations. This planning includes activities as diverse as assuring resource adequacy, system hardening, vegetation management, equipment upgrades, and training.

At the regional level, the Southwest Power Pool (SPP) acts as a reliability coordinator for transmission operators, generator operators, and balancing authorities in its 14-state territory, acting as a controller overseeing the interconnected operations of the power grid. SPP ensures reliable delivery of electricity to consumers by maintaining a wide-area view of the grid's current state and future conditions. Continuous coordinated operation of the bulk electric system is essential to maintain reliable electric service to all customers, and SPP has established reliability coordination procedures for around-the-clock coordination of normal and emergency operating conditions. As an additional reliability and preventative measure against impacts, SPP maintains, allocates, and supplies operating reserves within its Reserve Sharing Group to hedge against emergency situations and contingencies. The continuous operation of the bulk power system requires electric reserves be kept online and available to use to provide protection against contingencies. Operating reserves can be used to regulate load changes and prevent the need to

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[210] National Academies of Sciences, Engineering, and Medicine. *Enhancing the Resilience of the Nation's Electricity System.* https://doi.org/10.17226/24836 (June 21, 2021).

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shed firm load or curtail firm power sales. Through this proactive reserve sharing group, SPP ensures that it is prepared in advance for potential disruptions.[211]

All Oklahoma electricity providers also engage in reliability planning. Under the authority of OAC 165:35-25-14, the Oklahoma Corporation Commission maintains information about each regulated electric provider's reliability plan. This section of the administrative code requires regulated utilities to design and maintain a program to limit the frequency and duration of electric service interruptions.[212] As excerpted from the Commission's Rules:

> "This program must address all the factors that impact the reliability of the distribution system, including, but not limited to:
>
> 1) The age, distribution, and location of equipment on each circuit;
> 2) The number, density, and location of customers on each circuit;
> 3) The location and density of trees on the system;
> 4) An annual vegetation management plan;
> 5) The impacts on distribution system reliability of animals, wind, storms, ice, and automobile accidents."

As an example, Oklahoma historically has experienced electric outages due to ice accumulation and tree limbs pulling down lines. When a segment of lines sags toward or drops on the ground due to the weight of ice or tree limbs, the weight of the fallen lines causes the utility poles on both sides of that strand to pull inward and possibly snap. This causes the next segment of line to pull down, affecting the next poles and thereby creating a cascading effect. Understanding this common scenario, Oklahoma Gas & Electric (OG&E), Public Service Company of Oklahoma (PSO), and Liberty-Empire's approved reliability plans include a vegetation management program to trim the right-of-way along one-fourth of their distribution systems each year. Working with arborists, the companies have designed a program to clear potentially problematic vegetation so that it will take four years or longer to grow back into an area where they may become entangled with the electric lines. Further, all distribution lines are inspected on a 5-year cycle, with some lines inspected more frequently, in compliance the reliability plans mandated under OAC 165:35-25-14. Additionally, using a combination of the System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI) scores, the utilities identify their worst performing circuits, the cause of poor performance, and determine if action is required to mitigate problems.

Regulated utilities submit an annual reliability report to the OCC under OAC 165:35-25-20.[213] In response, OCC's Public Utility Division (PUD) issues an annual reliability scorecard for each

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[211] Southwest Power Pool. *SPP Reserve Sharing Group Operating Process.* https://www.spp.org/documents/56447/spp%20operating%20criteria%20and%20appendices%20v1.5.pdf (June 24, 2021).
[212] OAC 135:35-25-14.
[213] Individual utility reports can be accessed on the OCC PUD website at: https://oklahoma.gov/occ/divisions/public-utility/pudreports.html (November 25, 2020).

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entity that analyzes how many outages each customer had (SAEFI) and the duration (SAIDI). As of this writing, the 2020 Reliability Scorecard is available at https://oklahoma.gov/content/dam/ok/en/occ/documents/pu/pud-reports-page/2020reliabilityreport5-1-20.pdf

In addition, OAC 165:35-33-5(f) requires electric utilities to develop and keep updated a Homeland Security and Critical Infrastructure Plan, which designates physical assets and computer software that the utility considers to be critical infrastructure and outlines the utility's measures to secure those facilities from extended service interruptions. Pursuant to OAC 165:35-33-7, utilities keep these plans in a confidential location on-site, but are required to notify the Corporation Commission each year that the Plan is updated.[214] By understanding the precise location of critical infrastructure and planning to keep these secured, utilities can lessen the possibility of widespread outages resulting from damage to or outages at key facilities. More information on cybersecurity and critical infrastructure is discussed in the chapter of this plan titled "Cybersecurity Planning".

Electric cooperatives' and municipal utilities' reliability planning activities are not regulated by the Oklahoma Corporation Commission. However, these entities track reliability data internally and ensure adherence to high reliability standards through coordination and compliance with standards from regional and national organizations including the North American Electric Reliability Corporation (NERC)[215], the SERC Reliability Corporation's Reliability Assessment and Performance Analysis (RAPA) program[216], the U.S. Rural Utilities Services (RUS) standards,[217] and the Southwest Power Pool (SPP). In addition to the vegetation management programs implemented at most cooperatives, reliability planning occurs through equipment replacement and upgrades as well. For instance, KAMO Power, a generation and transmission cooperative, is currently engaging in system protection upgrades by changing its substations' protection relay systems to microprocessor relays and is also replacing outdated equipment by changing out instrumentation transformers and switch gear.[218]

In combination, efforts such as vegetation management, periodic system and equipment upgrades, and other more periodic efforts such as system hardening, reinforcement, and undergrounding programs can reduce exposure to common Oklahoma hazards such as high winds, lightning strikes, and ice thereby preventing many outages from ever occurring.

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[214] OAC 165:35-33-7
[215] North American Electric Reliability Corporation. *NERC Reliability Standards.* https://www.nerc.com/pa/Stand/Pages/default.aspx (November 5, 2020).
[216] SERC Reliability Corporation. *Reliability Assessment and Performance Analysis.* https://www.serc1.org/program-areas/reliability-assessments (November 14, 2020).
[217] USDA Rural Development, U.S. Department of Agriculture. *Program Regulations.* https://www.rd.usda.gov/resources/regulations/program-regulations (June 21, 2021).
[218] KAMO Electric Cooperative, Inc. *2019 Annual Report.* https://www.kamopower.com/sites/kamopower/files/PDF/KAMO%202019%20Annual%20Report.pdf#overlay-context=content/kamo-power-annual-report (November 3, 2020).

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An additional key component of preparation and prevention activities is training. Training for personnel is a critical component of all electric providers' preparation strategy in advance of outage and emergency situations so that when situations do arise, personnel are prepared and practiced in their responses. Trainings include apprenticeship programs to ensure complete skill sets, individual trainings related to specific technical skills, and desktop and tabletop exercises to simulate emergency responses. Most of Oklahoma's investor-owned utilities offer internal apprenticeship programs, while cooperatives and municipal utilities often participate in apprenticeship programs provided through statewide associations such as the Oklahoma Association of Electric Cooperatives and the Oklahoma Municipal Alliance (OMA). For instance, OMA offers a four-year, U.S. Department of Labor-certified apprenticeship program for member utilities, as well as 6-8 trainings per year on technical skills. The Federal Emergency Management Agency (FEMA) also provides myriad training opportunities for Oklahoma electric providers and support agencies for energy emergencies, particularly in the areas of emergency response and management.[219] To provide just one example, OG&E's Transmission and Distribution System Restoration Plan, provided annually to the Oklahoma Corporation Commission, incorporates an Incident Command System that includes FEMA course requirements for incident commanders and all key personnel.[220]

Finally, to prevent accidental disruptions, as part of the Oklahoma Underground Damage Prevention Act,[221] the Oklahoma One Call System, known as Okie811, requires companies and private citizens to call one number before digging on their property; by calling in the location of the proposed dig, the utilities can come out and mark their lines to avoid damage to underground electric infrastructure.[222]

Mitigation Measures and Restoration of Electric Power After Interruptions

When outages do occur, electric utilities must take action to repair system damage and restore service as quickly as possible. There are several short-term and long-term actions specific to Oklahoma that help utilities effectively respond to, and therefore mitigate the impact from, events and/or shorten the duration of outages after incidents and emergencies.

A short-term action electric providers can take prior to an event, presuming that the event can be predicted (such as severe weather), is pre-positioning equipment at points expected to be the most impacted. This helps electric providers avoid uncertainty due to possible transportation delays and guarantees availability of the equipment close to the potentially impacted sites, thereby reducing restoration times. While National Weather Service forecasts are available for all types of potential

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[219] Federal Emergency Management Agency. *Emergency Management Institute*. https://training.fema.gov/ (June 21, 2021).
[220] Oklahoma Gas & Electric. *Transmission and Distribution System Restoration Plan: ICS Emergency Preparedness.* Submitted annually to the Oklahoma Corporation Commission.
[221] O.S. § 63-142-6.
[222] OKIE811. *Home.* https://www.okie811.org/ (November 15, 2020).

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severe weather, to optimize the placement of this equipment, Oklahoma gains particular benefit from the availability of the Oklahoma-developed Sperry-Piltz Ice Accumulation (SPIA) Index[223] (see Appendix F and www.spia-index.com). Using experiences from previous ice storms, the SPIA Index uses an ice accumulation algorithm and subsequent utility damage index to predict both the location and severity of ice accumulations three to four days in advance of potentially damaging events while also enabling classification of potential electric utility system damage on a scale. Providing early warnings of major events such as ice storms to electric utilities and other emergency responders affords appropriate rapid response and recovery. The National Weather Service has a signed license agreement to use the SPIA Index at local weather forecasting offices (WFO). Forecasts 24 hours in advance are free to the public to use and can be used in conjunction with NWS forecasts on the website NationalOutages.com.[224]

Usage of the SPIA Index is particularly pertinent to the community lifelines referenced in the National Response Framework[225], as the ability to predict weather impacts can also allow energy emergency support agencies to coordinate supplies, purchases, deliveries, and inventories ahead of time, in concert with County Commissioners, Emergency Managers, and state Emergency Management officials, as well as with mutual aid entities, sheltering agencies, and contractors from across the state or multi-state region.

A longer-term mitigation strategy is the deployment of Advanced Metering Infrastructure (AMI), which includes smart meters, data management systems, and communication networks. Deployment of AMI has proven to lower outage costs and allow faster outage restoration through more efficient outage identification, allowing repair crews to be precisely dispatched to the specific outage location. Over the past decade, Oklahoma has been a leader in deployment of smart meter technology; as of 2019, Oklahoma electric providers had nearly 1.8 million advanced meters deployed statewide.[226]

As they respond to energy emergencies, regional and state-level electric providers follow Emergency or Restoration of Service plans. Regionally, SPP recently updated its Emergency Operating Plan, which is reviewed annually.[227] At the state level, regulated utilities' Restoration of Service Plans are updated and filed annually with the Corporation Commission under OAC

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[223] Sidney K. Sperry, Oklahoma Association of Electric Cooperatives and Steve Piltz, Chief Meteorologist for the National Weather Service in Tulsa, designed the SPIA Index.
[224] SPIA Index Forecasts can be customized 24 hours in advance at https://www.nationaloutages.com/forecasts/spia/ (June 21, 2021).
[225] U.S. Department of Homeland Security. *National Response Framework, 4th, ed. (October 2019).* https://www.fema.gov/sites/default/files/2020-04/NRF_FINALApproved_2011028.pdf (November 23, 2020).
[226] U.S. EIA. *Annual Electric Power Industry Report, Form EIA-861 detailed data files.* https://www.eia.gov/electricity/data/eia861/ (November 4, 2020).
[227] Southwest Power Pool. *SPP BA Emergency Operating Plan, V. 7.5. (September 2020).* https://spp.org/documents/63143/spp%20ba%20emergency%20operating%20plan_v%207.5.pdf (November 15, 2020).

165:35-19-4. After an outage, a utility must communicate its progress in restoring service and must use the following guidelines when developing and implementing their Plans:[228]

(1) Assessment of the extent of the service interruption and what resources (equipment, materials, and labor) will be required to restore service. The utility should also attempt to determine the number of customers affected and the geographic extent of the service interruption.

(2) Determinations as to whether service restoration can be accomplished through the use of in-house personnel only or if contractors (personnel obtained from other utilities or third-party entities) will be required. The objective is to have service restored as soon as possible.

(3) Identification of priorities for service restoration, based upon emergency needs and upon ease of restoration for the greatest use of money, time, and effort. Priority shall be given to any life-threatening situations known or discovered during restoration of service.

(4) Once electricity to installations affected with the interest of public health and safety has been restored (such as hospitals, fire and police departments, and 911 centers), service shall be restored to schools as quickly as feasible, during such time of the year that school is in session.

(5) Attempted notification of high-priority customers or major electric consuming facilities that are affected by the service outage, when possible. Radio and/or television should be utilized to notify larger numbers of customers as to the type of service outage, extent of the service outage, and the expected time to restore service. Other means of notification may also be utilized so long as the result is mass notification on an efficient, effective, and timely basis.

(6) Commission notification through the CSD Director and the Commission's Emergency Liaison to implement the process outlined in paragraphs A through C below. The Commission notification process to the designated CSD individual(s) and the Commission's Emergency Liaison may be accomplished by one or more of the following methods: business telephone and/or e-mail during the business hours of 8:00 a.m. through 4:30 p.m. Monday through Friday, or emergency cellular telephone number after normal business hours, weekends, and holidays. The notification shall consist of the following:

(A) An initial contact to notify Staff of outages which involve a major utility substation or facility; or which may cause a high degree of public interest or concern; or which have a duration of 4 hours or more and involve 1% or fifty (50) customers or more, whichever is greater, of the utility's meter count.

(B) Intermediate contact to provide status reports, as deemed necessary by the utility, or as may be requested by Commission and CSD Staff.

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[228] OAC 165:35-19-4.

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(C) A conclusory contact detailing the results and completion of the restoration of service plan implementation.

Although non-regulated utilities such as cooperatives and municipal electric providers are not required to submit restoration of service plans to the OCC, each of these types of electric providers also have these plans in place, and work with their statewide associations such as the Oklahoma Association of Electric Cooperatives or Oklahoma Municipal Alliance using outage management software to monitor outages and speed restoration.

After incidents or disruptions, the focus turns to repairing damage and restoring service. In these events, which in Oklahoma most commonly occur after severe weather, electric providers can restore service more quickly by requesting assistance from mutual aid organizations in which they hold membership. Under mutual aid, member utilities outside of the impacted area send crews and equipment to the affected location to assist with restoration efforts. All types of electric providers in Oklahoma participate in mutual aid programs. For example, PSO is a member of the EEI Mutual Assistance Program and various Regional Mutual Assistance Groups.[229] OG&E is a member of three regional mutual assistance groups: the Southeastern Electric Exchange (SEE), Midwest Mutual Assistance Group (MMAG), and Texas Mutual Assistance Group (TXMAG).

Among smaller providers, statewide associations play a key role in assisting their memberships in securing and coordinating mutual aid. For example, the Oklahoma Association of Electric Cooperatives (OAEC) coordinates mutual aid responses for its members using a standardized agreement in place across the membership. OAEC works with FEMA and obtains information from affected members about how much assistance and equipment is needed, as well as coordinates logistics when possible. Oklahoma electric cooperatives can also coordinate their mutual aid through NationalOutages.com, which not only provides outage data but also allows cooperatives to submit and fulfill mutual aid requests for equipment and/or crews.[230] Municipal electric utilities that are members of the Oklahoma Municipal Alliance (OMA), purchase their power from the Oklahoma Municipal Power Authority (OMPA), or purchase power from the Grand River Dam Authority all have signed mutual aid agreements with OMA.[231]

During the 2020 October Winter Storm, twelve of OMPA's 42 member cities requested and received mutual aid. It is important to note that because voltages and construction of the lines and circuitry tend to differ between cooperative, investor-owned, and municipal electric providers, it can create safety issues in providing mutual aid across provider types. Therefore, mutual aid across provider types would be limited to logistical or transportation assistance rather than technical aid.

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[229] AEP Public Service Company of Oklahoma. *2017 Emergency Response Plan.* Submitted annually to OCC PUD. No changes since date listed.
[230] National Outages & Mutual Aid. *Electrical Preparedness & Response Solutions.* https://www.nationaloutages.com/mutual-aid/ (November 15, 2020).
[231] Oklahoma Municipal Power Authority. *Mutual Aid.* https://ompa.com/programs/mutual-aid/ (November 5, 2020).

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To ensure that electric providers have access to best practices in outage response, at the federal level, emergency response agencies provide guidance through the Federal Interagency Operational Plan (FIOP) regarding minimizing the time of electric outages. The FIOP *Power Outage Incident Annex* specifies the need for a tiered response at the lowest jurisdictional level within those areas with the greatest chance of rapid restoration and recommends a coordinated effort among government jurisdictions at all levels and with business and industry.[232]

This objective is further addressed in a report from The President's National Infrastructure Advisory Council (NIAC) which sets forth recommendations for surviving catastrophic power outages.[233] Specifically, the NIAC recommends the following ongoing actions:

(1) Continue to coordinate efforts between government and industry through Emergency Support Function 12 (ESF 12) to prioritize rapid stabilization of the lifeline including working with Grid Security Emergency stakeholders.
(2) Engaging the National Institute of Standards and Technology (NIST) and National Risk Management Center (NRMC) to promote infrastructure resilience and develop informed decision-making strategies through cross-sector management for assuring protection of critical infrastructure with a focus on lifeline functionality.
(3) Draw on information from FEMA's 2018-2022 strategic plan emphasizing a whole-community approach for disaster response that includes inculcating a culture of preparedness that encourages incentivizing risk mitigation through innovation.
(4) Calls upon utilities to develop plans for reducing load while ensuring critical areas have power during grid emergencies or catastrophic power outages; also recognizes energy assurance is a national security issue thereby requiring liability protections be put in place as they are not provided under the Federal Power Act.
(5) Continue to model and develop best practices for assessing impacts on infrastructure from catastrophic events causing outages to identify vulnerabilities and devise strategies for mitigation.
(6) Integrating collaborative activities between Cybersecurity and Infrastructure Security Agency (CISA); Transportation Security Administration (TSA); DOE's Office of Cybersecurity, Energy Security, And Emergency Response (CESER); and industry partners in support of pipeline cyber and physical security.
(7) Assuring efforts by the Energy Subsector Coordinating Council (ESCC) focus on updating and modernization of voice and data telecommunications systems important to grid operations; such efforts include removing critical system components from private control

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[232] U.S. Department of Homeland Security, (2017) *Power Outage Incident Annex to the Response and Recovery Federal Interagency Plans*. https://www.fema.gov/sites/default/files/2020-07/fema_incident-annex_power-outage.pdf (June 24, 2021).

