Kentucky Energy Security Plan




State Energy Office
Energy and Environment Cabinet
August 2023

TEAM KENTUCKY
ENERGY AND ENVIRONMENT CABINET

1.0 Introduction

The Commonwealth of Kentucky has access to a variety of energy resources coupled with a robust network of pipelines and electric transmission lines allowing for a unique and diversified energy infrastructure. Energy providers, generators, transmitters, distributors, and associated equipment help ensure a strong and flexible infrastructure for the state. However, Kentucky has the potential to face a wide variety of man-made and natural hazard threats, most of which are small-scale and temporary. These limited disruptions are generally addressed and resolved by energy providers. Occasionally, these disruptions occur over wide areas for extended periods. It is then that they are labeled "energy emergencies" requiring a coordinated response effort from multiple public and private agencies.

Disruptions occur for a variety of reasons. These include extraordinary peak demands, unanticipated refinery or power plant shutdowns, damaged pipelines, transmission congestion, international political factors, cyber incidents, and terrorism. Hurricanes, severe thunderstorms, tornados, winter ice storms, flooding, and wildfires are the most prevalent natural disasters and account for the vast majority of energy emergencies. During recent years, Kentucky has experienced some loss of service resulting from these occurrences.

The State Energy Office of the Energy and Environment Cabinet (SEO-EEC) addresses Energy Security planning through a long-term lens of energy sustainability, resilience, and efficiency. The Kentucky Energy Security Plan is grounded in a framework of Kentucky's Incident Command Structure (ICS), FEMA's Community Lifelines, and the roles of emergency support functions to support those lifelines.

The main purpose of the Kentucky Energy Security Plan is to provide a resource primarily for state energy emergency personnel that includes:

- A description of the energy systems in or affecting Kentucky.
- A profile of energy use and production.
- Monitoring and response procedures for energy disruptions.
- Contact information for key players in the energy systems of Kentucky.

1.1 Purpose

The purpose of the Kentucky Energy Security Plan is to provide coordination, monitoring, assessment, and response to energy disruptions. The Plan outlines the current state of energy systems in the Commonwealth and describes what steps are to be taken, and by whom, in emergencies to help reduce the impact on the citizens and economy. The Plan serves as

Kentucky's Standard Operating Procedure (SOP) and guidance for energy emergency issues.

The effectiveness of the Plan is based on its ability to be a living document. It has been developed as a tool to be applied in managing Energy Security and not as a blueprint to accomplish a specific result. As such, it will be updated as personnel and situations change. Each use, either in exercise or in real world application, will allow it to be sharpened and refined.

As a living document, the Plan does have distinct phases with at least one phase active at all times. Exactly where one phase ends and another begins is not a precise point, but it allows for transition. The transition between phases will occur as the conditions in the Commonwealth change. The four phases of delineation are:

1. Monitoring
2. Situation and Preparation Phase
3. Emergency Response Phase
4. Emergency Assessment Phase

Each phase has its own unique characteristics and is discussed in detail in the Emergency Operation Design Concept (Section 3).

Energy Security planning requires good data acquisition and information management. A limited number of situations can be prepared for, but in the end, quick access to accurate data is an essential attribute of this plan. The Kentucky Energy Security Plan describes a process that looks at all available data, inventories, assets, and liabilities. Because of the unlimited number of potential emergencies that can occur, this Plan will rely heavily on the acquisition and organization of data in lieu of situational planning and modeling. It will also identify stakeholders in the energy arena. It will examine their roles and interests and assess how those roles and interests enhance emergency preparedness in Kentucky. Finally, it will outline an orderly process to employ these assets and agencies in responding to emergencies.

1.2 Defining Energy Emergencies

All energy emergencies are defined as energy imbalances: when the supply of energy resources is temporarily not able (or allowed) to meet the demand. Energy imbalances can occur at any time with or without warning. They may be the result of natural events or artificially induced by human events. Upon becoming an emergency, the energy system can move from a normal balance, or state of energy security, to an energy shortage to an energy crisis. The energy system can also move from the normal balance directly to a crisis, or state of energy insecurity. Influencing factors may include:

- Natural Disasters (earthquakes, floods, wildfires)
- Severe Weather Occurrences (tornados, snow and ice storms, hurricanes, wind)
- Artificial Pricing (embargos, collusion)
- Human Proceedings (labor disputes, strikes, cyber incidents)
- Government Activities (political instability, environmental regulation)
- Terrorism (direct physical or cyber)

Any of the factors listed above can solely, or in combination, be responsible for a brief energy disruption or a more prolonged crisis. The difference between general disruption and crisis is one of magnitude and duration. The system's stakeholders' ability to respond to a disruption can determine the extent of the resulting crisis. Issues that must be considered by the Plan in limiting the scope of or managing an emergency are:

- Intensity or Magnitude
- Cause(s)
- Geographical Distribution
- Duration
- Commodities Affected
- Time of Year
- Public Reaction
- System's Ability to Respond and Restore

Because of the dependence of energy through all areas of society, it is difficult to envision and plan for every possible energy emergency as each situation may be unique and require a specialized plan for correction. Below is a description of ways critical lifelines are dependent on energy supply.

The Plan recognizes this potential situational distinctiveness and relies on information, preparation, and cooperation to address each problem specifically. This requires that the Plan be dynamic. The strength of this plan is placed in the process to discover solutions. Confidence is vested in knowledge of the system through data collection and the working relationships of individuals through a defined structure of operation.

1.3 Basic Emergency Assumptions

Basic emergency parameters are random in nature and occurrence. Characteristics of emergencies that are difficult to predict include the following:

- The triggering event – natural, political, technological
- Geographic distribution of the event
- Time interval involved
- Magnitude of the primary and secondary effects of the emergency
- The speed at which the event occurs

These characteristics will obviously influence the ability and manner in which responders treat energy emergencies. Recognizing the potential unpredictability of these variables necessitates the development of multiple tools and techniques in management. Several other attributes associated with emergencies, while not present in all emergency situations, occur often enough to be considered basic planning considerations. Assumptions may include:

- Abnormal weather is the key event triggering outages.
- Electricity is the commodity most likely to experience outages.
- Public health and safety services require primary consideration in restoration.
- There will be many secondary disruptions caused by interruption of the primary energy flow.
- Management and repair will require the coordinated efforts of multiple public and private agencies.
- Some areas may be inaccessible or need to have access restricted.
- Hoarding or cost escalation of commodities is a real probability.
- Information dissemination to the public is critical to diffuse panic.