[233] National Infrastructure Advisory Council. *Surviving A Catastrophic Power Outage: How To Strengthen The Capabilities Of The Nation*. https://www.cisa.gov/sites/default/files/publications/NIAC%20Catastrophic%20Power%20Outage%20Study_FINAL.pdf (June 21, 2021).

to improve real-time coordinated and backup communications capabilities in the aftermath of disasters.

In sum, the list below provides a variety of specific options and best practices to manage supply and demand available to Oklahoma's electric sector during energy emergencies. Additional details regarding each of these options can be found in Appendix E.

Managing Supply

- Participate in regional planning and transmission organizations (Southwest Power Pool)[234]
- Temporarily increase levels of coal stockpiling by electric utility companies
- Temporarily substitute Oklahoma coal for Wyoming coal in coal-fired power plants
- Utilize buy-back rates that pay customers to sell excess self-generated electricity back to the grid for utility credit
- Reduce voltage in the system
- Utilize large backup generation when mobile units are available
- Use locomotive generators for electricity generation in selected locations

Managing Demand

- Activate interruptible rates/curtailment programs
- Implement system-wide rolling blackouts
- Enact voluntary or mandatory curtailment of public building energy use
- Employ and/or expand time-of-use rates for residential and/or industrial users
- Utilize the co-generation or fuel switching capacity of university and industrial customers when available
- Conduct a public information program that promotes home energy assessments
- Conduct a public information program or enact an incentive program to purchase more efficient appliances, add insulation, or change lighting
- Conduct a public information campaign calling for electricity conservation
- Increase rates to customers of self-regulated cooperatives or municipal utilities
- Encourage or direct government facilities to improve energy efficiency
- Encourage or direct regulated utility providers to increase and/or provide additional programs to their customers that focus on energy efficiency.
- Utilize buy-back rates that pay customers to sell excess self-generated electricity back to the grid for utility credit

[234] Oklahoma is one of 14 states located within the footprint of the Southwest Power Pool (SPP) which operates as a Regional Transmission Organization (RTO). RTOs were formed to maintain electric reliability and coordination and are mandated by the Federal Energy Regulatory Commission (FERC) to ensure reliable supplies of power, adequate transmission infrastructure, and competitive wholesale prices of electricity. The major services of SPP are Facilitation of the Transmission Grid, Reliability Coordination, Transmission Service/Tariff Administration, Market Operation, Setting of Standards, Compliance Enforcement, Transmission Planning and Training. As a part of compliance, the SPP has a Regional Entity (RE) that enforces compliance with federal and regional reliability standards for users, owners, and operators of the region's bulk power grid.

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- Encourage the use of alternative fuels such as natural gas, propane, diesel, or wood as the fuel source for home heating

CRUDE OIL AND PETROLEUM PRODUCTS

> *"The oil and natural gas industry has long maintained and been acknowledged for its serious commitment to the safety of infrastructure, workers, and processes. Disruptive events, whether manmade or natural, should be approached with the same commitment to safety, resilience and the needs of the community."*[235]

Although the crude oil and petroleum sector has many unique attributes, just as in the electric sector, it takes actors from all parts of the industry to design, implement, and enforce the regulations, trainings, plans, and programs that are designed to prevent incidents or disruptions and—when they do occur—to lessen the incident severity and/or time needed for recovery.

Preparation and Preventative Measures

Just as in the electric sector, the state of Oklahoma and the oil and petroleum industry have preventative programs in place to avoid oil and petroleum-related accidents or incidents and ensure a safe and reliable supply for consumers.

To set the standard for safety and prevention, both federal and state agencies are actively involved in regulating the various segments of the oil and petroleum industries. At the federal level, much of the regulation occurs through the U.S. Environmental Protection Agency (EPA). At the state level, both the Oklahoma Corporation Commission (OCC) and the Department of Environmental Quality (DEQ) provide regulatory oversight.

The Oklahoma Corporation Commission has inspection and regulatory responsibilities for exploration and production activities on oil and gas lease sites to ensure protection of public health and safety and the environment, for safe transport of hazardous materials, and for safe storage of petroleum-based fuel. Within the exploration and production segment, the OCC's Oil and Gas Conservation Division regulates crude oil well sites in the state, utilizing four regional offices to conduct administrative and on-site activities. Each district office is comprised of a manager, an environmental quality expert, and field inspectors.[236] Regulation of the oil industry at the drilling site is structured by Chapter 10 of the OCC Rules.[237] Chapter 10 includes technical rules on safe well drilling, use of proper equipment, and protecting groundwater as well as reporting requirements for any site incidents. Inspectors visit well sites and issue field citations to ensure

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[235] American Petroleum Institute. *Oil and Natural Gas Industry Preparedness Handbook. (April 2016).* https://www.api.org/~/media/Files/Policy/Safety/ONG-Industry-Preparedness-Handbook-v2.pdf (June 21, 2021).
[236] Large urban areas in the state (Oklahoma City and Tulsa) also employ their own site inspectors.
[237] OAC 165:10

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compliance with Chapter 10. Each well site is inspected at least once every five years, but high risk and high-capacity wells are inspected much more frequently—often several times per year. These sites include those that utilize commercial disposal pits and those that have large on-site disposal pits. In addition to conducting field inspections and ensuring regulatory compliance, the inspectors also coordinate with county emergency managers to minimize the potential for impacts or emergencies to occur.

Within industry, Oklahoma production companies emphasize training as a key preventative strategy. For example, Devon Energy follows the U.S. Department of Homeland Security Exercise and Evaluation program to train not only employees but community partners, and also provides in-house trainings for employees on FEMA's National Incident Management System's Incident Command System (ICS) in advance of events.[238] Another major Oklahoma producer, Continental Resources, also utilizes a best practice ICS structure in its organizational Emergency Response Plan and includes environmental training as a core requirement for employees and contractors. Embedding training as a key component within emergency preparation plans expands employee and contractor knowledge and awareness and enhances compliance with environmental laws and regulations. Finally, producers can engage with local planners to keep them abreast of exploration and production activities, including health and safety briefings where local emergency management and regional Commission employees are in attendance. This ongoing dialogue prepares local officials to better respond in case of an incident at a wellsite.

Despite detailed safety requirements as well as a fully trained workforce, spills, accidents, or other drill site emergencies may still occur. Therefore, Oklahoma production companies are engaging in new programming to further reduce the possibility of supply disruptions while simultaneously increasing their potential to maintain normal operations under a variety of circumstances.

For example, although incidents occurring at individual pad sites are unlikely to impact wider supply, in cases of interruption of power to sites or to disposal wells, production impacts could be more widespread. Electrical outages have the potential to impact wider operations as the pumps to dispose of produced water are electric. One preventative strategy against these impacts, currently employed at Continental Resources[239] and ConocoPhillips,[240] is produced water recycling, which reduces the quantity of water needing disposal while reducing the company's freshwater use. With a smaller volume of water needing disposal, a production company can more easily move to an alternate disposal well, or store water at recycling facilities temporarily and continue oil and gas operations until electricity is restored. In addition, system flexibility or redundancies, such as the

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[238] Devon Energy. *Emergency Preparedness.* https://www.devonenergy.com/sustainability/governance/emergency-preparedness (November 16, 2020).
[239] Continental Resources. *2019 ESG Report.* https://clr.com/wp-content/uploads/2021/02/ESG-Report-2_15.pdf (June 21, 2021).
[240] ConocoPhillips. *Water: 2019 Performance Highlights.* https://www.conocophillips.com/sustainability/managing-local-environmental-risks/water/ (June 21, 2021).

ability to switch from transporting produced water via pipeline to transporting via truck, gives a producer the ability to maintain operations if one system is disrupted.

Within the transportation segment, the Commission's Pipeline Safety Department inspects and regulates all intrastate petroleum transmission and distribution pipelines, whether gas or liquid. Under state statute, all operators of hazardous liquid transportation systems must submit their plans annually to the Commission that include their operational and maintenance information for safety.[241] The Pipeline Safety Office within the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration regulates interstate lines.[242] These inspection and maintenance programs ensure a safe baseline of operation for pipeline facilities and significantly lessen the likelihood of a fuel supply interruption. More detail on pipeline inspections appears below in the section on natural gas.

Within the refining, fuel, and storage segment, the Oklahoma DEQ is responsible for monitoring safe practices at oil refinery sites, primarily from an air[243] and water quality[244] standpoint. The Department offers a 24-Hour Emergency Response & Environmental Complaints Hotline (1-800-522-0206) and an online complaint form[245] that both state officials and the general public can utilize. The DEQ Hotline is continuously staffed by knowledgeable employees who can both answer questions and refer to appropriate division contacts as needed. The division contact list is not publicized, but division experts can be reliably reached via the Hotline.

To limit fire and explosion dangers, once crude oil is refined and processed into petroleum, OCC once again assumes regulatory authority over the safe operation of storage tank systems in Oklahoma to prevent and contain pollution caused by leaking underground storage tank systems and to reduce the hazards of fire and explosion. Chapters 25, 26 and 29 of the OCC rules (OAC 165:25-26, 29) outline the Commission's authority in ensuring safe petroleum storage for any aboveground, below-ground, or petroleum storage tanks over 110 gallons. These rules are based on industry standards from the American Petroleum Institute[246] and National Fire Protection

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[241] O.S. § 52-1-47.4. Hazardous Liquid Transportation System Safety Act. Plan for Inspection, Operation, and Maintenance of Transportation System.
[242] U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. *Regulations and Compliance.* https://www.phmsa.dot.gov/regulations-and-compliance (June 21, 2021).
[243] OAC 252:100.
[244] OAC 252:616.
[245] The DEQ online complaint form is available at https://www.deq.ok.gov/environmental-complaints/ (June 21, 2021).
[246] Current API Standard 2350 for overfill prevention is the 5th Edition, (September 2020). Full text available for purchase at https://www.api.org/products-and-services/standards/important-standards-announcements/standard-2350 (June 21, 2021).

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Association.[247,248] The Commission's Petroleum Storage Tank Division (PSTD) ensures compliance with these standards, which cover antifreeze, motor oil, motor fuel, gasoline, kerosene, diesel, and aviation fuel. The division employs inspectors who annually check testing records at refilling stations as well as test the corrosion protection system on the fuel storage tanks. Inspectors have the authority to lock down tanks and request an investigation if non-compliance is discovered. In addition, to hasten the ability to remediate any spills and mitigate spill impacts, new stations must file blueprints of underground tanks and lines with the OCC PSTD.

The U.S. Environmental Protection Agency (EPA) also has a role in incident prevention as it is also involved with inspecting petroleum storage tanks. Under 40 CFR Part 280,[249] EPA inspectors conduct periodic inspections of storage tanks and, if violations are found, EPA works collaboratively with the OCC staff to lockdown the tank and remediate the violation. The provisions of 40 CFR Part 280 were strengthened in 2015 to include additional training and operation requirements, as well as standardization provisions, which should help ensure fewer releases or spills in the future.

Mitigation Measures and Restoration of Supply After Interruptions

In the event of a spill, explosion, or other well site emergency within the exploration and production sector, impacts can best be mitigated through a swift response. To ensure a quick response to incidents, under OAC 165:10-17, well owners are required to post emergency contact information on a placard at each site and report to the OCC any site incident, explosions, or fires as soon as possible. Chapter 10 requires well owners to report these incidents to the relevant OCC field office which then coordinates with the OCC Public Information Officer. In addition, an OCC Oil and Gas Conservation Division manager always carries a division emergency phone for notification of incidents. Finally, if a reportable incident does occur, well owners must file a remediation plan with the OCC. If a well is abandoned and an incident occurs, OCC can order this well plugged by using a state fund capitalized by oil well operators. In emergency situations, OCC can utilize a Governor's letter and an emergency hearing before the Commission to plug a well in a matter of days or less.

At the federal level, the U.S. EPA is also involved in regulating various aspects of the oil industry in Oklahoma in such a way that there is proactive communication between exploration and

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[247] Flammable and Combustible liquids are covered under NFPA 30 Flammable and Combustible Liquids Code (2018 Edition). Full text available for purchase via https://webstore.ansi.org/Standards/NFPA-Fire/NFPA302018?gclid=Cj0KCQiAhZT9BRDmARIsAN2E-J3FlzF8GvV6VnijTKqdwXBmKo1r9Mw7gt71PuU7Eft9Oa4HVCRvrCMaAr08EALw_wcB (June 21, 2021).
[248] Fuel Dispensing Facilities and Repair Garages are covered under NFPA Code 30A. Full text available for purchase at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=30A (June 21, 2021).
[249] United States Environmental Protection Agency. *40 CFR part 280 Rule Summary.* https://www.epa.gov/ust/revising-underground-storage-tank-regulation-revisions-existing-requirements-and-new (November 15, 2020).

production companies and first responders. Advance knowledge of the details surrounding well sites gives first responders the ability to more quickly respond when an emergency occurs. First, under Superfund Amendments and Reauthorization Act (SARA), Title III (The Emergency Planning and Community-Right-To-Know Act)—which is enforced by the EPA—requires operators to notify local first responders if chemicals are stored at the well site.[250] Key reporting criteria include providing critical hazardous materials information for developing emergency plans for incidents and accidents to the state and local emergency responders and Material Safety Data Sheets (MSDSs) for any hazardous chemicals according to hazard category. This information must be provided to the State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and local fire departments. Finally, any oil storage facility must file a Spill Prevention, Control, and Countermeasure Plan (SPCC) with the EPA.

In Oklahoma, the Department of Environmental Quality (DEQ) serves as the administrative arm of the SERC. DEQ outlines the specific provisions required for reporting under OAC 252:20-1-4 and makes this information available to LEPCs and local fire departments. This provision helps responders be prepared to adequately take precautions and respond more quickly to mitigate damage. Oklahoma has five refineries, all of which hold permits both through the Resource Conservation and Recovery Act and air permits that are issued by DEQ. The refineries are required to submit reports of unpermitted hazardous waste releases to the environment or excess emissions to the air directly to DEQ.

In addition to reports required to be submitted to DEQ or OCC, any CERCLA hazardous substance release in a quantity that equals or exceeds the Reportable Quantity for that substance, or a discharge of oil to a waterbody, must be reported to the National Response Center at (800) 424-8802.

Quick notification is also a key measure for storage facilities and in the retail segment. As an example, within this segment, if an incident does occur, station operators must report any release or any spill within 24 hours to the OCC PSTD at either its regular contact number (405) 521-4683 or 24-hour emergency number (405) 823-0994.

Overall, communication is the key aspect in swift response to oil and petroleum emergencies. More detail surrounding the emergency communication in this sector appears in the chapter "Energy Emergency Communications Procedures."

When an outage or incident does occur, it is critical that responders have a variety of options available to them to manage supply and demand for oil and petroleum. Therefore, as mentioned above, the list below outlines a variety of specific options officials and energy emergency responders may choose to take when responding to oil or petroleum accidents, incidents, or other disruptions. Additional details regarding each of these options can be found in Appendix E.

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[250] 42 U.S.C. Chapter 116.

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Managing Supply

- State of Oklahoma assumes control of fuel prioritization
- Temporarily lift Federal Motor Carrier Safety Regulations (FMCSR) for over the road transport trucks
- Top off fuel storage tanks in anticipation of an event that will impact gasoline transportation
- Encourage or require longer refill cycles for tanks, or wait until tank is completely depleted before the tank is refilled
- Request waivers from the U.S. Environmental Protection Agency (EPA) for the import of gasoline that does not meet local air quality requirements
- Request waivers from EPA to allow for high sulfur diesel products to be used for highway consumption
- Petition the EPA to allow refineries to sell gasoline out of season or to suspend the Reid Vapor Pressure Standard (RVP) for gasoline
- Petition the U.S. Department of Energy or President for an exchange or release of crude oil from the U.S. Strategic Petroleum Reserve

Managing Demand

- Conduct a public information campaign designed to encourage ridesharing.
- Conduct a public information campaign designed to encourage fuel-efficient driving practices.
- Trigger the Oklahoma Emergency Price Stabilization Act
- Offer discounted rates or incentives for utilizing any public transit options
- Increase the number or frequency of bus routes
- Reduce speed limits on roadways and/or increase the enforcement of either lowered or existing speed limits
- Conduct a public information campaign encouraging private sector telecommuting or teleworking
- Enact or support a telework or telecommuting policy for public employees
- Encourage staggered commute times for public and/or private employers and/or staggered school start times
- Curtail use of marine and off-road recreational vehicles
- Encourage the use of alternative fuels such as CNG, biofuels, or diesel

NATURAL GAS

> *"The physical operations of natural gas production, transmission and distribution make the system inherently reliable and resilient. Disruptions to natural gas service are rare. When they do happen, a disruption of the system does not necessarily result in an interruption of scheduled deliveries of natural gas supply because the natural gas system has many ways of offsetting the impact of disruptions."*[251]

[251] Natural Gas Council. *Natural Gas Systems: Reliable and Resilient.* http://martelli.us/ngcouncil/wp-content/uploads/2018/03/Report-Natural-Gas-Systems-Reliable-Resilient.pdf (June 21, 2021).

In Oklahoma's natural gas sector, there are several key components to energy resilience. In this sector, physical security and redundancies are key components of reliability, as well as appropriately implemented operations, training, and regulatory compliance. In addition, this sector includes varying contract terms for customers that contribute to the industry's ability to maintain a safe and stable supply of energy.

Preparation and Preventative Measures

Significantly, the natural gas sector benefits from natural resiliency due to the primarily underground nature of its infrastructure. Although this offers significant protection from the many weather events that impact Oklahoma, there are still a number of key mechanisms used by government agencies, associations, and the natural gas industry to prepare for and prevent natural gas-related accidents or incidents and ensure a safe and reliable supply for consumers.

First, just as the oil and petroleum industries are, the various segments of the natural gas industry in Oklahoma are also regulated by the state and federal entities to help ensure physical security and safety.

The preparation and preventative measures taken within the natural gas production segment is very similar to the oil and petroleum sector; drilling and wellsite protections and regulations outlined in the above section are applicable.

In the gathering, processing, and transportation segments, similar to the regulatory framework for oil and petroleum pipelines, the Pipeline Safety Division within the OCC is responsible under OAC Chapter 20 for ensuring that *intrastate* natural gas and hazardous pipeline operators comply with state and federal pipeline safety regulations. Federal requirements mandate that pipeline operators determine the integrity of their pipelines through testing for appropriate pressure and for physical weakness or threats, as well as keeping logs of this testing. Pipeline Safety's field supervisors and field inspectors inspect the records and field operations of operators statewide, as well as perform site inspections.[252] It is important to note that pipelines located between the wells and the gathering lines are not subject to state inspection or regulation except for reporting of major incidents; gathering lines located in rural areas (approximately 80% of the state) are also not subject to state regulation.

Interstate pipeline operators transport natural gas across state lines. These operators are subject to safety regulations enforced by the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA),[253] however PHMSA is in daily email contact with the OCC to inform staff of any interstate incidents or accidents. U.S. DOT also provides Pipeline Security Guidelines for interstate pipeline operators that include detailed procedures for

[252] OAC 165:20-13-12.
[253] U.S. Department of Transportation Pipeline Safety Regulations at 49 C.F.R. Parts 191 and 192.

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conducting risk analysis and implementing security procedures.[254] More about these guidelines are discussed in the cybersecurity section of this plan.

In addition, under 49 CFR Part 192:615, natural gas pipeline operators must have written plans in place to minimize the risk from gas pipeline emergencies; these plans include an emergency response plan.[255]

Complementary to the regulatory requirements, Oklahoma's natural gas companies have also made commitments to and investments in preventative measures within the gathering, processing, and transportation segment. For instance, ONEOK undertakes external leak detection using aerial patrols and on-site inspections and internal leak detection using pressure flow and computational pipeline monitoring, as well as its current initiative (nearing completion) to build a remote monitoring network for its cathodic protection system, which assists in reducing pipeline corrosion and increases system knowledge. This organization also requires all employees to undertake Emergency Response Action Plan training at least once every 12 months to ensure a workforce ready to respond quickly in case of an incident and thereby reduce impacts. To ensure readiness to coordinate with emergency response authorities, beginning in 2019, ONEOK also conducted nearly a dozen emergency response drills that involved law enforcement, fire and emergency medical providers.[256]

Also, within the transportation and storage segment, the interstate pipeline firms that serve Oklahoma customers increase resilience through the variety of contracts offered. These options, which include "firm," "interruptible," and "no-notice," allow the largest natural gas customers to ensure that they can meet their obligations.[257]

Within the storage segment, Oklahoma natural gas storage provides supply stability, as gas can be stored when demand is low and withdrawn during shortages or periods of high demand. Gas storage in Oklahoma occurs primarily in depleted oil and gas reservoirs, although a very small amount of storage occurs in aquifers.[258]

In the distribution segment of the industry, Oklahoma's major distribution utilities, CenterPoint Energy Oklahoma and ONEGAS (whose Oklahoma division is Oklahoma Natural Gas Company), have maintained their own preventative measures. CenterPoint remains responsible for the

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[254] Transportation Security Administration. *Pipeline Security Guidelines.* https://www.tsa.gov/sites/default/files/pipeline_security_guidelines.pdf (June 21, 2021).
[255] 49 CFR Part 192.615. Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. Emergency Plans.
[256] ONEOK. *2019-20 Sustainability Report*. https://issuu.com/oneok_inc/docs/one-200302_esg_report_book_v12.5_single_pgs_081220?fr=sNjEyNTEwNzg3NTk (June 21, 2021).
[257] Natural Gas Council. *Natural Gas Systems: Reliable and Resilient*. http://martelli.us/ngcouncil/wp-content/uploads/2018/03/Fact-Sheet-Natural-Gas-Systems-Reliable-Resilient.pdf (June 21, 2021).
[258] U.S. Energy Information Administration. *Underground Natural Gas Storage Capacity: Oklahoma (2009-2019).* https://www.eia.gov/dnav/ng/NG_STOR_CAP_DCU_SOK_A.htm (November 25, 2020).

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maintenance of its pipeline distribution system and engages in annual cathodic protection test point reads that determine if the protection is still what it needs to be to prevent corrosion. In addition, CenterPoint conducts a leak survey once a year for business customers and once every 3 years for residential customers. Oklahoma Natural Gas Company (ONG) similarly operates both Distribution and Pipeline Integrity Management Programs that not only maintain and inspect the distribution and pipeline infrastructure systems, but also focus on high consequence areas in particular. This plan incorporates the American Petroleum Institute Pipeline Safety Management guidelines referenced more in depth later in this section.

Additionally, the industry is now pivoting toward a higher focus on emergency management. In Oklahoma, ONG is embracing this strategy to work more closely with emergency management professionals, partners, and agencies due to the frequency of more isolated incidents.

As an additional and widely utilized resource, associations such as the American Petroleum Institute (API) make resources available to all Oklahoma companies that outline best practice in preparation for (and response to) emergencies related to the oil and natural gas sector. API's 2016 publication, *Oil and Gas Industry Preparedness Handbook* offers a chapter dedicated specifically to state and local preparation.[259] Its 2015 publication *ANSI/API Recommended Practice 1173: Pipeline Safety Management Systems*[260] has now been adopted by companies such as ONG within their company-wide plans. Industry members can also review evaluative reports such as the Natural Gas Council's 2017 *Natural Gas Systems: Reliable and Resilient* report, which summarizes the industry's actions and activities surrounding stable energy supply.[261]

Finally, and similarly to the electric sector, to prevent accidental disruptions, the Oklahoma One Call System, known as Okie811, requires companies and private citizens to call one number before digging on their property—by calling in the location of the proposed dig, natural gas utilities can come out and mark their lines to avoid damage to underground facilities.

Mitigation Measures and Restoration of Supply After Interruptions

Despite the overall reliability of the natural gas sector, accidents and incidents do occur.

To ensure oversight of the response to incidents that occur within the transportation segment, all pipeline operators subject to federal regulation 49 CFR Parts 192 (natural gas) and 195 (liquids) have reporting requirements and must report incidents or accidents of a certain magnitude both to

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[259] American Petroleum Institute. *Oil and Natural Gas Industry Preparedness Handbook.* https://www.api.org/-/media/Files/Policy/Safety/ONG-Industry-Preparedness-Handbook-v2.pdf (June 21, 2021).
[260] American Petroleum Institute. *ANSI/API Recommended Practice 1173: Pipeline Safety Management System.* https://www.api.org/~/media/files/publications/whats%20new/1173_e1%20pa.pdf (June 21, 2021).
[261] Natural Gas Council. *Natural Gas Systems: Reliable and Resilient*. http://martelli.us/ngcouncil/wp-content/uploads/2018/03/Report-Natural-Gas-Systems-Reliable-Resilient.pdf (June 21, 2021).

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the PHMSA and OCC's Pipeline Safety Section.[262] Reports of code violations go to the pipeline operator for correction. If the violation is serious or the operator repeatedly violates regulations, Pipeline Safety will recommend an enforcement action to be filed. In the case of an accident with environmental consequences, OCC and the Department of Environmental Quality have a Memorandum of Understanding that oversees cleanup of crude oil or condensates from gas. Federal requirements also apply through standards issued by the U.S. EPA.
In the distribution segment, in the case of a supply interruption or shortage, regulated natural gas companies will inform the OCC under the following circumstances:

- The outage involves a major regulator station or facility
- The outage may involve a high degree of public interest or concern
- The outage will have a duration of 4 hours or more and involve 1% or 50 customers or more, whichever is greater, of the company's total meter count

As the collection point for reports of pipeline emergencies, OCC's Pipeline Safety section maintains an on-call employee (rotates weekly) who is available in emergency situations that can be contacted 24/7. Pipeline Safety personnel are not first responders, but they play an important role as evaluators of information. Pipeline Safety personnel may call operators to substantiate information or send inspectors to commence an investigation. Operators are required to conduct failure investigations and the Pipeline Safety Section audits the operators to make sure such investigations are carried out.

Just as in the electric sector, regulated natural gas utilities are required by the OCC to plan for supply interruptions and, under the Oklahoma Administrative Code (OAC 165:45-9-2), an updated Restoration of Service Plan must be filed with the Commission each year. After an outage, the utility must communicate its progress in restoring service and must use the following guidelines when developing and implementing their plans:

> (1) Assessment of the extent of the service interruption and what resources (equipment, materials, and labor) will be required to restore service. The utility should also attempt to determine the number of customers affected and the geographic extent of the service interruption.
> (2) Determinations as to whether service restoration can be accomplished through the use of in-house personnel only or if contractors (personnel obtained from other utilities or third-party entities) will be required. The objective is to have service restored as soon as possible.
> (3) Identification of priorities for service restoration based upon emergency needs and upon ease of restoration for the greatest use of money, time, and effort. Priority shall

[262] Both the federal PHMSA and the State of Oklahoma outline in detail what magnitude of leak or incident requires reporting. For natural gas, the federal standard for intrastate operators is $50,000 in economic loss, loss of a life, worker injury, or a loss of 3 million cu. ft. of gas. The state standard for natural gas is any underground excavated damage.

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be given to any life-threatening situations known or discovered during restoration of service.

An excerpt from CenterPoint Oklahoma's 2020 restoration of service plan follows. This excerpt is representative of restoration of service plans across the natural gas sector:

> CenterPoint has identified a primary and secondary emergency contact and has provided full contact information for these individuals to the OCC's Public Information Officer as part of its Restoration of Service Plan. An outline of the CenterPoint Oklahoma's Emergency Operations Plan as it relates to restoration of service is as follows:
>
> A. Determine the geographic area of the Outage, Near Outage or Other disaster.
> B. Determine the cause and the time needed to restore gas service to the impacted area.
> C. Determine how many meters are involved and the manpower required for turn off and turn on operation.
> D. Notify proper management, civil authorities, etc., if necessary.
> E. Request the needed number of completely equipped service persons for the turn-off operation.
> F. Request the scrolls, route cards, address lists and/or maps be printed.
> G. Isolated the affected area by turning off valves, regulator stations, or other pressure control devices.
> H. Identify those responsible for conducting field operations.
> I. Implement turn-off procedures (without blind plates).
> J. Request supplemental completely equipped service persons for the turn on operation.
>
> i. Restore service to system.
> ii. Purge system at identified purge points.
> iii. Turn on customers, identify and give special attention to priority customer – (tag door of any customer that cannot be turned on at this time). Request supplemental completely equipped service persons for the turn-on operation.

Finally, just as in the electric sector, natural gas utilities maintain mutual assistance agreements to help speed the recovery process when major incidents happen. In September 2020, several major national gas associations announced that beginning in January 2021, their existing mutual aid agreements (of which Oklahoma utilities are a part) would be combined into a new, expanded National Mutual Aid Program. Participating associations include the American Gas Association (AGA), American Public Gas Association (APGA), Northeast Gas Association (NGA), Southern Gas Association (SGA), and the MEA Energy Association (MEA).[263]

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[263] American Gas Association. *News Release: Natural Gas Associations Band Together to Expand National Mutual Aid Program. September 15, 2020.* https://www.aga.org/news/news-releases/natural-gas-associations-band-together-to-expand-national-mutual-aid-program/ (June 21, 2021).

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When an event does occur, even as the industry works to limit the time of disruption, it is critical that responders have a variety of options available to them to manage supply and demand for natural gas while the interruption is occurring. Therefore, the list below outlines a variety of specific options officials and energy emergency responders may choose to take when responding to natural gas shortages. Additional details regarding each of these options can be found in Appendix E.

Managing Supply

- Activate interruptible rates/curtailment programs
- Temporarily lift wellhead restrictions on the production of natural gas to allow companies to pump as much as possible
- Allow pipeline pack to increase reserve supplies available
- Local gas distribution companies (LDC) can purchase additional gas to meet demand
- Gas companies that are drawing gas from storage facilities can increase the rate of withdrawal to meet increased short-term demand
- Encourage or require gas companies, when technically feasible, to access and utilize other sources of gas, such as LNG, propane air stations, and/or synthetic natural gas

Managing Demand

- Encourage or require a temporary reduction in natural gas usage in state facilities or by industrial users
- Request that large commercial and industrial customers reduce gas use by adjusting their thermostat settings or reducing gas-consuming industrial processes
- Encourage residential customers to lower thermostats and water heating settings, reduce hot water demand, and defer using gas appliances
- Curtail or shut off gas supply to customers, regardless of interruptible agreements in place.
- Increase retail rates to consumers
- Conduct a public information campaign and/or offer incentives that provide information, energy estimates, or discounts for the purchase and installation of more efficient natural gas appliances
- Encourage large industrial customers to participate in a gas buy-back program

PROPANE

Preparation and Preventative Measures

To ensure safety and minimize risk of accidents and incidents within the propane industry, Oklahoma's regulatory body, the LP Gas Administration, mandates safety compliance in storage, distribution, dispensing, transporting, and utilization of Liquefied Petroleum Gas (LPG), also known as propane gas. The LP Gas Administration also oversees safety in the manufacture, fabrication, assembly, sale, installation, or use in this state of LPG systems, containers, apparatus,

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or appliances.[264] The LP Gas Administration ensures a high level of safety by adopting national safety codes of the National Fire Protection Association (NFPA 58 and 54) and Oklahoma rules and enforces compliance through administrative penalties. Oklahoma Administrative code 420:10-1 provides the LP Gas Administration with the authority to set permitting, training, and safety requirements for the industry.[265] Oklahoma has some of the most stringent requirements in the nation.

Statewide associations also provide the industry with training opportunities to ensure a high level of confidence in safety. The Oklahoma Propane Gas Association (OPGA) (affiliated with the National Propane Gas Association) represents approximately one-third of companies in Oklahoma as its members. As a key effort in propane tank safety, OPGA, alongside its sister organization, the LP Gas Research, Marketing and Safety Commission (LP Gas Commission), provides consumer safety programs that give rebates for upgrades to consumer propane regulators.[266] The OPGA and LP Gas Commission also facilitate required trainings for propane company employees covering topics such as changes in national safety code, proper install of infrastructure upgrades, and changes to Oklahoma's administrative rules.[267] Finally, these groups do consumer outreach and education, providing consumers with educational materials on topics such as how to read a propane gauge, familiarity with the smell of propane, and overall propane safety.

Mitigation Measures and Restoration of Supply After Interruptions

As with the other energy sectors, quick response is key in mitigating impacts after propane incidents. In the case of accident or fire at any location where a propane system or equipment is involved, or any accident involving propane systems or equipment, the dealer that owns, operates, services, or installs the equipment is required to notify the LP Gas Administrator as soon as is feasibly possible. The LP Gas Administration then conducts an investigation following the incident.[268]

In the event of a supply disruption, the statewide associations can work with the Oklahoma Secretary of Energy and Governor's Office to get a time-of-service waiver for commercial drivers to more quickly allow propane to be delivered and restore supply faster.

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[264] State of Oklahoma LP Gas Administration. *About*. https://lpgas.ok.gov/about (November 23, 2020).
[265] OAC 420:10-1.
[266] State of Oklahoma LP Gas Administration. *Propane Safety*. https://oklpgas.org/propane-safety/ (November 23, 2020).
[267] State of Oklahoma LP Gas Administration. *Training and Education*. https://oklpgas.org/training-education/. (November 23, 2020).
[268] OAC 420:10-1-14.

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The list below outlines a variety of specific options officials and energy emergency responders may choose to take when responding to propane gas events. Additional details regarding each of these options can be found in Appendix E.

Managing Supply

- Seek CDL Time of Service waiver to increase ability to deliver supply faster
- Top off storage tanks if supply disruption can be predicted in advance

Managing Demand

- Refill tanks at a slower rate, allowing tanks to get emptier before refill
- Encourage use of alternative fuels such as wood for home heating until propane supply can be restored

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EMERGING ISSUES IN 21st CENTURY ENERGY ASSURANCE PLANNING

The section below highlights a diverse group of key issues that warrant special consideration from Oklahoma energy emergency planners and responders as they evaluate the robustness and completeness of emergency plans and response protocols that must address a changing landscape in the early 21st century.

GLOBAL PANDEMICS

The Severe Acute Respiratory Syndrome Coronavirus 2(SARS-CoV-2), commonly known as the 2019 Novel Coronavirus or COVID-19 and has recently caused a global pandemic that affected Oklahoma beginning in early 2020, brings to bear new considerations for both reliability planning for continuity of operations as well as emergency planning. All Oklahoma entities with a role in energy production, generation, and delivery have faced new challenges with workforce disruptions, supply chain disruptions, new equipment and supply needs for personal protective equipment (PPE), necessitated workflow alterations, increased uncertainty regarding demand for energy, and increased cyber risks due to distributed and remote work.

In addition, as energy emergencies have occurred during the pandemic such as the February 2021 Polar Vortex event, mutual aid response, and emergency sheltering have all implemented new procedures due to social distancing requirements for virus mitigation.

Many entities have already built new pandemic modules into their organization's emergency response plans but should evaluate whether their planning incorporates six key recommendations as excerpted from the North American Energy Reliability Corporation (NERC) Coronavirus Disease (COVID-19) Pandemic Contingency Planning Alert:[269]

- Recommendation #1: Develop and maintain suitable situational awareness of the current status of the spread of COVID-19 and credible future estimates of its spread and impacts. Incorporate the CDC's most current travel advisories into event planning and travel arrangements and consider practices to increase awareness of employees' personal travel plans to areas with active advisories.
- Recommendation #2: Reinforce good personal hygiene practices across the workforce. Consider measures to increase the frequency and extent of cleaning and disinfecting surfaces and equipment that comes into routine contact with multiple

[269] North American Electric Reliability Corporation. *Recommendation to Industry: Coronavirus Disease (COVID-19) Pandemic Contingency Planning (March 10, 2020).* https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC_Alert_R-2020-03-10-01_COVID-19_Pandemic_Contingency_Planning.pdf (May 12, 2021).