1.4 State Government Role in Energy Emergency Management

When the demand for energy is greater than the supply or there is a disruption in the energy delivery system, energy insecurity is created. Typically, market forces and existing energy providers act swiftly and adequately address these disruptions or imbalances; however, these situations can occasionally result in an energy emergency.

If the situation becomes severely imbalanced or no visible means of correction is available, then state government intervention may become necessary in order to protect the health, safety, and welfare of its citizens. The government's intervention should be as minimal as possible to assist in the restoration. The major reliance should still be on market forces and direct response by energy owners and operators for correction.

The state's role in managing any energy emergency should be one of facilitator. In cooperation with other public institutions, energy providers, transportation brokers, and energy distribution groups, the state will attempt to find the least market-intrusive solution possible to rectify the problem. The state's primary goals in managing energy disruptions include:

- Establish legal authority to oversee management of energy shortfalls.
- Develop a single point of contact to act as coordinator during emergencies.
- Ensure provision of energy to essential service.
- Gather and disseminate accurate information in a timely manner during all energy situations.
- Be prepared to assist with public resources to decrease the severity and longevity of the emergency.
- Implement programs that effectively respond to the consequences of a variety of energy shortages.
- Solicit public participation in reducing demand during the emergency.
- Keep the public informed about the emergency and the actions that will be necessary for them to contribute to abating the crisis.

Because of the state's dependency on constant and reliable supplies of all sources of energy, the management of any disruption is critical. Circumstances can and do change quickly and without warning. A management system that relies on the overall coordination of resources from multiple public and private sources is imperative to accommodate the near limitless situations that may arise.

1.5 Community Lifelines

In 2019, FEMA developed the Community Lifelines construct to increase effectiveness in disaster operations and better position these emergency support agencies to respond to catastrophic incidents. Of the 15 ESFs, FEMA identifies eight Community Lifelines that are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.

Community Lifelines reframe incident information and understanding, communicate incident impacts using plain language, promote unity of effort across the whole community, and prioritize efforts to stabilize lifelines during incident response. During the initial response, priority efforts focus on stabilizing Community Lifelines.

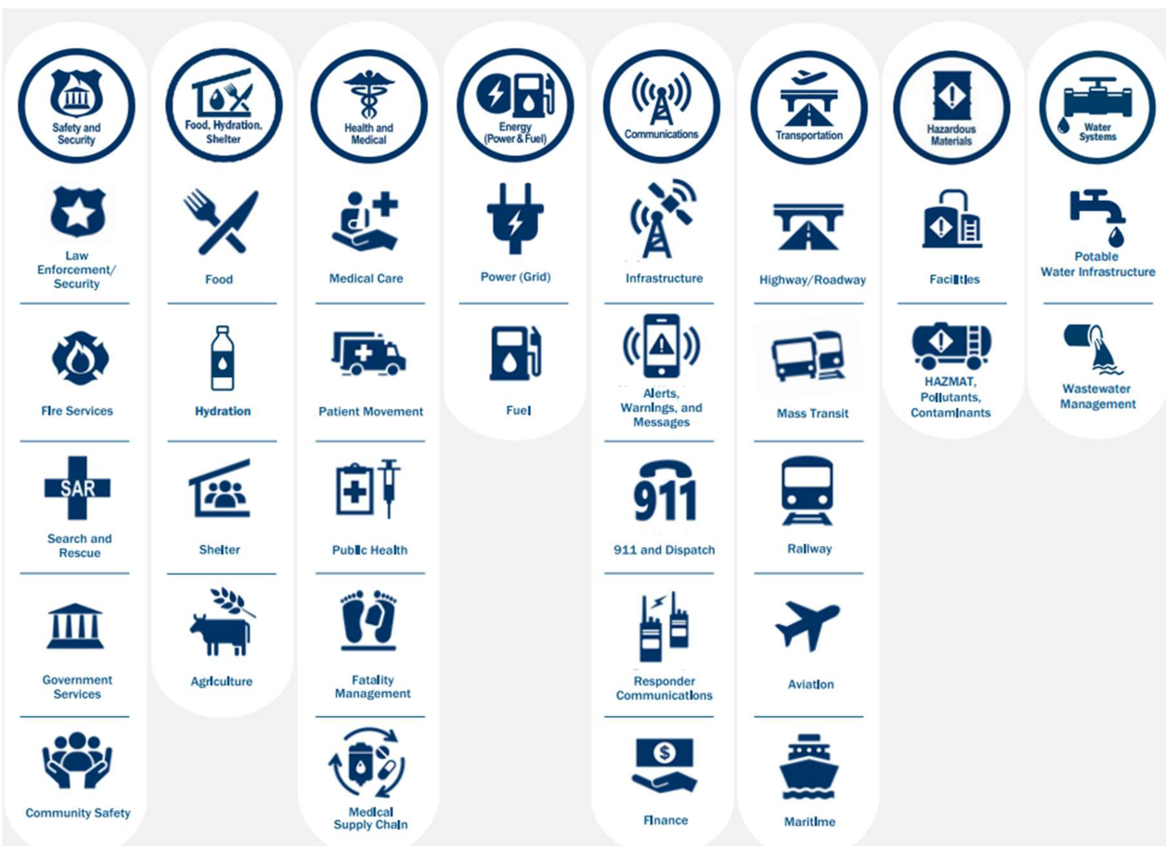


Figure 1: FEMA Community Lifelines

1.5.1 Cross- Sector Interdependencies

Below is an illustration of the interdependencies among the critical infrastructure sectors including the most crucial lifeline sectors: communication, transportation, water, and energy.