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people, particularly in business-critical spaces or confined spaces that may be more conducive to disease communicability. Such areas may include control rooms, shared vehicles, conference rooms, and break areas. Consider implementing additional access restrictions such as limiting visitors or nonessential meetings within these spaces and segregation of crews on shift work schedules.

- Recommendation #3: Review and update existing business continuity plans to ensure they are adequate to mitigate the direct impacts of a pandemic outbreak in the organization's footprint that creates staffing constraints for reliability and business functions. Recognize that a pandemic outbreak affecting the organization will also have similar effects on third-party contractors and supporting resources in the same footprint. Validate or develop thresholds and triggers for implementing increased flexible workforce arrangements and for more disruptive mitigations, and ensure these mitigations are harmonious with guidance from the CDC or Public Health Agency of Canada (PHAC) and local health agencies. Consider testing or exercising business continuity plans against a pandemic scenario.
- Recommendation #4: Assess the organization's resilience against disruption to the availability of critical components, materials, and support resources with supply chains originating or traversing significantly impacted regions globally. At the present time, this includes China and nearby Southeast Asian nations, so the most likely impact is expected to be to electronics, personal protective equipment and sanitation supplies, chemicals, and raw materials that are eventually transformed into goods directly purchased and used by North American asset owners and operators. Global transportation disruptions will also have ripple effects on the availability of these goods, particularly for "just-in-time" logistics systems. Organizations should work with their suppliers to understand current inventories of critical components throughout the supply chain, as well as their anticipated use and resupply rates, and identify changed risks to routine, planned, and contingency operations to prioritize efforts appropriately.
- Recommendation #5: Assess the need to adjust planned construction and maintenance activity schedules to prioritize the most important projects. Consider third-party support requirements and facility outage windows and understand consumption rates of spare parts and supplies required for both planned and contingency work. Adjust plans as needed to maintain safe and reliable operations through potential workforce availability or supply chain disruptions.
- Recommendation #6: Anticipate and prepare for coronavirus-themed opportunistic social engineering attacks. Spearphishing, watering hole, and other disinformation tactics are commonly used to exploit public interest in significant events. Take steps to ensure continued visibility and maintenance of cyber assets in the event of staffing disruptions. Ensure information and communications technology resources are appropriate to accommodate increased use of remote work arrangements consistent with business continuity plans without compromising security. Consider conducting planned stress tests for these arrangements.

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As information will continue to develop and evolve, organizations and agencies are also encouraged to keep abreast of changing guidance and public health recommendations that may update the guidance listed above. The U.S. Department of Energy has provided a listing of sector-specific websites that provide specific updates on the current COVID-19 pandemic;[270] in the event of future pandemics, Oklahoma organizations should look to these organizations to publish guidance specific to those incidents:

- American Public Power Association (APPA): APPA Coronavirus page
- American Gas Association (AGA): AGA Coronavirus page
- American Petroleum Institute (API): API Pandemic Resources page
- American Fuel and Petrochemical Manufacturers (AFPM): AFPMA COVID-19 page
- American Public Gas Association (APGA): APGA Coronavirus Resources page
- Edison Electric Institute (EEI): EEI Pandemic page
- Electric Power Research Institute (EPRI): EPRI COVID-19 Page
- Electricity Subsector Coordinating Council (ESCC): ESCC COVID-19 Resources
- International Association of Drilling Contractors (IADC): IADC COVID-19 Update page
- International Liquid Terminals Association (ILTA): ILTA Pandemic Resources page
- Interstate Natural Gas Association of America (INGAA): INGAA COVID-19 Response page
- National Propane Gas Association (NPGA): Hours of Service Waivers page
- National Rural Electric Cooperatives (NRECA): NRECA COVID-19 page
- Petroleum Marketers Association of America (PMAA): PMAA Coronavirus Resources page
- Offshore Operators Committee: COVID-19 Mitigations page

DIVERSIFICATION OF THE TRANSPORTATION SECTOR

Over the past decade, Oklahoma has seen significant diversification of its transportation sector. Having fleet, emergency, and public transportation vehicles, as well as private vehicles that utilize diverse fuel sources provides additional reliability that in the event of an electrical outage or one type of fuel shortage, at least a portion of an organization's fleet or response vehicles will still be operational. Alternative fuel vehicles can also play a key role in storm recovery or to assist with evacuations after widespread events that may cause traditional gasoline shortages, as was demonstrated on the U.S. East Coast after Hurricane Sandy caused gasoline shortages and CNG buses, garbage trucks, and dump trucks were some of the only vehicles able to secure fuel and operate, providing much needed assistance in storm cleanup and service provision.[271]

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[270] U.S. Department of Energy Office of Cybersecurity, Energy Security, and Emergency Response. *COVID-19 Energy Sector Response Efforts and Frequently Asked Questions. (March 2020).* https://www.energy.gov/ceser/articles/covid-19-energy-sector-response-efforts-and-frequently-asked-questions (May 13, 2021).

[271] Motor Week. *AutoWorld: Sandy Recovery*. https://www.motorweek.org/features/auto_world/sandy_recovery (May 14, 2021).

In 2017, the most recent year of published data, Oklahoma had 5,723 alternative fuel fleet vehicles on the road in the state. These vehicles were primarily fueled by ethanol (E85) but also included compressed natural gas (CNG), electricity, and liquefied petroleum gas. Together these vehicles utilize over 1 million gallons of alternative fuel annually.[272] Given the significant lag in data reporting, these figures are likely a significant undercount of alternative fuel vehicles in the state, particularly electric vehicles. In Oklahoma, the Clean Cities Coalition program staff report that Oklahoma is currently second in the nation for electric vehicles per capita, and ninth in CNG fueling. Other trends include a reduction in light duty CNG usage, and an increase in light, medium and heavy-duty electric vehicle usage.[273] To maximize understanding of resource availability and capacity, assurance planners in Oklahoma may wish to engage in a coordinating activity to maintain regular updates to alternative fuel vehicle inventories and consider a mechanism for information sharing with state emergency officials.

Oklahoma is also developing the fueling infrastructure to support the increasing number of alternative fuel vehicles in the state. As of this writing, Oklahoma offers 116 CNG fueling stations, 75 E85 fueling stations, 304 EV charging stations, and 122 propane fueling stations.[274] More complete location and contact information for these stations can be found https://www.alternativefuellocal.com/states/oklahoma/. Other resources to access station maps include Plugshare.com for electric vehicles and https://afdc.energy.gov/stations/#/find/nearest for any type of alternative fuel vehicle.

Energy assurance planners, emergency responders and other energy sector stakeholders in Oklahoma can utilize the Clean Cities Coalition[275] as a resource for information and data on emerging technologies and market dynamics, trainings, and opportunities for financial incentives to implement alternative fuels into emergency response. The National Alternative Fuels Training Consortium[276] also partners with the Clean Cities program to offer trainings nationwide to first responders across sectors and can serve as a resource for Oklahoma entities wishing to understand, implement, or operate additional alternative fuel vehicles within their organizations.

As Oklahoma continues to further develop its fueling and charging infrastructure for alternative fuel vehicles, particularly electric vehicles, the state may also be able to explore vehicle-to-grid (V2G) technologies for use in energy emergencies. Although the technology is not yet cost effective for implementation, in the future, electric buses or larger fleet vehicles with a full charge may be able to serve as an electric source in emergency situations or during high peak demand.

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[272] U.S. Energy Information Administration. *Renewable and Alternative Fuels, Alternative Fuel Vehicle Data,* https://www.eia.gov/renewable/afv/users.php?fs=A&uyear=2017&ufueltype=cng,evc,e85,hyd,lng,lpg,oth (May 21, 2020).
[273] Interview with Association of Central Oklahoma Governments staff. October 7, 2020.
[274] U.S. Department of Energy Alternative Fuels Data Center. *Alternative Fueling Station Counts by State.* https://afdc.energy.gov/stations/states (May 14, 2021).
[275] Oklahoma Clean Cities Coalition. *Home.* http://www.okcleancities.org/home (June 21, 2021).
[276] National Alternative Fuels Training Center. *Home.* https://naftc.wvu.edu/ (May 14, 2021).

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Some early work on V2G potential was funded through the New York State Energy Research and Development Authority (NYSERDA) and may be a suitable reference for Oklahoma planners who wish to engage in initial explorations or discussions about this future potential.[277]

Finally, energy assurance planners may wish to explore the possibility for solar electric vehicle charging (portable or stationary) as a further redundancy to ensure operational vehicles within their fleets should other electric generation fuel sources be disrupted. Currently, much of the discussion on solar EV charging focuses on household-level charging, however solar EV fleet charging is an emerging topic that should be monitored.[278] More discussion about solar electricity generation and energy storage can be found in the storage subsection of this chapter.

RENEWABLE ENERGY, ENERGY STORAGE, AND DISTRIBUTED GENERATION

Although Oklahoma has utilized renewable energy, particularly wind but also hydroelectric and solar power, for many years, new tools are emerging that when used in conjunction with renewable energy, enable it to grow in its role to provide a reliable and resilient energy system for the state. One emerging tool in reliability planning that is increasingly commonly paired with renewable energy resources is energy storage, primarily focusing on battery technology. Energy storage is increasingly important as battery technology advances and becomes more cost-effective, as intermittent resources such as renewables play an increasing role in the fuel mix, and as Oklahoma experiences increasingly common extreme weather events that can cause demand spikes, short term outages, and temporary reductions from baseload energy sources. Energy storage systems offer myriad benefits in conjunction with renewable energy resources. They can provide near-instantaneous capacity during peak demand events, smooth out fluctuations in energy production, and provide a hedge against short term outages.

As shown in the "Energy Profile for Oklahoma" chapter of this plan, renewable energy, and particularly wind energy is a significant and growing component of Oklahoma's fuel mix, providing many benefits including diversification of fuel sources, zero ongoing fuel costs, and environmental benefits. Wind energy frequently sets penetration records within the Southwest Power Pool and electric providers and individual property owners are expressing increasing interest in generating electricity from low-carbon sources. However, along with these benefits comes the challenge of using an intermittent generation resource when needing to provide stable, reliable electricity. Energy storage is one way to smooth out potential fluctuations in renewable energy production.

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[277] New York State Energy Research and Development Authority. *New York State Grid-Interactive Vehicle Study: Roadmap. Final Report. (December 2015).* https://www.nyserda.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Transportation-Reports (May 14, 2021).
[278] McKinsey Sustainability. *Charging Electric Vehicle Fleets: How to Seize the Opportunity (March 10, 2020).* https://www.mckinsey.com/business-functions/sustainability/our-insights/charging-electric-vehicle-fleets-how-to-seize-the-emerging-opportunity# (June 28, 2021).

The Skeleton Creek project in Major, Alfalfa, and Garfield counties provides a case study as the first wind-solar-storage hybrid renewable system in the Southwest Power Pool territory and serves as a nation-leading, utility scale example of how a 200 megawatt, 4-hour battery system can back up 500 megawatts of solar and wind production and operate more similarly to a traditional power plant.[279] There are 250 MW of wind production already in service for this project, and the 250 MW of solar and battery backup will be operational by 2023.[280] The electricity generated from the project will be utilized by Western Farmers Electric Cooperative. Reliability planners interested in smaller utility scale battery projects may also wish to review the Rush Springs storage project, commissioned in late 2020, which provides a 10 MW, 2-hour battery backup to the Rush Springs Wind Energy Center near Marlow, Oklahoma.[281]

Although today Oklahoma primarily uses wind as a renewable and intermittent resource, as solar energy becomes a growing component of the state's fuel mix, storage technologies will become increasingly vital for solar installations as well. One case study through the American Center for an Energy Efficient Economy examined the ability of solar plus storage to provide resiliency after an earthquake event in California;[282] Oklahoma may wish to look at exemplary studies to engage in a fuller understanding of how storage can support existing renewable resources as an energy assurance planning tool. Understandably, adding storage to any energy installation also adds cost; although battery technology is improving in efficacy for short term fluctuations and outages, and battery costs continue to fall, planners should utilize valuation models to better assess the cost-benefit tradeoffs.[283]

Another emerging tool that Oklahoma energy assurance planners should remain aware of as a resiliency enhancement, which can assist with longer term outages due to high-impact, low probability events such as extreme weather, is utilization of distributed energy resources (DER). A DER is:

> *"a resource sited close to customers that can provide all or some of their immediate electric and power needs and can also be used by the system to either reduce demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if*

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[279] Energy Storage News. *Turbines operational at Skeleton Creek wind-solar-storage hybrid project in Oklahoma. (January 5, 2021).* https://www.energy-storage.news/news/turbines-operational-at-skeleton-creek-wind-solar-storage-hybrid-project-in (June 21, 2021).
[280] NextEra Energy Resource. *Skeleton Creek Project Overview.* https://www.nexteraenergyresources.com/skeleton-creek-project/project-overview.html (May 16, 2021).
[281] OK Energy Today. *NextEra unveils Oklahoma's first battery energy storage system*. http://www.okenergytoday.com/2020/11/nextera-unveils-oklahomas-first-battery-energy-storage-system/ (May 16, 2021).
[282] ACEEE. *Solar + Storage for Resiliency.* https://www.aceee.org/files/proceedings/2016/data/papers/11_1046.pdf (May 14, 2021).
[283] National Renewable Energy Laboratory. *Valuing the Resilience Provided by Solar and Battery Energy Storage Systems.* https://www.nrel.gov/docs/fy18osti/70679.pdf (May 14, 2021).

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providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load."[284]

DER can take many forms, some of which, like energy efficiency, are more mature mechanisms and are discussed in the "Energy Profile for Oklahoma" chapter, but key emerging formats that may be particularly relevant for Oklahoma resiliency include resilient solar, combined heat and power (CHP), and/or microgrid systems.

First, as property owners also take an increasing interest in renewable energy generation located onsite at residential, small commercial, and critical facility locations, primarily rooftop solar photovoltaic generation, they are also beginning to invest in battery or diesel generation backups for their systems, creating a more resilient distributed energy resource that can operate during electrical outages or provide emergency power to critical facilities.[285] Notably, additional regulatory rate design is needed to enable more widespread solar plus storage functionalities.[286] In addition, there are numerous considerations to take into account from a siting and technical perspective before a solar plus storage resource is considered. Planners interested in the detailed specifications to consider may wish to review Chapter 5.9 of the National Renewable Energy Laboratory report *Best Practices for Operation and Maintenance of Photovoltaic and Energy Storage Systems; 3rd Edition* at https://www.nrel.gov/docs/fy19osti/73822.pdf.

Some essential facilities around the nation have begun exploring CHP systems (also known as cogeneration systems) to stay operational for critical functions such as patient care during more extended electric outages that could occur more frequently if the existing trend of more frequent severe, extreme weather events leads to blackouts.[287] A CHP system typically uses waste heat from electrical generation to create energy for heating and cooling needs, reducing the facility's load profile during times of normal energy delivery. However these systems can also be designed specifically to provide power for essential functions separate from the grid during emergency situations and serve as a backup generation system, if the system is configured to do so as part of

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[284] NARUC Staff Subcommittee on Rate Design. (2016). *Distributed Energy Resources Rate Design and Compensation*. Washington, DC: National Association of Regulatory Utility Commissioners.
[285] National Association of Regulatory Utility Commissioners. *The Value of Resilience for Distributed Energy Resources: An Overview of Current Analytical Practices. (April 2019).* https://pubs.naruc.org/pub/531AD059-9CC0-BAF6-127B-99BCB5F02198 (June 21, 2021).
[286] National Renewable Energy Laboratory. *An Overview of Behind-the-Meter Solar-Plus-Storage Regulatory Design: Approaches and Case Studies to Inform International Applications (March 2020).* https://www.nrel.gov/docs/fy20osti/75283.pdf (June 21, 2021).
[287] U.S. Environmental Protection Agency. *HP for Hospitals: Superior Energy for Superior Patient Care.* https://www.epa.gov/chp/chp-hospitals-superior-energy-superior-patient-care (May 16, 2021).

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the design.[288, 289] As hospitals, nursing facilities, and emergency response headquarters sense more frequent or severe risk from energy disruptions in Oklahoma, planners and energy providers should be aware of the feasibility of CHP systems and of the growing interest from essential facilities to increase the resiliency of their critical infrastructure and buildings. Today, most CHP systems use natural gas as the primary fuel source, but interest is growing in hybrid systems that incorporate renewable energy and use CHP generation as a foundation for the microgrid systems that are beginning to operate around the United States.[290,291] Oklahoma energy assurance planners interested in additional resilience should remain abreast of developments related to deployment of microgrids.

As all the distributed energy, hybrid energy and storage systems, and technologies mentioned above carry additional costs and technical requirements, careful considerations must be undertaken as any Oklahoma entity considers upgrading for reliability or resiliency. For those wishing additional resources, the U.S. Energy Information Administration offers specific evaluations of cost and feasibility of many of the above systems in its 2020 report *Distributed Generation, Battery Storage, and Combined Heat and Power System Characteristics and Costs in the Buildings and Industrial Sectors.*[292] However, Oklahoma must remain aware of and involved with meeting the modern challenges of energy reliability, resilience, and assurance and thus should not overlook market and technological developments that could aid in the state's preparedness for energy disruptions.

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[288] U.S. Department of Energy, Energy Efficiency & Renewable Energy Building Technologies Program. *Hospitals Discover Advantages to Using CHP Systems.* https://www1.eere.energy.gov/buildings/publications/pdfs/alliances/hea_chp_fs.pdf (June 21, 2021).
[289] ICF International, prepared for Oak Ridge National Laboratory. *Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities. (March 2013).* https://www.energy.gov/sites/prod/files/2013/11/f4/chp_critical_facilities.pdf (June 21, 2021).
[290] Combined Heat and Power Alliance. *CHP Systems are the Backbone of Microgrids Across the United States.* https://chpalliance.org/chp-systems-are-the-backbone-of-microgrids-across-the-united-states/ (June 24, 2021).
[291] U.S. Department of Energy and Entropy Research, LLC. *State of the CHP Industry and Market Trends.* https://www.energy.gov/sites/default/files/2020/09/f79/3%20Market%20Status_compliant.pdf (June 24, 2021).
[292] U.S. Energy Information Administration. *Distributed Generation, Battery Storage, and Combined Heat and Power System Characteristics and Costs in the Buildings and Industrial Sectors (March 2020).* https://www.eia.gov/analysis/studies/buildings/dg_storage_chp/pdf/dg_storage_chp.pdf (June 21, 2021).

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CONCLUSION

Oklahoma's energy landscape is one-of-a-kind. In conjunction with the state's main emergency planning document—the Oklahoma Emergency Operations Plan—this Energy Assurance Plan represents a detailed picture of the energy industries of our state, outlines the history and potential for likely causes of energy emergencies, and presents policy and strategy options for decision makers to utilize when mitigating and responding to energy emergencies. It is intended as an additional "tool in the toolbox" for government and private sector partners to utilize in a way that will minimize the impact of future energy emergencies.

The importance of fostering an ongoing dialogue regarding energy assurance cannot be overstated. Therefore, it is Oklahoma's intent to regularly revisit the content of this Plan to ensure its accuracy, and to continue the conversation with government partners, energy providers, and other stakeholders to ensure that this Energy Assurance Plan continues to best provide information and direction to energy planners and responders for many years into the future.

At any time, questions and comments regarding the Energy Assurance Plan may be directed to Secretary Kenneth Wagner at (405) 522-7099 or Kenneth.Wagner@ee.ok.gov.

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APPENDIX A:
QUICK REFERENCE CONTACT LIST

Agency	Contact Number
American Red Cross	(405) 228-9500
	(800) 733-2767
Grand River Dam Authority	(918) 256-5545
	(918) 256-0911
Oklahoma Association of Electric Coops	(405) 478-1455
Oklahoma Corporation Commission	(405) 521-2211
Oklahoma Dept. of Environmental Quality	(405) 702-0100
	(800) 522-0206
Oklahoma Dept. of Human Services	(877) 751-2972
Oklahoma Dept. of Public Safety/Emergency Highway Patrol	(405) 425-2424
Oklahoma Dept. of Transportation	(405) 521-6000
Oklahoma Emergency Management	(405) 521-2481
Oklahoma Homeland Security	(405) 425-7296
Oklahoma LP Gas Administration	(405) 521-2458
Oklahoma Military Department/Oklahoma National Guard	(405) 228-5000
Oklahoma Municipal Alliance	(405) 340-8313
Oklahoma Municipal Power Authority	(405) 340-5047
	(580) 763-8047
Oklahoma Petroleum Marketers & Convenience Store Association	(405) 842-6625
	(703) 351-8000
Oklahoma Propane Gas Association	(405) 424-1775
Oklahoma Secretary of Energy & Environment	(405) 522-7099
Oklahoma State Bureau of Investigation	(405) 848-6724
Oklahoma State Dept. of Health	(405) 271-0900
Oklahoma State Energy Office (in partnership with OSEE)	(800) 879-6552
	(800) 272-9741
Oklahoma Telephone Association	(405) 525-7700
Oklahoma Water Resources Board	(405) 530-8800

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APPENDIX B:
INFORMATION AND RESOURCES TO MONITOR ENERGY SUPPLY AND DEMAND, BY SECTOR

General Information

U.S. Energy Information Administration (EIA)
(http://www.eia.gov)
Provides a wide range of information and data covering energy production, inventories, demand, imports, exports, and prices. The EIA also prepares analyses and special reports on topics of current interest.

Monthly Energy Review
(http://www.eia.gov/totalenergy/data/monthly/index.cfm)
A monthly publication containing recent energy statistics and information including information about total energy production, consumption, and trade; energy prices; overviews of petroleum, natural gas, coal, electricity, nuclear energy, renewable energy, and international petroleum; carbon dioxide emissions; and data unit conversion values.

Energy Assurance Daily
(http://www.oe.netl.doe.gov/ead.aspx)
Provides a summary of public information concerning current energy issues. It is published Monday through Friday to inform stakeholders of developments affecting energy systems, flows, and markets. It provides highlights of energy issues including coverage of major energy developments in the electricity, petroleum, and natural gas industries; energy prices; and other relevant news.

Emergency Situation Reports
(http://www.oe.netl.doe.gov/emergency_sit_rpt.aspx)
Contains impact studies on the disruption of energy infrastructure caused by disasters such as hurricanes, a regional power blackout, wildfires, etc.

NOAA
(http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/)
The National Weather Service and National Oceanic and Atmospheric Administration (NOAA) provides data on cooling and heating degree days that can be helpful to development of forecasts of extreme weather conditions that create peak loads on the electrical generation system or increases in demand for gas for space heating.
National Weather Center
(http://www.ou.edu/nwc)

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The University of Oklahoma hosts the National Weather Center, which is a unique partnership of University of Oklahoma, NOAA, and state organizations that work together to improve understanding of events in Earth's atmosphere over a wide range of time and space. The National Weather Center has played a key role in weather forecasting during previous Oklahoma emergencies and remains a valuable local resource.

Monitoring Electricity

Electric Power Monthly
(http://www.eia.gov/electricity/monthly/index.cfm)
Monthly report on electricity sales and electricity production, by state, month, sector, and power generation fuel.

Hourly Electric Grid Monitor
*(*https://www.eia.gov/beta/electricity/gridmonitor/dashboard/electric_overview/US48/US48?src=email)
Hourly grid monitor that tracks generation and demand by region and energy source.

Quarterly Coal Report
(http://www.eia.gov/coal/index.cfm)
Quarterly report that lists the amount of coal consumed in each state and prices paid by each sector. It also estimates levels of fuel inventories by utility and reports the number of days of fuel supply on hand at each location for coal- and oil-fired plants.

Regional System Reliability Forecast
(http://www.nerc.com/pa/RAPA/Pages/default.aspx)
The North American Electric Reliability Corporation (NERC) publishes annual reports of regional system reliability that assess regional reserve margins by comparing net system availability with peak load projections and system-pool reserve availability.

Electric Emergency Incident and Disturbance Report
(http://www.oe.netl.doe.gov/oe417.aspx)
Provides information on electric emergency incidents and disturbances. Used by the Department of Energy to fulfill its overall national security and other energy emergency management responsibilities, as well as for analytical purposes.

Oklahoma Gas and Electric Outage Map
(https://www.oge.com/wps/portal/oge/outages/systemwatch)
OG&E offers web-based outage information that can be accessed by the public.

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Public Service Company of Oklahoma Outage Map
(https://www.psoklahoma.com/outages)
PSO offers web-based outage information that can be accessed by the public.

Liberty Utilities Outage Map
(https://central.libertyutilities.com/all/residential/emergencies-outages/outages-map.html)
Liberty offers web-based outage information that can be accessed by the public.

Oklahoma's Electric Cooperatives Outage Map
(https://outages.oaec.coop/outages/maps)
OAEC offers web-based outage information that can be accessed by the public.

Oklahoma Municipal Power Authority Outage Map
(https://ompa.com/outages/)
OMPA offers web-based outage information that can be accessed by the public.

Monitoring Natural Gas

Natural Gas Monthly
(http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.html)
Provides data on natural gas production, supply, consumption, disposition, storage, imports, exports, and prices in the United States. The report is published by state, month, and sector.

CNGNow
(http://www.cngnow.com)
Provides nationwide information on locations and prices for Compressed Natural Gas for use as a vehicle fuel.

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration (PHMSA)
(http://www.phmsa.dot.gov/pipeline/library/data-stats/pipelineincidenttrends)
Provides information, by state, on pipeline incidents that may affect supply.

Monitoring Petroleum

U. S. Energy Information Administration Reports (EIA)
(http://www.eia.gov/petroleum/reports.cfm?t=214)
The EIA collects and analyzes data on petroleum prices, inventories, and demand. Reports are available on a weekly, monthly, and yearly basis.

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American Petroleum Institute
(http://www.api.org/products-and-services/statistics)
The API publishes information on the average pump price for gasoline, state motor fuel tax rates, and U.S. oil and petroleum product imports by country.

Federal Highway Administration
(http://www.fhwa.dot.gov/policyinformation/quickfinddata/qffuel.cfm)
The FHA publishes data, monthly and annually, on motor fuel usage across the United States.

GasBuddy
(http://www.gasbuddy.com)
Provides information on the lowest available price of gasoline and diesel fuel by city and state.

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APPENDIX C:
LEGAL AUTHORITY FOR ENERGY EMERGENCY PLANNING AND RESPONSE

The information below identifies the primary sources of legal authority that relate to energy emergencies in the state of Oklahoma. As is typical of all energy assurance activities, several levels of government have authorities and emergencies. Authorities listed are current as of 2020. This section is not intended to provide an exhaustive list of all energy emergency legislation, but rather the overarching authorities given to each level of government for energy emergency planning and/or response. References to sector-specific legislation are provided in the relevant Plan sections where appropriate.

State Authority

These state authorities were compiled after using a National Conference of State Legislatures (NCSL) Energy State Bill Database[293] search. The NCSL database led to identification of several House and Senate bills relevant to Oklahoma energy assurance activities since 2016. The bills were cross-checked during a concurrent search of the Oklahoma State Legislature Bill Search database. This effort was intended to not only verify the information identified through the NCSL query, but to also assure the bills were appropriately categorized as new or amendments to existing legislation. Importantly, this process did not identify any changes to the existing primary legal authorities previously identified, although numerous new or amended legal directives were identified that are referenced in relevant sections of the Plan as noted above.

Oklahoma Emergency Management Act (63 O.S. § 63-683.1-63.683.36)
This law replaced the Oklahoma Civil Defense and Emergency Resources Management Act of 1967 as the primary state law detailing emergency management in Oklahoma. It declared the policy of Oklahoma to be that all emergency management and hazard mitigation functions of the state be coordinated to the maximum extent with comparable functions of the federal government, other states and localities, and private agencies. The goal is to assure the most effective preparation and use of the available workforce, resources, and facilities for dealing with disaster and hazard mitigation. Each state agency, board, commission, department, or other state entity having responsibilities either indicated in the state Emergency Operations Plan must have written plans and procedures in place to protect individual employees, administrators, and visitors from natural

[293] National Conference of State Legislatures, *Energy State Bill Tracking Database.* https://www.ncsl.org/research/energy/energy-legislation-tracking-database.aspx (June 18, 2021).

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and man-made disasters and emergencies occurring at their workplace. All such plans and procedures are made in concurrence with Oklahoma Department of Emergency Management (OEM), which is responsible for establishing an OEM Guidebook titled "Emergency Standard Operating Procedures." Each state agency, board, commission, department, or other state entity must provide an annual report on the status of their emergency management program to OEM. OEM then must compile and integrate all reports into a report to the Governor and Legislature on the status of state emergency preparedness.

Oklahoma Emergency Response Act (27A O.S. § 27A-4-1-101 – 27A-4-1-106)
The purpose of this 1993 Act is to provide a rapid, coordinated, and effective network for response to dangerous substance incidents or events necessary to protect the public health and safety of this state and to preserve property. It also seeks to provide direction and information to responders for the management of dangerous substance incidents or events and to reduce the duplication of effort between local, county, and state entities. Finally, the Act sought to organize, prepare, and coordinate all state available manpower, materials, supplies, equipment, facilities, and services necessary for dangerous substance response.

Oklahoma Emergency Price Stabilization Act (15 O.S. § 15-777.1)
In 1999, Oklahoma enacted the Oklahoma Price Stabilization Act to prevent unwarranted price increases shortly after the occurrence of a disaster in the state. Once the Governor or President has declared a state of emergency, the bill prohibits prices from rising more than 10 percent in the covered area. Violators will face up to a year in prison and a fine of up to $1,000, as well as penalties of up to $10,000 and restitution.

Oklahoma Homeland Security Act (74 O.S. § 74-51.1)
The Oklahoma Homeland Security Act was established to respond to acts of terrorism that may occur in the state. The Act created the Oklahoma Office of Homeland Security (OOHS) as well as establishing the position of Homeland Security Director to head the office. The Governor is appointed as the state's chief counterterrorism official and places administrative responsibility on the director. Among other things, OOHS is tasked with developing, coordinating, implementing, and administering a comprehensive state plan for responding to events such as acts of terrorism, public health emergencies, cyberterrorism, or incidents involving weapons of mass destruction. Likewise, the Act designates OOHS as the agency responsible for developing interoperable public safety communications planning for the state.
NOTE: In August 2020, Governor Stitt issued Executive Order 2020-25 that consolidated OOHS under the Office of Emergency Management.[294]

References to agency, organization or industry-specific statutory responsibilities, mandates and programs can be found in the sector-specific sections of this Plan.

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[294] State of Oklahoma, Secretary of State. https://www.sos.ok.gov/documents/filelog/93659.pdf (June 16, 2021).

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Federal Authority

A listing of key federal energy emergency authorities appears below. This section includes major federal authorities related to cybersecurity, which although not specific to energy emergencies, are important to reference given the volume of critical infrastructure that exists within the energy sector.

Homeland Security Presidential Directive 5 (HSPD - 5)
This directive enhances the ability of the United States to manage domestic incidents by establishing a single, comprehensive National Incident Management System (NIMS). It requires all federal departments and agencies to cooperate with the Secretary of Homeland Security by providing their full and prompt cooperation, resources, and support as appropriate and consistent with their own responsibilities for protecting the nation's security. This action also directed the development of the National Response Framework (NRF) which was established to align federal coordination structures, capabilities, and resources into a unified, all-discipline, and all-hazards approach to domestic incident management. Additionally, the NRF directs that state, local, and tribal governments as well as non-governmental organizations utilize NRF-established incident reporting protocols, modify existing plans to ensure alignment with the NRF, and notify the Secretary of Homeland Security of any substantial conflicts between the NRF and state or tribal government laws or regulation.

Presidential Policy Directive 8: National Preparedness (PPD-8)
This Directive strengthens U.S. security and resilience through preparation for the threats that pose the greatest risk to the security of the nation, including acts of terrorism, cyber-attacks, pandemics, and catastrophic natural disasters. The five mission areas included in PPD-8 include Prevention, Protection, Mitigation, Response and Recovery.

Presidential Policy Directive 21: Critical Infrastructure Security and Resilience (PPD-21)
Issued in February 2013, this directive revokes Homeland Security Presidential Directive 7 (HSPD-7) and establishes a national policy on critical infrastructure security and resilience, structured around three strategic imperatives: 1) to refine and clarify functional relationships across the Federal Government to advance the national unity of effort to strengthen critical infrastructure security and resilience; 2) to enable effective information exchange by identifying baseline data and systems requirements for the Federal Government; and 3) to implement an integration and analysis function to inform planning and operations decisions regarding critical infrastructure. It required DHS to create an update to the National Infrastructure Protection Plan that addresses the implementation of PPD-21, the requirements of Title II of the Homeland Security Act of 2002 as amended, and alignment with the National Preparedness Goal and System required by PPD-8; and create a National Critical Infrastructure Security and Resilience R&D

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Plan[295] that takes into account the evolving threat landscape, annual metrics, and other relevant information to identify priorities and guide R&D requirements and investments.

Homeland Security Policy Directive 23: Cybersecurity Policy (HSPD-23)
This directive, also known as NSPD-54, outlines the nation's cybersecurity policy, strategy, and implementation procedures. This directive is the foundational legal authority for the Comprehensive National Cybersecurity Initiative (CNCI).

Presidential Policy Directive 41: United States Cyber Incident Coordination (PPD-41)
This directive provides the framework for the federal government's response to any cyber incident, whether involving public or private entities. It also establishes lead federal agencies for major incident response.

Robert T. Stafford Disaster Relief and Emergency Assistance Act
The Federal Emergency Management Agency (FEMA), following a presidential declaration of emergency or major disaster, provides assistance; such assistance may require support from other Federal agencies including acquiring resources and personnel to support state and local emergency and disaster assistance efforts. Requests for a presidential declaration of an emergency or major disaster must be made by the Governor of the affected state based on a finding by the Governor that the situation is of such severity and magnitude that effective response is beyond the capabilities of the state. DOE supports DHS/FEMA relief efforts by assisting federal, state, and local government and industry with their efforts to restore energy systems in disaster areas. When necessary, DOE also may deploy response staff to disaster sites. DOE is the lead agency directing Emergency Support Function-12 (Energy), which assists the restoration of energy systems and provides an initial point-of-contact for the activation and deployment of DOE resources. These activities are performed pursuant to the Stafford Act and HSPD-5 (Management of Domestic Incidents) and National Response Plan (NRP).

The Federal Power Act (FPA)
This Act is the primary federal statute governing the wholesale transmission and sale of electric power as well as the regulation of hydroelectric power. Pertinent to this plan, section 202(c) allows the Secretary of Energy discretion to initiate connections or other such efforts to best address the emergency and serve the public interest; this authority expressly emphasizes response during a war in which the United States is engaged or when emergencies exist that require a sudden increase in demand for electric energy—due to generation or transmission issues or a lack of fuel for such activities.

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[295] U.S. Department of Homeland Security, *National Critical Infrastructure Security and Resilience Research and Development Plan.* https://www.dhs.gov/sites/default/files/publications/National%20CISR%20R%26D%20Plan_Nov%202015.pdf (June 18, 2021).

A thorough listing of federal acts, authorizations, and references, including sector-specific authorities, can be found in Appendix C of the State Energy Assurance Guidelines developed by the National Association of State Energy Officials (NASEO) (Version 3.1, December 2009).[296]

Local Authority

Political Subdivisions-Emergency Management Programs-Emergency Management Directors (63 O.S. § 63-683.11)
Oklahoma statutes require that all incorporated jurisdictions in the state develop emergency management programs. County jurisdictions are also required to have a qualified emergency management director. A complete list of these emergency management directors can be found on the Office of Emergency Management's website.[297] Any incorporated municipality must either have their own emergency management director or create an agreement with the county for emergency management services. These emergency management organizations must develop local emergency operations plans that include preparedness, response, recovery, and mitigation. These plans must be based on a hazard and risk assessment. Finally, the statute requires that localities coordinate their plans with state level officials.

Public Health and Safety-Statewide Mutual Aid System (63 O.S. § 63-695.2)
In the case that an emergency occurs which is too great for the locality to deal with unassisted, Oklahoma statute also provides for local emergency management directors to enter into mutual aid agreements for reciprocal emergency management aid and assistance. Localities may work with other public or private agencies in the state, and if granted approval by the governor, work with emergency management organizations in bordering states. States may also develop Emergency Management Assistance Compacts (EMAC) for interstate aid and assistance requests, although states are not required to provide assistance under compacts.