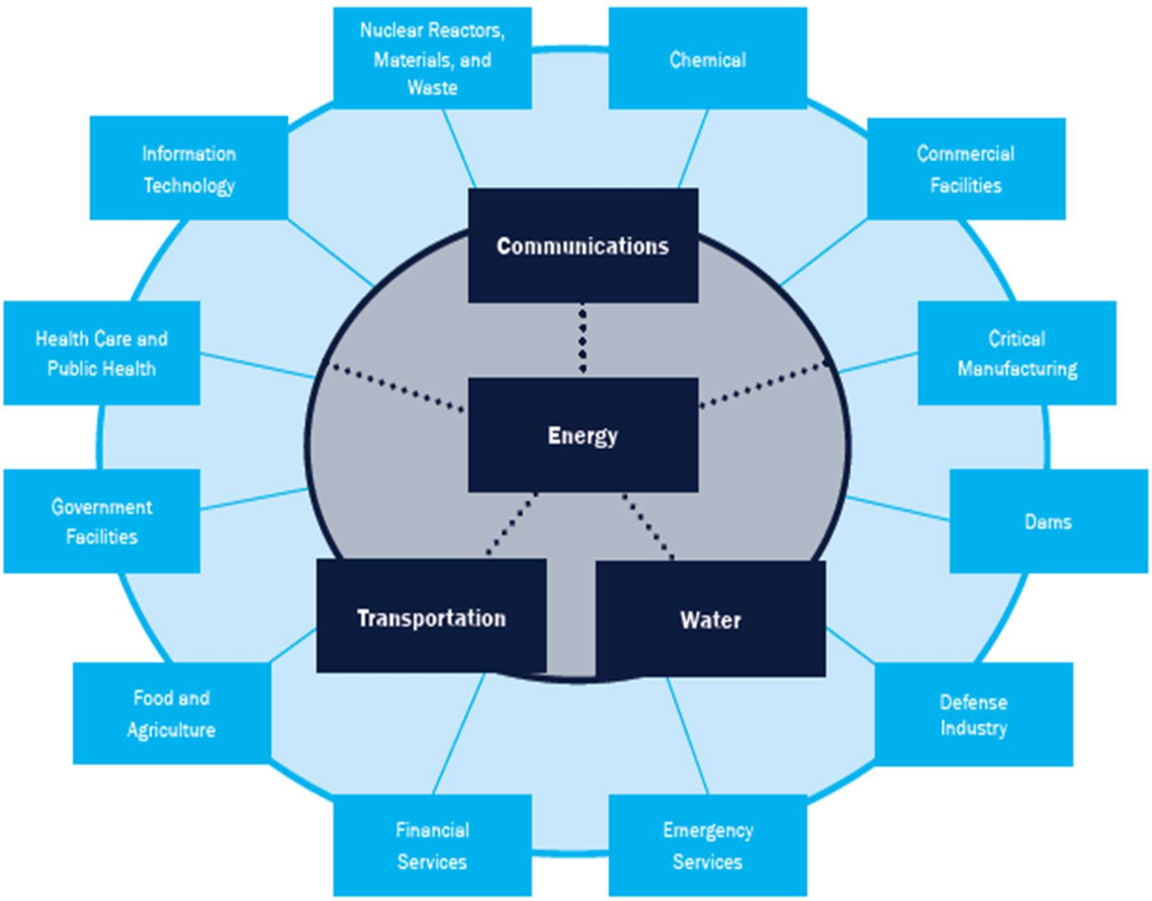


Figure 2: Critical Infrastructure Sector Interdependencies

Lifelines provide an outcome-based, survivor-centric frame of reference that assists responders with: Root Cause Analysis, Interdependencies, Prioritization, and Ease of Communication. The energy system consists of electricity, natural gas, oil, coal, nuclear, and renewable energy assets that are interconnected and complex. It is necessary that planners understand the dependent relationships among energy infrastructure systems, key local services, and valued community assets. Identifying and understanding interdependencies (two-way) or dependencies (one-way) between infrastructure assets and sectors is important for assessing risks and vulnerabilities and energy security and resilience planning.

The Department of Homeland Security (DHS) has defined 16 critical infrastructure sectors including energy. All of the other critical infrastructure sectors depend on power and/or fuel to operate. A disruption or loss of the services provided by the energy sector can directly affect the security and resilience within and across numerous sectors. The energy sector also depends on other sectors to help provide its services. There are also interdependencies within the energy sector itself. A comprehensive understanding of such interdependencies enables the sector to mitigate potential vulnerabilities and helps ensure that the nation's economy continues to deliver goods and services during extraordinary events.