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[296] National Association of State Energy Officials, *State Energy Assurance Guidelines* (Version 3.1, December 2009, p. 44). *http://www.naseo.org/eaguidelines/* (June 18, 2021).
[297] Oklahoma Department of Emergency Management, *Oklahoma Emergency Management Directors*, https://oklahoma.gov/content/dam/ok/en/oem/documents/Oklahoma%20Emergency%20Management%20Directors.pdf (June 18, 2021).

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APPENDIX D:
COOPERATIVES SERVING OKLAHOMA

Oklahoma statute 17 O.S. §158.27 allows electric cooperatives to opt out of price regulations and be self-governing with an elected board of directors accountable to their customers. Most of the cooperatives in the State have opted for the self-regulatory option. While the OCC does not directly regulate these cooperatives in terms of rates, the OCC is responsible for monitoring the status and reliability of each provider and, for those cooperatives that have not opted out of price regulation, for monitoring the accuracy and prudence of purchased power costs passed on to their Oklahoma customers through the Purchased Power Adjustment Clause.

Those that have not opted out of price regulation and whose service reliability and pricing is regulated by the OCC are:

- Arkansas Valley Cooperative
- Canadian Valley Electric Cooperative*
- Northeastern Oklahoma Electric Cooperative**
- Rich Mountain Electric Cooperative
- Southwest Arkansas Electric Cooperative

The cooperatives that have opted out of price regulation by the OCC but that are still under the Commission's regulation for service reliability are:

- Alfalfa Electric Cooperative, Inc.*
- Central Rural Electric Cooperative**
- Choctaw Electric Cooperative, Inc.*
- Cimarron Electric Cooperative, Inc.*
- CKenergy Electric Cooperative*
- Cookson Hills Electric Cooperative**
- Cotton Electric Cooperative, Inc.*
- East Central Electric Cooperative***
- Harmon Electric Association, Inc.*
- Indian Electric Cooperative**
- Kay Electric Cooperative, Inc.*
- Kiamichi Electric Cooperative, Inc.***
- Lake Region Electric Cooperative**
- Northfork Electric Cooperative, Inc.*
- Northwestern Electric Cooperative, Inc.*
- Oklahoma Electric Cooperative, Inc.*
- Ozarks Electric Cooperative**
- People's Electric Cooperative
- Red River Valley Rural Electric Association, Inc.*
- Rural Electric Cooperative, Inc.*
- Southeastern Electric Cooperative, Inc.*
- Southwest Rural Electric Association, Inc.*
- Tri-County Electric Cooperative*****
- Verdigris Valley Electric Cooperative**

*Denotes membership in the Western Farmers Electric Cooperative (WFEC)
**Denotes membership in KAMO Electric Cooperative, Inc. (KAMO Power)
***Denotes membership in both WFEC and KAMO Power
*****Denotes membership in Golden Spread Electric Cooperative

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APPENDIX E:
ENERGY EMERGENCY RESPONSE IMPLEMENTATION ACTION MENUS

To create the Energy Emergency Response Implementation Action Menu below the authors reviewed the following: state best practices, NASEO documents, peer state Energy Assurance plans for all geographically and structurally similar states to Oklahoma; national and local organization reports, and governmental reports. While the information contained in this Appendix is by no means exhaustive because of the contextual nature of energy disruptions linked to different types of incidents and accidents, it provides basic operational information and parameters pertaining to best practices for responding to sectoral energy supply and demand concerns. This Appendix also does not aim to address the interconnected nature of events that can cause cascading failures. Overcoming systemic failures requires planning involving key cross-sector actors within the scope of the National Response Framework[298] under the direction of Emergency Support Function 12-Energy (ESF-12). The interconnected nature of events is discussed more in detail in this report in the chapter entitled "Preparing For, Mitigating, and Responding to Energy Emergencies."

ELECTRICITY EMERGENCY RESPONSE MENU

Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric	**Demand**	Utilize capacity at sites with fuel switching or co-generation capabilities.	A load shedding mechanism that can reduce electric demand on the grid.	Utility will contact co-generation site to request that the co-generation capacity be utilized to reduce their electric demand.	3 4

[298] U.S. Department of Homeland Security, National Response Framework, 4th, ed. (October 2019). https://www.fema.gov/sites/default/files/2020-04/NRF_FINALApproved_2011028.pdf (June 21, 2021).

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric	**Supply**	Temporarily increase levels of coal stockpiling by electric utility companies.	Allows electric utilities to plan for predicted fuel shortages. Increasing stockpiles of necessary fuel above 45 day prepares to handle the upcoming shortage.	Utilities may increase stockpiles without OCC input. Utility notifies OCC if stockpile exceeds 45 day supply and OCC regulates how much of the cost can be passed through in rate base after the fact.	2 3 4
Electric	**Supply**	Temporarily substitute Oklahoma coal for Wyoming coal in coal-fired power plants.	In the event of a WY coal shortage, Oklahoma coal could be used to keep generation constant. OK coal is not of the same type as WY coal; therefore, waivers would be needed.	Utilities would contact DEQ and U.S. EPA to request waivers to temporarily substitute one type of coal for another.	4
Electric	**Supply**	Reduction of voltage in the system.	Reduction of voltage by less than five or six percent can reduce the demands on the system, with most customers not being adversely impacted. Be aware, this short-term solution should be taken only after public notice has been given, as certain sensitive electrical equipment may be adversely affected, and would need to be protected.	Utilities would notify customers in conjunction with OCC, and then utilities would perform the voltage reduction.	4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric	**Supply**	Utilize large backup generation when mobile units are available.	Utilities and large industrial customers can install large generators that can supply from 75 to 100 megawatts of temporary diesel generation to ease electrical shortages.	OEM will facilitate communication between customers in need of backup generation and utilities that maintain lists of priority restoration. Generator owners should be prepared to mobilize generators to appropriate locations once identified. OEM should coordinate request for backup generators with FEMA and U.S. DOE, which can often provide emergency generators for critical infrastructure or fuel sites. OEM and the National Guard also have generator staging points that can be utilized.	4
Electric	**Supply**	Use locomotive generators for electricity generation in selected locations.	Oklahoma has more useable freight rail lines than almost any other state. By utilizing these rail lines, locomotives can be used as emergency electricity generation sources to provide electricity for critical facilities.	OEM should facilitate communications with OK DOT and OCC to determine rail line locations and feasibility of placing locomotives near centers of need.	4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric **Natural Gas**	**Demand**	Activate interruptible rates/curtail-ment programs.	A load shedding mechanism whereby industrial customers receive a lower rate in exchange for willingness to have their service interrupted in times of high system demand.	All utilities have these programs currently in place and could activate curtailments as needed without state approval. Utilities must provide notice to the individual users prior to curtailing.	1 2
Electric	**Demand**	Implement system-wide rolling blackouts.	A load shedding mechanism that allows a utility to reduce the impacts realized from extended outages.	Utility must notify customers and OCC prior to outages beginning and duration of outages must be determined by the utility. Utility must consider if any customers should be exempted from the blackouts. Coordinate with OEM and OCC to disseminate information on blackout locations and duration via media and utilize smart meters as possible to target outage locations.	4
Electric	**Demand**	Voluntary or mandatory curtailment of public building energy use.	Load shedding mechanism that could mean reduced hours of operations to curtail energy use.	Utilities would communicate with OMES/Governor's Office regarding the need for energy reductions. Governor would issue an Executive Order closing buildings or modifying access.	3 4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric	**Demand**	Employ and/or expand time-of-use rates for residential and/or industrial users.	A load shedding mechanism which creates strong financial incentives for consumers to use electricity at off-peak times. Programs are most effective with smart meters in place.	Utilities with programs already in place (OG&E and PSO) can employ these programs without input from state officials.	1 2 3 4
Electric	**Supply**	Participation in regional planning and transmission organizations (Southwest Power Pool).	The Southwest Power Pool has the ability to shift power from state to state within its authorized region as a means of alleviating localized outages.	SPP can see each generating unit and transmission line and monitors these 24/7/365. OCC PUD maintains staff in active communication with SPP to update on status of shortages. Utilities can also go directly to SPP.	1 2 3 4
Electric	**Demand**	Conduct a public information program on home energy assessments.	An assessment will show the problems that can, when corrected, increase residential energy efficiency, thus reducing electricity demand.	Utilities administer these programs and are responsible for promoting them. Utilities could be encouraged by OCC to more widely publicize the programs.	1 2

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric	**Demand**	Implement a public information or incentive program that encourages Oklahomans to purchase more efficient appliances, add insulation, or change lighting.	A mechanism to reduce energy consumption.	Utilities currently offer these incentives. State agencies including OCC and ODOC also promote these incentives to the public. Consider increasing publicity/visibility in times of shortage.	1 2
Electric	**Demand**	Conduct public information campaign that includes a variety of electricity saving tips.	Encourages customers to reduce energy consumption.	Utilities currently offer these promotional materials. Consider using public figures such as OCC Commissioners or Governor for PSAs regarding electricity conservation in times of shortage.	1 2 3 4
Electric	**Demand**	Increase rates for customers.	Higher prices discourage consumption during shortages. This type of short-term change could only feasibly be implemented in a self-regulated co-op or municipal utility setting.	Utilities must publicize the rate increases thoroughly to realize the conservation benefits. Co-op board members or city governments must approve rate changes. The State has no authority over these changes as these are unregulated utilities.	2 3 4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric	**Demand**	Encourage or direct government facilities to improve energy efficiency.	Reduces energy consumption.	61 Okla. St. § 213 mandates that new construction or substantial renovation projects in state buildings over 10,000 sq. ft. must meet a high-performance building standard. Shorter term measures could be coordinated through OMES and Governor (Executive Order in an emergency situation).	1 2 3 4
Electric	**Demand**	Encourage or direct regulated utility providers to increase and/or provide additional programs to their customers which focus on energy efficiency.	Reduces energy consumption.	OCC can encourage additional programming at any time. Directing additional programming would be accomplished through a formal rulemaking process or legislation.	1
Electric	**Demand**	Utilize buy-back rates that pay customers to sell excess self-generated electricity back to the grid for utility credit.	Reduces the need for utility generation.	The current state net metering policy already encourages customer self-generation but there are cost barriers to customers selling back to the grid.	1

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Electric Natural Gas Propane	**Demand**	Encourage the use of alternative fuels, such as natural gas, propane, diesel or wood as the fuel source for home heating.	Provides alternative heating sources in event of electrical outages.	Utilities, the Dept. of Health, Fire Marshall, and public figures should utilize PSAs and all media outlets to communicate the risks and benefits of safely using alternative fuels for home heating.	2 3 4

PETROLEUM EMERGENCY RESPONSE MENU

Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum	**Supply**	State of Oklahoma assumes control of fuel prioritization.	63 O.S.2011, Section 683.9(1), gives the Governor authority to assume regulatory control over essential resources, to determine priority of such resources and allocate such resources. Other than the statute, there are no pre-selected lists. The guiding principle is to give the flexibility needed to meet the demands of the situation.	The Governor's Office would coordinate with the Corporation Commission and OEM to determine the appropriate prioritization.	3 4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum Propane	**Supply**	Temporarily lift Federal Motor Carrier Safety Regulations (FMCSR) restrictions for over the road transport trucks.	Temporarily removes driver hour restrictions and various other regulations to allow for extended delivery hours by transit companies of petroleum products, such as LPG, gasoline, or diesel.	A Governor's Declaration of Emergency automatically lifts FMCSR. See Appendix G. Coordinate with surrounding states to ensure smooth interstate travel of equipment or fuel.	3 4
Petroleum Propane	**Supply**	Top off fuel storage tanks in anticipation of an event that will impact fuel transportation.	Private retailers/dealers may choose to do this voluntarily to ensure available supply if a shortage is imminent. This is currently a common practice for petroleum retailers.	Retailers/dealers will monitor potential shortages and act accordingly.	1 2 3 4
Petroleum Propane	**Supply**	Encourage or require longer refill cycles or waiting until tank is completely depleted before the tank could be refilled.	Caution is needed, as distributors may have difficulty efficiently scheduling routes with less predictable schedules, as well as ensuring that this option is not utilized in times of extreme cold.	Work in conjunction with the Governor's Office. OCC PST Division would encourage or direct petroleum delivery schedules to be modified on the basis of fuel need. LPG board would have to be consulted regarding propane.	4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum	**Supply**	Request waivers from the U.S. EPA for the import of gasoline that does not meet local air quality requirements	Request should be substantiated with fuel supply/ consumption data for both impacted and alternative fuels, and include information on specific efforts to seek alternative sources of compliant fuels.	Any waiver requests would be made by either the Office of the Secretary of Energy and Environment (OSEE) on behalf of the Governor's office, or by DEQ at the request of, or in consultation with, OSEE.	4
Petroleum	**Supply**	Request waivers from the U.S. Environmental Protection Agency to allow for high sulfur diesel products to be used for highway consumption.	Almost all diesel fuel available today is ultra-low sulfur diesel, which has significant air quality benefits over high sulfur diesel. Vehicles or equipment with new emission control technology (2007 and later) can fail if run on high sulfur diesel.	Any waiver requests would be made by either the Office of the Secretary of Energy and Environment (OSEE) on behalf of the Governor's office, or by DEQ at the request of, or in consultation with, OSEE. Refineries would have to change their process requirements for sulfur content since almost all diesel today is ultra-low sulfur diesel. See Appendix G for detailed implementation instructions.	4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum	**Supply**	Petition the U.S. Environmental Protection Agency to allow refineries to sell gasoline out of season or to suspend the Reid Vapor Pressure Standard (RVP) standard for gasoline allowing for more gasoline to be produced from a barrel of oil.	Seasonal blend requirements for gasoline force refineries to stockpile gasoline and not be allowed to sell it until a particular date. The RVP measures gasoline volatility. Suspending the RVP allows for more gasoline to be produced from a barrel of oil.	Any waiver requests would be made by either the Office of the Secretary of Energy and Environment (OSEE) on behalf of the Governor's office, or by DEQ at the request of, or in consultation with, OSEE. See Appendix G for detailed implementation instructions.	4
Petroleum	**Supply**	Petition the U.S. Department of Energy or President for an exchange or release of crude oil from the U.S. Strategic Petroleum Reserve.	The Strategic Petroleum Reserve is an emergency response tool the President can use should the United States or individual states or regions be confronted with an economically-threatening disruption in oil supplies.	The Governor would make the petition to the U.S. DOE or President.	4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum	**Demand**	Conduct a public information campaign to encourage ridesharing.	Has the potential to reduce vehicle fuel needs.	Governor's Office, OCC, DEQ, OSEE, and ODOT can coordinate with trade and municipal associations regarding fuel conservation.	2 3 4
Petroleum	**Demand**	Conduct a public information campaign to encourage efficient driving practices.	Consumers can be encouraged to use the correct air pressure in tires, utilizing driving practices which are targeted at improving fuel efficiency, removing wind resistant equipment such as luggage racks, and discouraging discretionary driving.	Coordinate with ODOT; coordinate with auto manufacturers.	1 2 3 4
Petroleum	**Demand**	Trigger the Oklahoma Emergency Price Stabilization Act.	This may be enacted with the declaration of an emergency, and the Act forbids price increases in excess of 10%.	The trigger is the Governor's declaration of emergency through Executive Order. Enforcement by the Attorney General.	2 3
Petroleum	**Demand**	Offer discounted rates or incentives for utilizing any public transit options.	Reducing the cost of public transit encourages citizens to utilize this option rather than driving private vehicles.	The DEQ model for ozone alert days could be utilized.	3 4
Petroleum	**Demand**	Increase the number or frequency of bus routes	See above.	See above.	3 4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum	**Demand**	Reduce speed limits on roadways, and/or increase the enforcement of either lowered or existing speed limits.	ciency usually decreases at speeds above 50	The Oklahoma Department of Transportation regulates speed limits and their enforcement through the State Patrol. Coordinate with Governor's Office.	3 4
Petroleum	**Demand**	Create a public information campaign encouraging employers to offer telecommute or telework options.	For each day employees do not commute to the office, up to 20% of fuel can be conserved.	Issue PSAs from state leaders, authorized by the Governor.	3 4
Petroleum	**Demand**	Enact/support a telework or telecommute policy for public employees	Reduces fuel consumption by roughly 20% weekly for each day employees do not commute to the office.	The Governor could declare this policy.	3 4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Petroleum	**Demand**	Encourage staggered commute times (commuting off-peak hours or days) for public and/or private employers and/or school start times.	Reduces the amount of transit time in congested areas, and thereby reduces the amount of fuel consumed.	Governor could allow for public employees to utilize flex time. Public officials could encourage the private sector via PSA's.	3 4
Petroleum	**Demand**	Curtail recreational marine or off-road vehicle use.	Reduces discretionary use of vehicle fuel.	The public safety department or GRDA would enforce curtailments of recreational use.	4
Petroleum	**Demand**	Encourage the use of alternative fuels such as CNG, biofuels, or diesel natural gas, especially in public and school fleets.	Converting a portion of fleets to a secondary fuel source creates a hedge against fuel shortage or emergency.	Department of Commerce SEO, OCC, private utilities, Secretary of Energy, and Governor could all be involved in promoting this initiative.	1 2 3 4

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NATURAL GAS EMERGENCY RESPONSE MENU

Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Natural Gas	**Supply**	Temporarily lift wellhead restrictions on the production of natural gas.	Allows companies to pump as much gas as possible.	OCC regulates this through rulemaking, every 6 months holding a market demand hearing which sets maximum flow for wells. This hearing can occur on an accelerated schedule if necessary (emergency rulemaking).	4
Natural Gas	**Supply**	Allow pipeline pack to increase reserve supplies available.	Allows pipeline companies to store additional natural gas in the pipelines. This is generally done in anticipation of elevated demand.	The allowable pipeline pressure increases are regulated by federal law.	1 2 3 4
Natural Gas	**Supply**	Local gas distribution companies (LDC) can purchase additional gas in order to meet demand.	Mainly a preventative measure to be used when shortages can be anticipated —there must be an adequate gas supply available to purchase additional gas. The price of this purchased gas, contract details, the availability of gas transmission capacity, and the ability of the company's system to accept additional supply may impact the amount that can be purchased.	This activity will be conducted by private gas companies; OCC should remain actively involved in understanding anticipated supply shortages.	1 2 3