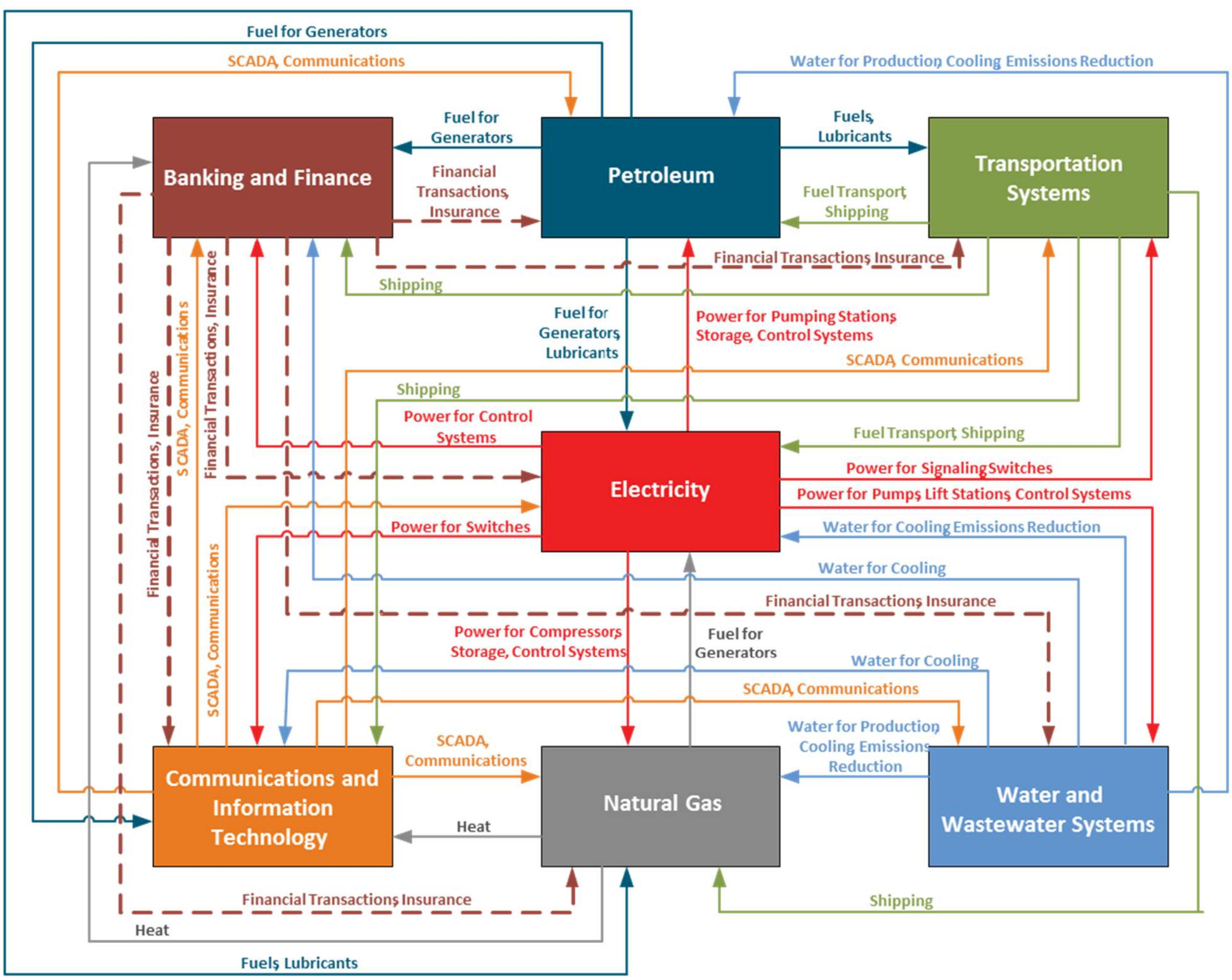


Figure 3: Critical Infrastructure Interdependencies

In order for infrastructure systems—such as transportation, communications, water, and wastewater systems to maintain their functionality, energy infrastructure must be operating properly. This understanding can help plan for additional energy-related resilience, and help mitigate the potential consequences of large-scale failures of energy systems. Listed below is how energy (power and fuel) can specifically relate to energy supply management issues.

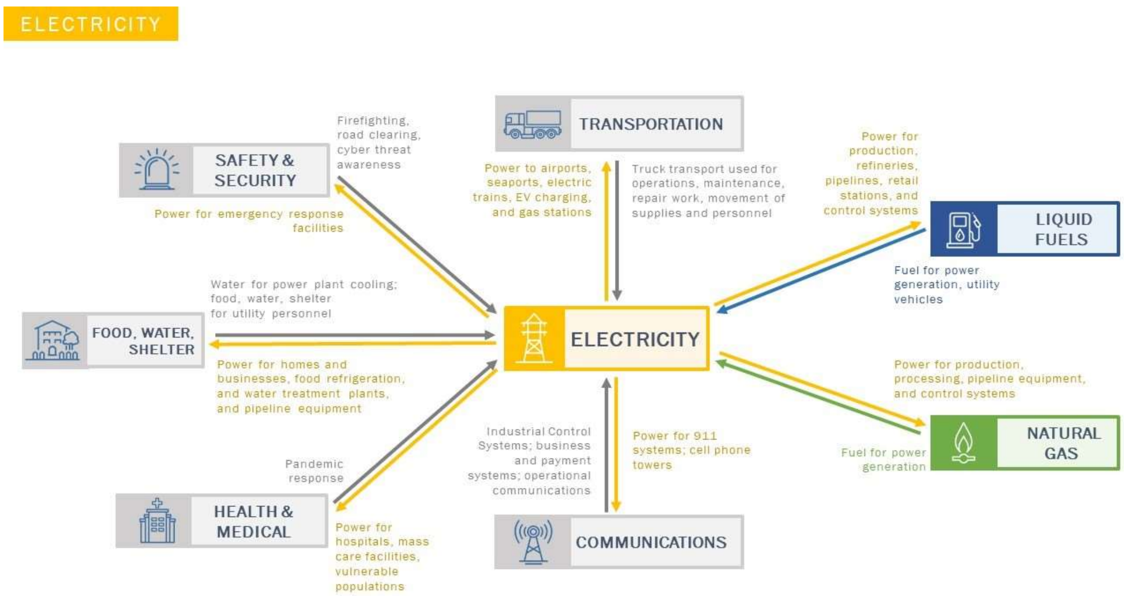


Figure 4: Energy Lifeline Interdependencies

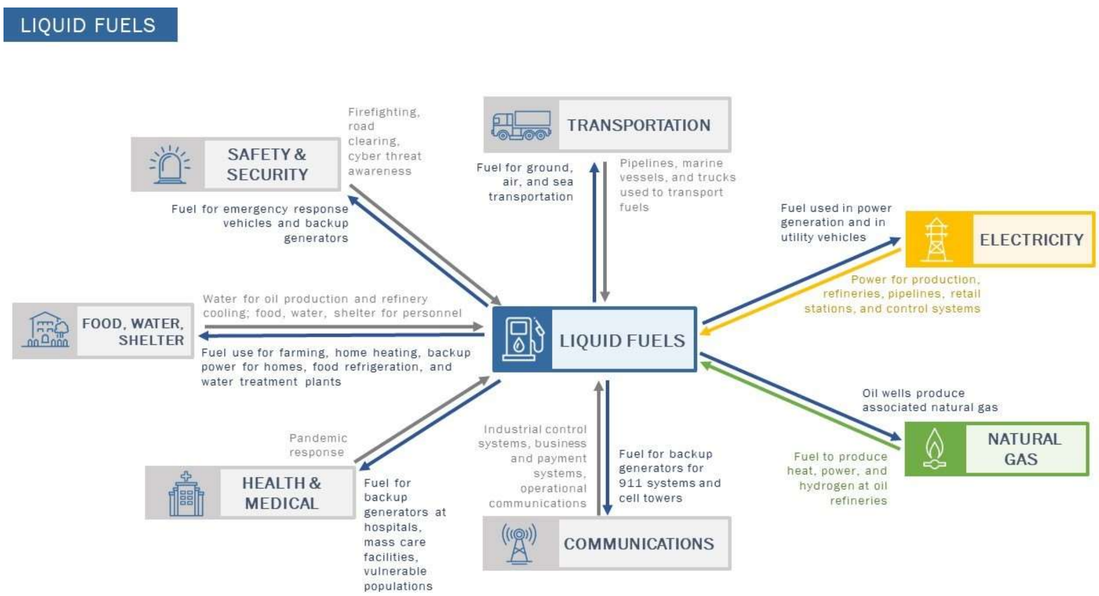


Figure 5: Liquid Fuels Lifeline Interdependencies

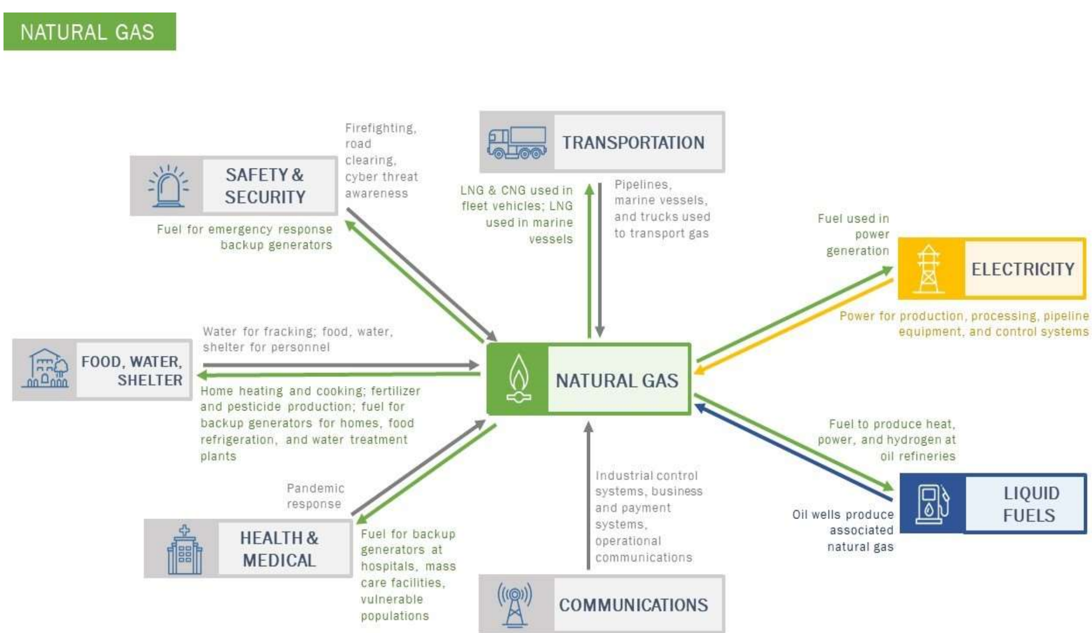


Figure 6: Natural Gas Lifeline Interdependencies

2.0 Organization and Management

2.1 Organization

In the event of an energy emergency in Kentucky, the following agencies are the responsible parties involved in identifying, addressing, and resolving the disruption:

- The Governor's Office
- Kentucky Division of Emergency Management
- State Energy Office in the Energy and Environment Cabinet
- Public Service Commission
- Energy Assurance Advisory Group
- Kentucky Government Agencies

Not every event will require the involvement of all agencies; each agency works independently to manage specific events without the assistance of other groups. However, each group works in a cooperative and consolidated manner to address emergencies when they occur.

In the event of a declared emergency, the chain of command and assignment of responsibilities follows in the order as outlined above. In addition to the state agencies and resources listed above, the Commonwealth of Kentucky will seek information and assistance from groups outside of state government. These groups will include primary energy suppliers, trade associations, transportation providers, pipeline companies, and other relevant organizations. Input from this diverse group is helpful in determining the type and scale of the emergency and in planning the appropriate response.

Energy Emergency Response contacts can be found in Appendix C.

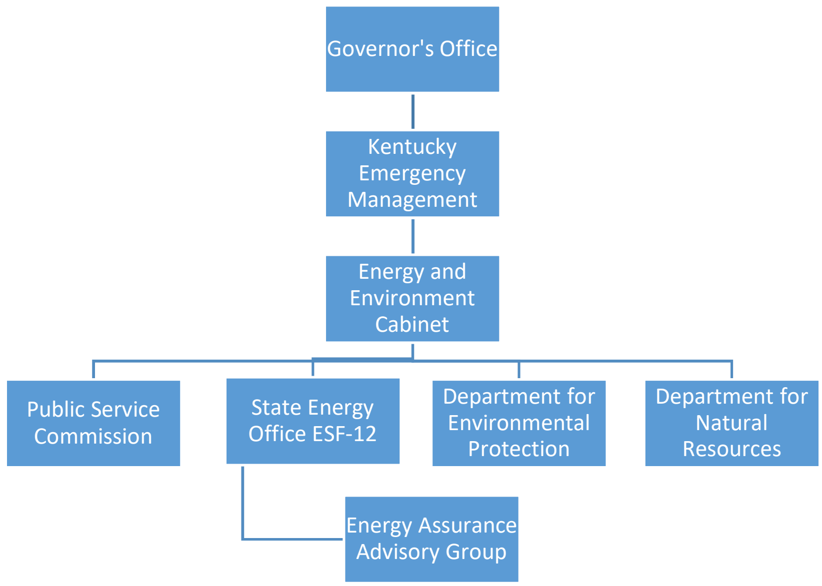


Figure 7: Energy Emergency Command Chart

2.2 Governor's Office

The ultimate authority to respond to any emergency resides in the Governor of the Commonwealth of Kentucky. In accordance with KRS Chapter 39A.100, the Governor may declare an emergency and assume direct operational control of all disaster and emergency response forces in the Commonwealth. With the exception of firearms and ammunition, the Governor may secure any needed resource in the state including means of transportation and communication, fuel, food, clothing, medicine, and buildings.

Short of declaring an emergency, the Governor may also take necessary actions to mitigate any situation that, without intervention, may escalate into an emergency. The Governor can ask the public to voluntarily conserve electricity, gasoline, and other energy sources in times of minor energy shortfalls. Likewise, in times of a more severe energy crisis, the Governor has the authority to issue mandatory conservation and usage measures.

In times of an emergency, the Governor is the final communication link, acting as the point of contact with the federal government and other state governments. In addition, the public looks to the Governor for critical information and general reassurance when difficulties arise.

2.3 Kentucky Division of Emergency Management

The Director of the Kentucky Division of Emergency Management is the Governor's designated representative to coordinate the Commonwealth's response to all state emergencies. The Kentucky Division of Emergency Management (KYEM) is a division of the Kentucky Department of Military Affairs. KYEM functions and roles are dictated in Chapter 39A of the Kentucky Revised Statues (Appendix B). It has two primary mission statements.

> **Mission 1:** To protect the Commonwealth from all situations that could result in a loss of life or loss of property. To establish and maintain world class programs focusing on education and preparedness, community restoration, communications, service coordination, planning, preparation, mitigation, response and recovery.
>
> **Mission 2:** To protect and restore our Commonwealth from all forms of dangers through effective preparation, mitigation, planning, training, response and recovery operations using effective communications, collaboration and coordination techniques.

KYEM is the lead state agency solely dedicated to carrying out mitigation, preparedness, and response and recovery related to actual or potential emergency activities in the state. KYEM's main office is located on the Boone National Guard Center in Frankfort. It also has 10 Area Response Offices located throughout the state. In addition, each county in the state has an Emergency Management Director.