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Natural Gas	**Supply**	Gas companies that are drawing gas from storage facilities can increase the rate of withdrawal.	Helps meet increased short-term demand.	No special permissions needed. Companies make these decisions independently--contractually they may go up to their maximum withdrawal rate without notifying state officials.	2
Natural Gas	**Supply**	Encourage/require gas companies when technically feasible to access and utilize other sources of gas, (LNG, propane air stations, synthetic natural gas plants).	Diversifies fuel sources, decreasing reliance on natural gas.	Would require that conversion equipment exists, and the companies would be buying gas “off system".	4
Natural Gas	**Demand**	Encourage/ require a short-term reduction in natural gas usage in state facilities or by industrial users.	Temporarily relieves demand on the natural gas system.	Governor has authority over state facilities. OEM would coordinate communication requirements or encouragement for industrial users. OCC becomes involved if curtailment issues arise.	3 4

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Natural Gas	**Demand**	Request that large commercial and industrial customers reduce gas use by decreasing their thermostat settings or reducing gas-consuming industrial processes.	See above.	OCC is involved through interruptible gas rates. Once signed up the utility has the discretion how to execute the curtailment.	1 2 3 4
Natural Gas	**Demand**	Encourage residential customers to lower thermostats and water heating settings and defer using gas appliances.	See above.	A utility or the state could issue PSA's to consumers to encourage their participation.	2 3 4
Natural Gas	**Demand**	Curtail or shut off gas supply to customers, regardless of interruptible agreements in place.	Assures reduction in natural gas use for serious shortage situations.	Utilities should use this approach with caution, as customer pilot lights must be relit following a cut off, or serious hazards such as gas accumulation within residences and business, could result.	4+

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Type of Emergency	Supply or Demand Side	Measure	What it Does	Recommended Steps	Shortage Level
Natural Gas	**Demand**	Increase retail rates to consumers.	Higher cost often reduces consumption.	Requires a statutory change and emergency rulemaking.	4+
Natural Gas	**Demand**	Conduct a public information campaign and/or offer incentives that provide information, energy estimates, or discounts for the purchase and installation of highly efficient natural gas appliances.	Encourages public use of highly efficient natural gas appliances.	Financial incentive programs are administered at the utility level but are authorized at OCC.	1 2 3 4
Natural Gas	**Demand**	Encourage large industrial natural gas customers to participate in a gas buy-back program.	Some larger industrial customers purchase gas from 3rd party suppliers and pay only a transportation fee to the utility. In a shortage situation, certain large customers may be willing to interrupt operations if the buy-back premium is high enough.	This would be a transaction in the private sector.	4

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Appendix F:
Sperry-Piltz Ice Accumulation Index

More complete information, forecasting tools and weather analysis can be found at the SPIA website, spia-index.com. Images displayed with permission from Sidney K. Sperry, developer of the SPIA index.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Weather Conditions and SPIA Index Levels at a Glance:

Ice and Wind: *Average NWS Ice in Inches; Wind in MPH.	< 15 mph	15-25 mph	25-35 mph	> = 35 mph
0.10 – 0.25 inches	0	1	2	3
0.25 – 0.50 inches	1	2	3	4
0.50 – 0.75 inches	2	3	4	5
0.75 – 1.00 inches	3	4	5	5
1.00 – 1.50 inches	4	5	5	5
> 1.50 inches	5	5	5	5

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APPENDIX G:
Issuing Declarations and Requesting Waivers

ISSUING AN EMERGENCY OR DISASTER DECLARATION

Under the Oklahoma Emergency Management Act of 2003, the Governor has the authority to declare an emergency or after any natural or man-made emergency. The Governor must declare the emergency through Executive Order, or the Legislature can pass a concurrent resolution for the Governor to exercise emergency powers. Once an emergency is declared, the Governor has significantly increased powers to ensure the allocation of resources throughout the state. Examples of previous Executive Orders are shown below.

FILED
December 30, 2020
Oklahoma Secretary of
State Office

J. Kevin Stitt
Office of the Governor
State of Oklahoma

EXECUTIVE DEPARTMENT
EXECUTIVE ORDER 2020-36

I, J. Kevin Stitt, Governor of the State of Oklahoma, pursuant to the power vested in me by Section 2 of Article VI of the Oklahoma Constitution, hereby declare the following:

1. Severe winter weather, freezing rain, snow and wind beginning December 30, 2020 and ongoing is expected to cause damage to public and private properties and utilities, including electric systems, within the State of Oklahoma; and said damages have caused an undue hardship on the citizens of this State.

2. It may be necessary to provide for the rendering of mutual assistance among the State and political subdivisions of the State with respect to carrying out disaster emergency functions during the continuance of the State emergency pursuant to the provisions of the Oklahoma Emergency Management Act of 2003.

3. There is hereby declared a disaster emergency caused by severe winter weather in 39 Oklahoma counties that threatens the public's peace, health, and safety. The counties included in this declaration are:

   Alfalfa, Beckham, Blaine, Caddo, Canadian, Cleveland, Comanche, Cotton, Creek, Custer, Dewey, Ellis, Garfield, Grady, Grant, Greer, Harmon, Harper, Jackson, Jefferson, Kay, Kingfisher, Kiowa, Lincoln, Logan, Major, McClain, Noble, Oklahoma, Osage, Pawnee, Payne, Pottawatomie, Roger Mills, Stephens, Tillman, Washita, Woods, and Woodward

4. The State Emergency Operations Plan has been activated and resources of all State departments and agencies available to meet this emergency are hereby committed to the reasonable extent necessary to protect lives and to prevent, minimize, and repair injury and damage. These efforts shall be coordinated by the Director of the Department of Emergency Management with comparable functions of the federal government and political subdivisions of the State.

Based on the foregoing, pursuant to the power vested in me by Sections 1 and 2 of Article VI of the Oklahoma Constitution and 63 O.S. *§§* 683.1 *et seq.*, and pursuant to 49 C.F.R. Part 390.23, I hereby declare that there is a State of Emergency continuing in the State of Oklahoma.

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Due to winter weather conditions anticipated in the immediate future including power outages caused by ice accumulations on power lines and vegetation and strong winds, it is necessary to assist and expedite all efforts of relief. In order to accommodate this need and to provide assistance to the residents of the State of Oklahoma in this extraordinary situation, I hereby order the temporary suspension of the following as they apply to vehicles in the support efforts:

1. The requirements for size and weights permits of oversized vehicles under Title 47 of the Oklahoma Statutes whose sole purpose is transportation of materials and supplies used for emergency relief and power restoration;

2. The cost and fees of overweight permits required of carriers whose purpose is the transportation of materials and supplies used for emergency relief and power restoration, which require an overweight permit under Title 47 of Oklahoma statutes;

3. The requirements under Parts 390 through 399 pursuant to part 390.23 of Title 49 of the Federal Motor Carrier Safety Administration Regulations;

4. The requirements for licensing/operating authority as required by the Oklahoma Corporation Commission; and

5. The requirements for licensing/registration authority as required by the Oklahoma Tax Commission.

Nothing contained in this declaration shall be construed as an exemption from the Controlled Substance and Alcohol Use and Testing requirements (49 C.F.R. Part 382), the Commercial Driver License requirements (49 C.F.R. Part 383), the Financial Responsibility requirements (49 C.F.R. Part 387), or any other portion of the regulations not specifically identified herein. Motor carriers that have an Out-Of-Service Order in effect cannot take advantage of the relief from regulation that this declaration provides.

This Executive Order shall be effective until 11:59 p.m. CST, January 12, 2021.

Copies of this Executive Order shall be distributed to the Director of Emergency Management, Oklahoma Corporation Commission, Oklahoma Department of Transportation, Oklahoma Tax Commission, Oklahoma Adjutant General's Office, Office of Management and Enterprise Services, and the Oklahoma Department of Public Safety, who shall cause the provisions of this Order to be implemented by all appropriate agencies of State government.

IN WITNESS WHEREOF, I have set my hand and caused the Great Seal of the State of Oklahoma to be affixed at Oklahoma City, this 30th day of December, 2020.

BY THE GOVERNOR OF THE STATE OF OKLAHOMA

J. KEVIN STITT

ATTEST:

BRIAN BINGMAN, Secretary of State

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It is important to note that the Governor also has powers to declare a health-related emergency in the state, given special treatment to critical infrastructure, including energy infrastructure, or designating aspects of the energy industry as critical industries or businesses. A recent example of this occurred as a result of the Governor's Executive Order (2020-07) declaring a health emergency as a result of the novel coronavirus (COVID-19) pandemic. In an Executive Memo that followed after his initial Executive Order, Governor Stitt enumerated portions of Oklahoma's energy sector as essential businesses with permission to remain open during the pandemic. The text of this Executive Memo appears below.

J. Kevin Stitt
Office of the Governor
State of Oklahoma

FILED
MAR 2 5 2020
OKLAHOMA SECRETARY
OF STATE

EXECUTIVE DEPARTMENT
AMENDED EXECUTIVE MEMORANDUM 2020-01

On March 25, 2020, the 164th case of a novel coronavirus ("COVID-19"), was confirmed in the State of Oklahoma. As noted in a previous Executive Order, the United States Centers for Disease Control and Prevention has identified the potential public health threat posed by COVID-19 as "high" both globally and in the United States. In addition, on March 14, 2020, the President of the United States declared a national health emergency in the United States as a result of the national spread of COVID-19.

On March 15, 2020, I issued Executive Order 2020-07 declaring an emergency caused by the impending threat of COVID-19 to the people of this State and the public's peace, health, and safety. And, on March 24, 2020, I issued the Fourth Amended Executive Order 2020-07. Paragraph 20 of the Fourth Amended Executive Order 2020-07 ordered all businesses not identified as being within a critical infrastructure sector as defined by the U.S. Department of Homeland Security (USDHS) and located in a county experiencing community spread of COVID-19, as identified by OSDH on its website, to close.

In addition to those critical infrastructure sectors identified by USDHS, I hereby add the following:

- HEALTHCARE / PUBLIC HEALTH
  - Health care providers (e.g. physicians, dentists, psychologists, mid-level practitioners, nurses and assistants, infection control and quality assurance personnel, pharmacists, physical and occupational therapists and assistants, social workers, speech pathologists and diagnostic and therapeutic technicians and technologists).
  - Manufacturers, technicians, logistics and warehouse operators, and distributors of personal care/hygiene products.
  - Behavioral health workers (including mental and substance use disorder) responsible for coordination, outreach, engagement, and treatment to individuals in need of mental health and/or substance use disorder services.
  - Workers who provide support to vulnerable populations to ensure their health and well-being including family care providers.
  - Medicinal marijuana dispensaries and all licensed medicinal marijuana companies that are in the supply chain for any medicinal marijuana dispensary
  - Workers supporting veterinary hospitals and clinics.

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- LAW ENFORCEMENT, PUBLIC SAFETY, FIRST RESPONDERS
  - Including front line and management, personnel include emergency management, law enforcement, Emergency Management Systems, fire, and corrections, search and rescue, tactical teams including maritime, aviation, and canine units.
  - Workers at Public Safety Answering Points.
  - Fire mitigation activities.
  - Private security, private fire departments, and private emergency medical services personnel.
  - State and County workers responding to abuse and neglect of children, elders and dependent adults.
  - Animal control officers.

- FOOD AND AGRICULTURE
  - Farm supply and hardware stores
  - Groves, greenhouses, nurseries, and vineyards
  - Agriculture, Forestry, Fishing and Hunting
  - Food manufacturing
  - Beverage and tobacco product manufacturing
  - Manufacturing of fiber and forestry products
  - Veterinary services
  - Certified farmers' markets, farm and produce stands
  - Food cultivation, including farming, livestock and fishing
  - Support of agricultural production including manufacturers, processors, sellers, transporters, and suppliers of livestock, poultry, feed, seed, water, fertilizer, herbicides, or insecticide and those that care for animals, crops, groves, greenhouses, nurseries, vineyards, forests, farms, and ranches
  - Hardware stores, farm stores, and garden centers

- ENERGY

  Electricity Industry
  - Acquisition (SCADA) systems, and utility data centers; Cybersecurity engineers, cybersecurity risk management.
  - Power Generation, Transmission
  - Safety and environmental personnel, and those who support and ensure the supply chain and supply chain management
  - These categories of workers applies to all wind, solar, gas, hydroelectric and coal facilities.

  Petroleum Workers:
  - Midstream Companies
  - Liquids or produced water/waste storage facilities
  - Petroleum refinery fractionators, blenders
  - Produced water waste facilities, including UIC wells and transportation
  - Brine separation and processing facilities

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- Transportation maintenance and inspection workers
- Pipeline maintenance and construction workers who may be required to traverse state lines to maintain facilities that cross state lines
- Workers who maintain supply chain for these facilities
- Petroleum security operations employees and workers who support emergency response services

Natural and Propane Gas Workers:

- Other compression facilities
- Processing, refining, and transporting natural gas liquids, including propane gas, for use as end-use fuels or feedstocks for chemical manufacturing
- Propane gas storage, transmission, and distribution centers
- Compressed natural gas, liquefied natural gas, and propane gas retail and non-retail fuel stations, depots, and truck stops, that serve the public as well as private stations that support local and regional transportation companies such as transit authorities, refuse fleets, and freight haulers

- WATER AND WASTEWATER
  - Drinking water and wastewater
  - Drinking water plant superintendents, managers, operators and maintenance technicians
  - Drinking water distribution system operators and maintenance technicians
  - Wastewater plant superintendents, managers, operators and maintenance technicians
  - Wastewater collection system operators and maintenance technicians
  - Laboratory certified operators and employees of a government or privately-owned laboratory that are accredited to analyze routine compliance drinking water or municipal wastewater samples
  - Rural water association staff and technical support staff
  - Rural water districts, including all facilities

- TRANSPORTATION AND LOGISTICS
  - Taxis, transportation services including Transportation Network ComTaxis, transportation services including Transportation Network Companies, and delivery services, including Delivery Network Companies.
  - Wholesale trade
  - Transportation and warehousing
  - Postal services and distribution centers

- PUBLIC WORKS
  - Solid waste & hazardous waste
  - Utilities
  - Underground damage prevention services
  - Operational staff for solid waste pick-up
  - Operational staff at solid waste transfer and disposal facilities

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- Operational staff at hazardous waste treatment, storage, and disposal facilities, including underground injection control sites

- COMMUNICATIONS AND INFORMATION TECHNOLOGY
  - Broadcasting
  - Publishing industries
  - Telecommunications
  - Data processing, hosting, and related services
  - Software publishers
  - All other miscellaneous schools and instruction
  - Computer systems design and related services

- OTHER COMMUNITY-BASED GOVERNMENT OPERATIONS AND ESSENTIAL FUNCTIONS
  - Faith-based services that are provided through streaming or other technology.
  - Critical government workers, as defined by the employer and consistent with Continuity of Operations Plans and Continuity of Government plans.
  - Workers supporting public and private childcare establishments, pre-K establishments, K-12 schools, career and technology centers, colleges, and universities for purposes of distance learning, provision of school meals, or care and supervision of minors to support essential workforce across all sectors.
  - County workers responsible for determining eligibility and safety net benefits.
  - The Courts, consistent with guidance released from the Oklahoma Supreme Court and Oklahoma Court of Criminal Appeals.
  - Tag agencies
  - Workers and instructors supporting academies and training facilities and courses for the purpose of graduating students and cadets that comprise the essential workforce for all identified critical sectors.
  - Hotel Workers where hotels are used for COVID-19 mitigation and containment measures, including measures to protect homeless populations.
  - Hotels
  - Construction Workers, including residential and commercial, and workers who support the construction, operation, inspection, and maintenance of construction sites and construction projects (including housing construction and heavy and civil engineering construction)
  - Businesses and workers that support the supply chain for commercial and/or residential construction and development
  - Workers such as plumbers, electricians, exterminators, and other service providers who provide services that are necessary to maintaining the safety, sanitation, construction material sources, and essential operation of construction sites and construction projects (including those that support such projects to ensure the availability of needed facilities, transportation, energy and communications; and support to ensure the effective removal, storage, and disposal of solid waste and hazardous waste).

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- Oklahoma One-Call or OKIE 811
- Commercial Retail Stores, that supply essential sectors, including convenience stores, general merchandise stores, liquor, pet supply stores, auto supplies and repair, hardware and home improvement, and home appliance retailers.
- Motor vehicle and parts dealers
- Workers supporting the entertainment industries, studios, and other related establishments, provided they follow covid-19 public health guidance around social distancing.
- Workers critical to operating Rental Car companies that facilitate continuity of operations for essential workforces, and other essential travel.
- Workers that provide or determine eligibility for food, shelter, in-home supportive services, child welfare, adult protective services and social services, and other necessities of life for economically disadvantaged or otherwise needy individuals (including family members).
- Workers at animal care facilities that provide food, shelter, veterinary and/or routine care and other necessities of life for animals.
- Public and private golf courses, public parks, and workers needed to maintain normal operations.
- Workers involved with home repair and maintenance including roofing, lawn care, foundation repair, and similar businesses whose work is primarily performed out of doors.
- Executive, legislative, and other general government support
- Administration of human resources programs
- Administration of environmental quality programs
- Administration of housing programs, urban planning, and community development
- Administration of economic programs

- CRITICAL MANUFACTURING
  - Paper manufacturing
  - Printing and related support activities
  - Plastics and rubber products manufacturing
  - Mineral product manufacturing
  - Primary metal manufacturing including equipment

- FINANCIAL SERVICES
  - Finance and Insurance
  - Real estate and Leasing services
  - Management of companies
  - Business associations
  - Financial advisory

- CHEMICAL
  - Petroleum and coal products manufacturing
  - Chemical manufacturing

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- COMMERCIAL AND PROFESSIONAL SERVICES
  - Professional (such as legal and accounting), scientific, and technical services
  - Administrative and support services
  - Waste management and remediation services
  - Death care services
  - Dry cleaning and laundry services
  - Repair and maintenance

- DEFENSE INDUSTRIAL BASE
  - Explosives manufacturing
  - National security and international affairs

IN WITNESS WHEREOF, I have set my hand and caused the Great Seal of the State of Oklahoma to be affixed at Oklahoma City, this 25th day of March, 2020.

BY THE GOVERNOR OF THE STATE OF OKLAHOMA

J. KEVIN STITT

ATTEST:

MICHAEL ROGERS, SECRETARY OF STATE

REQUESTING WAIVERS FROM FEDERAL MOTOR CARRIER SAFETY REGULATIONS IN AN ENERGY EMERGENCY

The following are executive orders issued by the Governor in previous emergency situations which lifted Federal Motor Carrier Safety Regulations (FMCSR) during an energy emergency. These orders can be used as models for the future and altered to fit the precise circumstances being addressed. It is important to note that without a formal declaration of emergency, the Governor could still issue an Executive Order that grants a waiver from FMCSR for a particular sector, such as propane. It is also important to note that the waiver applies to any carrier providing direct relief or support to recovery efforts for the emergency situation and is not industry-specific.

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Typically, private companies or carriers will contact the Corporation Commission, but could also contact the Oklahoma Department of Emergency Management or the Secretary of Energy and Environment's Office to request the waiver. The initial contact may vary depending on the existing relationships already in place. OEM, OCC and/or the Secretary's Office then work hand in hand with the Governor's office to prepare the language for the Executive Order.

After issuing the Executive Order, the National Association of State Energy Officials recommends the following steps to ensure that affected groups are aware of the waiver being in effect:

1. Post a copy of the Governor's emergency declaration on a publicly available website and provide a link to the emergency declaration as part of notifications made to the motor carrier industry and state, local, and federal agencies.
2. Notify the motor carrier safety enforcement agency of state government that an emergency has been declared, in what part of the state, and that the safety regulations are temporarily waived as a result of this declaration.
3. Provide notification of emergency declaration to the FMCSA state office and regional administrator.
4. Notify motor carrier industry associations or motor carriers servicing the state directly through any automated system to quickly communicate with the industry. This communication should encourage, but not require, drivers transporting fuels to the areas in which an emergency has been declared to have with them a copy of the emergency declaration and a copy of the website link from the declaration can be printed.
5. Provide notification to state-level Energy Emergency Assurance Coordinators (see the "Energy Emergency Communications Procedures" chapter of this Plan) in those states within the region that may have motor carriers passing through them to provide relief in the affected state. It is also advisable to coordinate with neighboring states in advance of this declaration, if possible.

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Filed
February 12, 2021
OKLAHOMA SECRETARY
OF STATE

J. Kevin Stitt
Office of the Governor
State of Oklahoma

EXECUTIVE DEPARTMENT
EXECUTIVE ORDER 2021-06

I, J. Kevin Stitt, Governor of the State of Oklahoma, pursuant to the power vested in me by Section 2 of Article VI of the Oklahoma Constitution, hereby declare the following:

1. Extreme freezing temperatures and severe winter weather including snow, freezing rain, and wind beginning February 7, 2021, and continuing, are expected to cause damage to public and private properties and utilities, including electric, gas and water systems, within the State of Oklahoma causing an undue hardship on the citizens of this State.

2. It may be necessary to provide for the rendering of mutual assistance among the State and political subdivisions of the State with respect to carrying out disaster emergency functions during the continuance of the State emergency pursuant to the provisions of the Oklahoma Emergency Management Act of 2003.

3. There is hereby declared a disaster emergency caused by severe winter weather in ***all 77 Oklahoma counties*** that threatens the public's peace, health, and safety.

4. The State Emergency Operations Plan has been activated and resources of all State departments and agencies available to meet this emergency are hereby committed to the reasonable extent necessary to protect lives and to prevent, minimize, and repair injury and damage. These efforts shall be coordinated by the Director of the Department of Emergency Management with comparable functions of the federal government and political subdivisions of the State.

5. State agencies, in responding to this disaster emergency, may make necessary emergency acquisitions to fulfill the purposes of this proclamation without regard to limitations or bidding requirements on such acquisitions.

Based on the foregoing, pursuant to the power vested in me by Sections 1 and 2 of Article VI of the Oklahoma Constitution and 63 O.S. §§ 683.1 *et seq.*, and pursuant to 49 C.F.R. Part 390.23, I hereby declare that there is a State of Emergency continuing in the State of Oklahoma.

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Due to winter weather conditions ongoing and anticipated in the immediate future, it is necessary to assist and expedite all efforts of relief. In order to accommodate this need and to provide assistance to the residents of the State of Oklahoma in this extraordinary situation, I hereby order the temporary suspension of the following as they apply to vehicles in the support efforts:

1. The requirements for size and weights permits of oversized vehicles under Title 47 of the Oklahoma Statutes whose purpose is transportation of materials and supplies used for emergency relief and utility restoration;

2. The cost and fees of overweight permits required of carriers whose purpose is the transportation of materials and supplies used for emergency relief and power restoration, which require an overweight permit under Title 47 of Oklahoma statutes;

3. The requirements under Parts 390 through 399 pursuant to part 390.23 of Title 49 of the Federal Motor Carrier Safety Administration Regulations;

4. The requirements for licensing/operating authority as required by the Oklahoma Corporation Commission; and

5. The requirements for licensing/registration authority as required by the Oklahoma Tax Commission.

Nothing contained in this declaration shall be construed as an exemption from the Controlled Substance and Alcohol Use and Testing requirements (49 C.F.R. Part 382), the Commercial Driver License requirements (49 C.F.R. Part 383), the Financial Responsibility requirements (49 C.F.R. Part 387), or any other portion of the regulations not specifically identified herein. Motor carriers that have an Out-Of- Service Order in effect cannot take advantage of the relief from regulation that this declaration provides.

This Executive Order shall terminate at the end of thirty days.

Copies of this Executive Order shall be distributed to the Director of Emergency Management, Oklahoma Corporation Commission, Oklahoma Department of Transportation, Oklahoma Tax Commission, Oklahoma Adjutant General's Office, Office of Management and Enterprise Services, and the Oklahoma Department of Public Safety, who shall cause the provisions of this Order to be implemented by all appropriate agencies of State government.

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IN WITNESS WHEREOF, I have set my hand and caused the Great Seal of the State of Oklahoma to be affixed at Oklahoma City, this 12th day of February, 2021.

BY THE GOVERNOR OF THE STATE OF OKLAHOMA

J. KEVIN STITT

ATTEST:

BRIAN BINGMAN, Secretary of State

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J. Kevin Stitt
Office of the Governor
State of Oklahoma

FILED
February 10, 2021
OKLAHOMA SECRETARY
OF STATE

EXECUTIVE DEPARTMENT
EXECUTIVE ORDER 2021-04

WHEREAS, the State of Oklahoma and many of the surrounding states are experiencing an extended period of extremely cold weather, which has resulted in an increased demand for liquefied petroleum gas, also referred to as "propane;" and

WHEREAS, distributors of liquified petroleum products in the State of Oklahoma are already beginning to experience shortages in supply and transportation challenges; and

WHEREAS, many Oklahoman residents depend on the use of liquefied petroleum products for survival during the winter months; and

WHEREAS, the limited suspension of certain hours of service regulations for drivers of commercial motor vehicles transporting liquefied petroleum products in our state will ensure adequate supplies of liquefied petroleum products throughout the state, thereby reducing the damaging effects of a potential shortage;

NOW, THEREFORE, I, J. Kevin Stitt, Governor, pursuant to the power vested in me by Sections 1 and 2 of Article VI of the Oklahoma Constitution and 63 O.S. § 683.1 *et seq.,* and pursuant to Part 390.23 of Title 49 of the Code of Federal Regulations, hereby declare that because there is a state of emergency existing in the State of Oklahoma due to limited liquefied petroleum products supplies, it is necessary to assist and expedite all efforts of transportation of liquefied petroleum products throughout Oklahoma. In order to accommodate this need and to provide assistance to the citizens of Oklahoma in this extraordinary situation, I hereby order vehicles used in the support efforts to be exempt from Parts 390 through 399 of Title 49 of the Federal Motor Carrier Safety Regulations.

Declaration of this emergency provides relief for 30 days from Sections 390 through 399 of the Federal Motor Carrier Safety regulations for those interstate and intrastate carriers who are providing direct assistance to this emergency. Direct assistance terminates when a driver or commercial motor vehicle is used in interstate or intrastate commerce to transport cargo not destined for the emergency relief effort, or when a motor carrier dispatches such driver or vehicle to a location outside the relief area.

Nothing contained in this declaration shall be construed as an exemption from the Controlled Substance and Alcohol Use and Testing requirements (49 C.F.R. Part 382), the Commercial Driver License requirements (49 C.F.R. Part 383), the Financial Responsibility requirements (49 C.F.R. Part 387), or any other portion of the regulations not specifically identified herein. Motor carriers that have an Out-Of-Service Order in effect cannot take advantage

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of the relief from regulation that this declaration provides.

While operating under this Order, drivers of commercial motor vehicles shall be required to spend a minimum of 8 hours in sleeper berth within any given 24-hour period. The duration of each timeframe spent in sleeper berth within each 24-hour period shall be at the discretion of each driver based in his/her needs, as long as the sum of all said sleeper berth totals a minimum of the required 8 hours.

This Order applies only to the transportation of liquefied petroleum gas to provide direct assistance to this emergency. No other products, including other petroleum products, are covered by the exemption and suspension under this Order.

This emergency notice will remain in effect for 30 days.

Copies of this Executive Order shall be distributed to the Director of the Oklahoma Department of Emergency Management, Oklahoma Corporation Commission, Oklahoma Department of Transportation, and the Oklahoma Department of Public Safety, who shall cause the provisions of this Order to be implemented by all appropriate agencies of State government.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Oklahoma to be affixed at Oklahoma City, Oklahoma, this 10th day of February, 2021.

BY THE GOVERNOR OF THE STATE OF OKLAHOMA

J. KEVIN STITT

ATTEST:

BRIAN BINGMAN, SECRETARY OF STATE

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Mary Fallin
Governor

FILED
DEC 22 2017
OKLAHOMA SECRETARY OF STATE

EXECUTIVE DEPARTMENT
EXECUTIVE ORDER 2017-44

WHEREAS, the State of Oklahoma is experiencing cold weather after a period of unseasonably mild temperatures, which has resulted in increased demand for liquefied petroleum products, hereinafter referred to as "propane;" and

WHEREAS, distributors of liquefied petroleum products in the State of Oklahoma are experiencing challenges in the implementation of electronic logging devices; and

WHEREAS, the potential for cold weather temperatures over the holidays, may result in increased demand for propane; and

WHEREAS, liquefied petroleum products resource at certain Oklahoma refineries are currently stressed, significantly delaying the delivery of liquefied petroleum products to transportation companies in some instances, thereby forcing transportation companies and retailers to obtain liquefied petroleum products from other locations in surrounding states; and

WHEREAS, many Oklahoman residents depend on the use of liquefied petroleum products for survival during the winter months; and

WHEREAS, the limited suspension of certain hours of service regulations for drivers of commercial motor vehicles transporting liquefied petroleum products in our state will ensure adequate supplies of liquefied petroleum products throughout the state, thereby reducing the damaging effects of a potential shortage;

NOW, THEREFORE, I, Mary Fallin, Governor, pursuant to the power vested in me by Sections 1 and 2 of Article VI of the Oklahoma Constitution and 63 O.S. § 683.1 *et seq.*, and pursuant to Part 390.23 of Title 49 of the Code of Federal Regulations, hereby declare that because there is a state of emergency existing in the State of Oklahoma due to limited liquefied petroleum products supplies, it is necessary to assist and expedite all efforts of transportation of liquefied petroleum products throughout Oklahoma. In order to accommodate this need and to provide assistance to the citizens of Oklahoma in this extraordinary situation, I hereby order vehicles used in the support efforts to be exempt from Parts 390 through 399 of Title 49 of the Federal Motor Carrier Safety Regulations.

049016

STATE CAPITOL BUILDING • 2300 N. LINCOLN BOULEVARD, SUITE 212 • OKLAHOMA CITY, OKLAHOMA 73105 • (405) 521-2342

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Nothing contained in this declaration shall be construed as an exemption from the Controlled Substances and Alcohol Use and Testing requirements (49 C.F.R. Part 382), the Commercial Driver's License Standards requirements (49 C.F.R. Part 383), the Minimum Levels of Financial Responsibility for Motor Carrier requirements (49 C.F.R. Part 387), or any other portion of the regulations not specifically identified herein. Motor carriers that have an Out-Of-Service Order in effect cannot take advantage of the relief from regulation that this declaration provides.

This Order applies only to the transportation of liquefied petroleum products to provide direct assistance to this emergency. No other products, including other petroleum products, are covered by the exemption and suspension under this Order.

This emergency notice will remain in effect for fourteen (14) days from December 22, 2017.

Copies of this Executive Order shall be distributed to the Director of Emergency Management who shall cause the provisions of this Order to be implemented by all appropriate agencies of state government.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Oklahoma to be affixed at Oklahoma City, Oklahoma, this 22nd day of December 2017.

BY THE GOVERNOR OF THE STATE OF OKLAHOMA

MARY FALLIN

ATTEST:

SECRETARY OF STATE

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REQUESTING A FUELS WAIVER

In the event of a fuel supply emergency, the U.S. EPA, with the concurrence of the Department of Energy, may temporarily waive a fuel or fuel additive requirement if doing so will alleviate the fuel supply emergency. The Clean Air Act Section 211(c)(4)(C), which authorizes fuels waivers, specifies the criteria for granting these waivers, and the conditions that must be included in a fuel waiver.

According to the U.S. EPA, a formal written request for a fuel waiver should be made by or on behalf of the Governor of an affected state or territory and be directed to the U.S. EPA Administrator. The request should describe how the fuels waiver criteria specified in Clean Air Act have been met.[299] In particular, the waiver request should address the following:

- The nature of the Act of God or other event that caused the shortage
- An explanation of why the shortage was not foreseeable and could not have been prevented by prudent planning on the part of the suppliers of the fuel
- The type of fuel for which a shortage exists
- The geographic area that is affected
- The effect of the shortage on fuel supplies, such as the number of gasoline stations that are, or are expected to be, out of fuel
- The expected duration of the shortage
- The specific nature of the waiver being requested, including the duration, the geographic area, and the alternative fuel that would be allowed

There are several types of fuels waivers that states may request from U.S. EPA, but for Oklahoma, the most likely might be a waiver for the Gasoline Reid Vapor Pressure (RVP) standards. U.S. EPA regulates the vapor pressure of gasoline sold at retail stations during the summer ozone season to reduce evaporative emissions from gasoline that contribute to ground-level ozone and diminish the effects of ozone-related health problems.[300] Depending upon the state and month, gasoline may not exceed 7.8 psi or 9.0 psi. Oklahoma's gasoline is currently regulated as not to exceed 9.0 psi in all months, in all counties.[301]

If Oklahoma wishes to request a waiver for the Gasoline Reid Vapor Pressure (RVP) standards, the Governor or his authorized representative should contact the U.S. EPA Air Enforcement Division (202-564-2260) or the Transportation and Regional Programs Division (734-214-4956),

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[299] National Association of State Energy Officials. *Introduction to Federal Fuel Waivers.* https://www.naseo.org/Data/Sites/1/thompson.pdf. (June 25, 2021).
[300] U.S. Department of Energy. *Energy Waiver Library*. https://www.energy.gov/ceser/energy-waiver-library. (June 25, 2021).
[301] U.S. Environmental Protection Agency. *Gasoline Reid Vapor Pressure: State by State RVP Table.* https://www.epa.gov/gasoline-standards/gasoline-reid-vapor-pressure#table (March 1, 2021).

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both of which can be reached Monday through Friday, 8 am to 5 pm ET to obtain information about any fuel waiver request. Outside of these times, the governor or his authorized representative may contact U.S. EPA's Emergency Operations Center at its emergency number, 202-564-3850.

The U.S. Department of Energy also recommends that a state consider sharing any waiver requests or implementations with EnergyResponseCenter@hq.doe.gov to improve situational awareness, as U.S DOE plays a critical role in assessing fuel supply and sharing that information with the EPA.

Myriad examples of past fuels waivers issued by U.S. EPA are available at https://www.epa.gov/enforcement/fuel-waivers. In Oklahoma, the Secretary of Energy & Environment typically acts as the Governor's representative in requesting RVP waivers. Historically, these requests are sent to U.S. EPA from the Oklahoma Secretary of Energy and Environment's Office, with communication of the action to support agencies such as the OCC Oil & Gas Division, Oklahoma Department of Environmental Quality, and Oklahoma Department of Agriculture. An example of this communication is below.

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Michael J. Teague
Secretary of Energy & Environment

Mary Fallin
Governor

STATE OF OKLAHOMA
OFFICE OF THE
SECRETARY OF ENERGY & ENVIRONMENT

August 28, 2017

The Honorable Scott Pruitt
Administrator
U.S. Environmental Protection Agency
Mail Code 1101A
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460

And

Mr. Lawrence Starfield
Acting Assistant Administrator
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Mail Code 2201A, Room AR 3204
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460

RE: Request for Fuel Waiver Concerning Gasoline for Oklahoma

Dear Administrator Pruitt and Acting Assistant Administrator Starfield,

Due to the landfall of Hurricane Harvey and subsequent catastrophic flooding across Texas and Louisiana, it is believed that shortages of summertime gasoline blends will occur throughout Oklahoma and the region. On behalf of Governor Mary Fallin, I would request that the U.S. Environmental Protection Agency (EPA) exercise its authority under the Clean Air Act to temporarily waive fuel requirements for Low Reid Vapor Pressure (RVP) fuel throughout the State of Oklahoma.

This waiver request is consistent with temporary fuel waivers that you have issued for the State of Texas and has been requested for the State of Louisiana. The State of Oklahoma believes that gasoline supplies will be constrained across the region due to the closure of Gulf Coast refineries.

Thank you for consideration of this request. If you have any questions about this request, please contact Tyler Powell at (405) 522-7193.

Sincerely,

Michael J. Teague
Secretary of Energy and Environment

204 N. ROBINSON, SUITE 1010 • OKLAHOMA CITY, OK 73102 • 405-285-9213 • FAX 405-285-9212

cc: Governor Mary Fallin
Mr. Sam Coleman, Acting Regional Administrator, EPA Region 6
Mr. Guy Donaldson, EPA Region 6
Mr. John Walser, EPA Region 6
Mr. Scott Thompson, Oklahoma Department of Environmental Quality

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