Throughout the Commonwealth, the Kentucky Division of Emergency Management (KYEM), as outlined in KRS 39A, 106 KAR 1:210, and 106 KAR 1:220, is responsible for coordination of emergency response/relief/recovery training and exercises in preparation for natural and manmade disasters such as tornadoes, storms, earthquakes, hazardous material incidents, as well as acts of terrorism involving weapons of mass destruction.

All other agencies in the Commonwealth will actively support KYEM in response to emergencies of severe specific incidents.

Figure 8: Kentucky Division of Emergency Management

Figure 9: KYEM Regions

2.4 State Energy Office of the Energy and Environment Cabinet

The State Energy Office of the Energy and Environment Cabinet has many roles and functions. SEO-EEC has direct responsibility for development of Energy Security and energy emergency management planning in the state. The SEO-EEC's energy mission is to support the utilization of all of Kentucky's energy resources for the betterment of the Commonwealth while protecting and improving our environment.

Staff within the SEO-EEC are responsible for monitoring, advising, and implementing programs and policies to meet the Governor's energy strategy or state-led energy initiatives for the Commonwealth. The office does this through grant management, data and modeling analysis, education and outreach, and policy support to regulatory agencies. In addition to working directly with the energy commodity producers, the SEO-EEC also works with the companies that transport and deliver energy resources to processors and consumers.

Along with planning and participation in policy directives for all energy sources, the SEO-EEC has direct responsibility for the coordination of petroleum fuels – propane, heating oil, kerosene, gasoline, and diesel fuels. The SEO-EEC has the responsibility to facilitate both the flow of information among and between state, federal, and non-governmental agencies during energy emergency situations and the development and maintenance of the Energy Security Plan.

While the Energy Emergency Assurance Coordinator (EEAC) is the primary point of contact for managing and responding to energy emergencies in the state, it requires a team effort to provide the level of knowledge necessary to oversee a number of emergencies. This can be due to the many disciplines the emergency crosses or the rapidity at which information is required to respond efficiently. The EEAC in each state has the responsibility to communicate and share information with other states in the impacted region when a multi-state energy emergency occurs under an agreement supported by DOE, NGA, NASEO, NARUC, and NEMA.

The SEO-EEC will respond to energy emergencies, especially those of a catastrophic nature, using a team concept. Individuals may vary depending on the situation, but the core team will consist of the following members: Energy Security coordinator; data analyst; and public information officer.

This core team will collectively gather information, analyze the emergency, access available resources, and prepare situational reports. The team will also provide information and make recommendations to the Energy Assurance Advisory Group (EAAG).

The Kentucky SEO-EEC is responsible for initiating ESF-12 during times of energy emergencies. The SEO-EEC will work together with KYEM and all energy emergency partners to address any energy deficiency in the state. SEO-EEC is the primary body to assure all Kentucky emergency energy partners are aware of circumstances and coordinating their efforts to solve any energy emergency.

2.5 ESF-12

The Kentucky Energy Security Plan is a component of the State Emergency Operations Plan (SEOP). The Kentucky Division of Emergency Management (KYEM) is the primary agency responsible for emergency operations management in Kentucky and ultimately oversees all aspects of the SEOP. In the event of an emergency, the Director of KYEM may activate the State Emergency Operations Center (SEOC), which would activate the SEOP.

Depending on the type of emergency, the activation of the SEOP may trigger the activation of the Energy Security Plan, of which Emergency Support Function (ESF) 12 is an element.

Emergency Support Function 12 (ESF-12) is the primary Emergency Support Function that defines how energy-related emergencies in Kentucky will be handled. The EEC-SEO is responsible for monitoring, collecting, analyzing, and disseminating information on energy networks within the Commonwealth.

Emergency Support Function 12 is one of 15 Emergency Support Functions found in Appendix (A) and are a part of the SEOP. The basic framework for the ESFs remains constant from the federal government through to the smallest local entity. This allows for uniformity of information transfer and structuring of management responsibilities. Specific procedures and administrative requirements related to most emergencies are outlined in some detail.

The Plan is also used at times when an emergency has not been declared but conditions related to energy supplies or prices are of concern. This chain of control provides uniformity of knowledge and responsibility throughout the system to guide responders in managing and recovering from situations that threaten or affect a significant number of citizens within the Commonwealth.

The SEO-EEC works in coordination and in partnership with the Kentucky Public Service Commission (PSC) along with other ESFs contained within the EEC. The SEO-EEC will not normally act in a direct management capacity during an energy emergency, but will provide coordination, information and assistance to those agencies providing direct assistance.

The goal of ESF-12 is to implement organized procedures to determine how energy resources are used within the state during an emergency. It does so by establishing organizational structure, outlining direction and control, developing a concept of operation, and assigning responsibilities. The ESF-12 as found in the SEOP is as follows:

2.5.1 Structure and Operations

ESF-12 Coordinator
- State Energy Office within Energy and Environment Cabinet (SEO-EEC)

Primary Agencies
- Energy and Environment Cabinet (EEC)
- Public Service Commission (PSC)
- Energy Assurance Advisory Group (EAAG)

Support Agencies
- Kentucky Office of the Attorney General (KOAG)
- Kentucky Cabinet for Economic Development (CED)
- Kentucky Cabinet for Health and Family Services (CHFS)
- Kentucky Department for Local Government (DLG)
- Kentucky Department of Agriculture (KDA)
- Kentucky Finance and Administration Cabinet (FAC)
- Kentucky Emergency Management (KYEM)
- Kentucky Office of Homeland Security (KOHS)
- Kentucky Transportation Cabinet (KYTC)
- Kentucky Infrastructure Authority

- U.S Department of Energy Office of Cybersecurity, Energy Security, and Emergency Response (DOE-CESER)
- U.S Department of Energy ESF-12
- National Association of State Energy Officials (NASEO)
- National Association of Regulatory Utility Commissioners (NARUC)
- Federal Emergency Management Agency (FEMA) Region IV ESF-12
- U.S Department of Energy Office of Cybersecurity, Energy Security, and Emergency Response (DOE-CESER)
- National Association of State Energy Officials (NASEO)
- National Association of Regulatory Utility Commissioners (NARUC)
- Federal Emergency Management Agency (FEMA) ESF-12
- U.S. Department of Energy
- U.S. Environmental Protection Agency

MISSION

The mission of ESF-12 is to provide for the organization, coordination, and direction of all energy resources within the Commonwealth for use during an emergency. This is done by defining and establishing responsibility and authority in energy matters at the various levels within the Commonwealth, and by establishing close working relationships with public and private sector energy producers, marketers and transporters.

ASSUMPTIONS

- Corrective actions will require cooperation at multiple levels of government and with private sector energy providers.

- A wide range of events, both natural and human derived, can disrupt existing energy networks. These disruptions will require state, local and federal agencies to take action, in conjunction with the private sector, to re-establish normalcy.

- Not all events will require the participation of all agencies. All events will be managed at the lowest level of responsibility.

- Energy emergencies affecting the state will typically be managed by energy related agencies that comprise the Kentucky Energy and Environment Cabinet.

DIRECTION AND CONTROL

- The KYEM Director, via the SEOC, is the Governor’s designated representative to coordinate the Commonwealth’s response to all state emergencies. During an energy emergency, the SEOC receives guidance and recommendations from the SEO-EEC.

Additionally, the SEOC coordinates energy emergency policy and actions with the EEC Secretary. The SEOC is responsible for coordinating issues concerning local government operations and works directly with local government through the KYEM Area Managers.

- The SEO-EEC is responsible for tracking energy networks affecting the Commonwealth and overseeing the coordination and implementation of the Energy Security Plan.
- The SEO-EEC oversees the activities of the Energy Assurance Advisory Group. The EEC Secretary chairs the Advisory Group.
- The Energy Assurance Advisory Group is responsible for (1) Reviewing and implementing the state Energy Security Plan; (2) Representing and communicating the needs of their respective constituencies to ESF-12; and (3) Serving as liaison to national or regional organizations.

CONCEPT OF OPERATIONS

Operational Phases

Preparedness

- Review and update state and federal disaster procedures as they relate to ESF-12 activities.
- Continually monitor the energy network infrastructures and supply chains.
- Develop the Emergency Energy Security Plan and train key personnel in operational phases.
- Access information on existing state and federal databases regarding energy supplies and demand.
- Develop and maintain relationships with all public and private energy industry personnel involved in operational phases of energy management.
- Participate in exercises to test the operational effectiveness of the emergency response plan.
- Coordinate the Energy Assurance Advisory Group.
- Upon instructions from the Governor or representative, shift to response phase.

Response

- Develop situational energy assessment and provide to EEC Secretary and the SEOC.
- Contact energy industry personnel and energy emergency committee members to provide update assessment.
- Start a continuity file notebook; the continuity file will consist of all event-related actions documented for the event.
- Establish contact with and request information on supply and demand from producers, distributors, or trade organization of the energy commodity experiencing the disruption.
- Establish contact through the SEOC with county emergency management agencies in the affected areas.
- Obtain information on current energy utilization conditions and needs.
- Coordinate press releases in accordance with the Emergency Energy Security plan and the SEOC Joint Information Center (JIC), and coordinate communications utilizing prepared media advisories and public announcements regarding the potential energy shortage and appropriate public actions.
- Obtain current information regarding energy shortages, prices, and curtailments in the affected region.
- Share information and coordinate responses between like agencies, if the nature of the emergency involves multiple states.
- Establish contact with respective federal government agencies, providing update on emergency status and anticipated actions.
- Identify and contact the Federal Coordination Officer (FCO) through the SEOC in accordance with FEMA ESF-12.
- Utilize the Ready-Op software for situational awareness and communication with ESF-12 partners.
- Activate the Energy Assurance Advisory Group.

- Advise the Governor and the SEOC on current and continuing functions, problems and activities in the energy area.
- Assist the Governor or the SEOC in carrying out the policies, plans, and instructions pertaining to energy resources as outlined in the Emergency Energy Security Plan.
- Advise the Governor or the SEOC on the Commonwealth's energy resource needs.
- Implement policies and programs outlined in the Emergency Energy Security Plan to maximize available supplies or minimize existing demand levels.
- Maintain current information on the availability of energy resources and systems within the Commonwealth.
- Analyze the current situation and determine the best utilization of available energy resources.
- Recommend, if the situation continues to deteriorate, to the SEOC that the Governor declare a state of emergency under the provisions of KRS Chapter 39A.100.
- If it appears that options available to the Commonwealth to deal with the problem have proven inadequate, the next level of mobilization is to request federal assistance. Federal assistance would generally be available in the case of a national or international energy emergency. The SEO-EEC and representatives from other appropriate state departments will be responsible for coordinating, monitoring, and assisting federal programs. Federal assistance may be requested sooner if such actions prevent the need to take actions that are more drastic.
- Recommend opening of public shelters during time of crisis dealing with energy-related problems.
- Shift to recovery phase upon instructions from the SEOC or the Governor.

Recovery

- Carry out operations as directed by the SEOC to save lives and property.
- Revert to response or preparedness phase upon direction of the SEOC.
- Advise the SEOC and the Governor on current and continuing functions, problems, and activities related to the energy disruption.

- Assist the SEOC and the Governor in carrying out the policies, plans, and directives outlined in the Emergency Energy Security Plan or current operational plan pertaining to restoring energy resources balance.
- Advise the Governor or the SEOC on state energy resource needs.
- Maintain current information on the availability of energy resources.
- Coordinate requests for energy resources based on current policies or situational operation plans.
- Recommend the issuance of authorizations for necessary use of energy resources to essential users.
- Research, analyze, and determine the best utilization of available energy resources supply based on current conditions.
- Survey organizations upon completion of the operation and the costs of preparing and conducting the operation.
- Analyze the effectiveness of the Emergency Energy Security Plan in addressing the situation and formulating a response to the energy disruption.

ASSIGNMENT OF RESPONSIBILITIES

Primary Agencies

Energy and Environment Cabinet

- *Department for Environmental Protection (DEP)*
    - The DEP is responsible for coordinating ESF-3 (Public Works) and 10 (Oil and Hazardous Materials) activities as it relates to energy issues and works cooperatively with ESF-12.
    - The DEP is also responsible for assisting with fuel waivers, working on debris management and solid waste issues following an event, coordinating water and wastewater emergency information, education and outreach on hazardous material management during an event, and responding to oil and hazardous material releases.
- *Department for Natural Resources (DNR)*

- The DNR is responsible for the inspection, permitting, and reclamation of Kentucky coalmines and the safety of mineworkers.
- The DNR is responsible for the permitting, inspection, and reclamation of the crude oil and natural gas industry in Kentucky.
- The DNR is responsible for the protection, conservation and enhancement of Kentucky's forest resources and for providing assistance to Kentucky's 121 conservation districts.

- *Office of Nature Preserves*
  - Manages the cabinet's rare species and natural areas management programs
- *Public Service Commission (PSC)*
  - The PSC is responsible for all issues dealing with natural gas and electrical service, including utilities normally considered non-jurisdictional.
  - The PSC is responsible for natural gas pipelines and electric transmission issues.
- *State Energy Office within Energy and Environment Cabinet (SEO-EEC)*
  - The SEO-EEC serves as coordinator for ESF-12, and is responsible for all issues dealing with natural gas products and petroleum industries [all liquid petroleum fuels and liquid petroleum gas (LPG)].
  - The SEO-EEC will be the primary agency responsible for monitoring, collecting, analyzing, and disseminating information on energy networks with the Commonwealth.
  - The SEO-EEC will not normally act in a direct management capacity during an energy emergency, but will provide information and assistance to agencies providing direct assistance.
  - The SEO-EEC will develop and maintain an Emergency Energy Security Plan for the Commonwealth.
  - The SEO-EEC will coordinate the Energy Assurance Advisory Group.
  - The SEO-EEC and the PSC provide staff to the SEOC as needed.

- When required, the SEO-EEC assign ESF-12 Coordinators to the Federal JFO as described in the NRF.

Local Government Representatives

- County governments are responsible for the coordination of all energy resources within their respective areas in coordination with the SEOC.
- Each county judge executive or mayor of an urban county government will coordinate energy resources and supplies during an emergency through the SEOC.
- Government representatives oversee local or regional energy emergency plans.

Supporting Agencies

- All supporting agencies for this ESF will provide information and resources as required by the ESF-12 Coordinator.
- Supporting agencies will ensure their representatives are properly trained and exercised on the plans and procedures relating to their work.
- When requested, support agency representatives will conduct ESF-12 support activities as identified by the Secretary of the EEC.

At all phases of an energy emergency, the SEOC is the primary point of coordination and must be advised of all assistance provided. The SEOC and appropriate law enforcement and emergency response agencies must be immediately alerted should events deteriorate to the extent that citizens and property within the Commonwealth are exposed to greater risk.

Energy Assurance Advisory Group

The Energy Assurance Advisory Group is comprised of public sector advocates, local government representatives, supporting state agencies, private sector associations, public sector association, industry and utility partners, along with relevant federal and state associations.

- The Group will meet annually to review the Energy Security Plan and at the request of the EEC Secretary as issues arise.
- Each member is responsible for communicating to the SEO-EEC of energy-related disruptions, events, needs, or concerns.

- Each member is responsible for understanding the functions, roles and responsibilities of ESF-12.

Energy Assurance Advisory Group Members:

EEC Primary Agencies

Support Agencies

Kentucky Public Service Commission

Office of the Attorney General (OAG)

- The OAG serves as a primary support agency where it represents interests of the public. OAG deals with issues involving price gouging for all energy sources except for utilities under the jurisdiction of the PSC.

Private and Public Associations

- Kentucky Municipal Utility Association
- Kentucky Oil and Gas Association
- Kentucky Gas Association
- Kentucky Coal Association
- Kentucky Utility Information Exchange
- Kentucky Association of Manufacturers
- Kentucky Chamber of Commerce
- Kentucky Chapter of American Petroleum Institute
- Kentucky Propane and Gas Association
- Kentucky Petroleum Marketers Association
- Kentucky Industrial Utility Customers
- Kentucky Clean Fuel Coalition
- Kentucky Association of Counties
- Kentucky League of Cities
- Kentucky Council of Area Development Districts
- Kentucky Association of Electric Cooperatives
- Kentucky Rural Water Association
- Kentucky Motor Trucking Association
- Kentucky Emergency Management Association
- Red Cross

Industry Representatives

- Energy industries (mining, extraction, generation, production, transmission, and distribution, transportation, wholesale and retail) are responsible for operating their systems and facilities to provide the maximum possible service within their capabilities, and fulfill essential needs as specified by appropriate governmental authorities. This includes responsibility for management, continuity, personnel and facility protection, conservation of supplies, restoration of damaged facilities, and the expansion or improvement of systems as practical and as necessitated under emergency conditions.

- To carry out these responsibilities, a representative of the major private sector industries operating in Kentucky will serve on the Energy Assurance Advisory Group and will recommend priorities, provide guidance and develop solutions.

- Operational control of the energy industries will remain with the responsible officials of the industry.

The SEO-EEC will serve as the coordinating body to assure all ESF-12 functions outlined in the SEOP are accomplished. Each organization noted in ESF-12 has essential responsibilities that are critical to the Kentucky Energy Security Plan, and the SEO-EEC is responsible for organizing and coordinating this effort.

The ESF-12 also offers guidance as to how and when agencies will participate in responding to disruptive or emergency energy situations. ESF-12 also offers a broad concept of operation from preparedness to recovery. Each phase suggests general activities to be carried out during that phase.

The Department of Energy CESER has developed an ESF-12 “Playbook” that provides a starting point for energy emergency response planning including a framework for evaluating energy emergencies, guidance and templates for emergency response actions, and other supplemental planning, monitoring, and response resources. The Playbook is intended to provide guidance on how and when to utilize authorities and response actions detailed in State Energy Security Plans.

The ESF-12 Playbook can be found in attachment # 1 of Appendix A.

2.6 Public Service Commission

The Kentucky Public Service Commission (PSC) is a three-member administrative body with quasi-legislative and quasi-judicial duties and powers. The PSC regulates over 1,100 utilities in the state. It is funded by an assessment, paid by these utilities, based on their annual gross intrastate revenues. The PSC performs its regulatory functions through issuance of written orders following adjudicative and rulemaking procedures. Specific citations can be found in KRS Chapter 278 and administrative regulations promulgated by the Commission.

The mission of the PSC is to foster the provision of safe and reliable service at a reasonable price to the customers of jurisdictional utilities while providing for the financial stability of those utilities by setting fair, just, and reasonable rates and supporting their operational competence by overseeing regulated activities.

The Commission regulates the intrastate rates and services of investor-owned electric, natural gas, telephone, water, and sewage utilities, customer-owned electric and telephone cooperatives, water districts and associations, and certain aspects of gas pipelines. The following are some of the areas for which the Commission has regulatory responsibility:

- Rate increase or reduction.
- Expansion or reduction of utility service boundaries.
- Construction and operation of utility facilities.
- Meter accuracy.
- Operating conditions of a utility.
- Management audits.
- Valuation of utility property.
- Natural gas and coal purchasing practices.
- Issuance or assumption of securities by a utility.
- Consumer complaints.
- Compliance with service and safety regulations.

The PSC is also responsible for oversight of regulated electric and natural gas utilities during any energy emergencies. The SEO coordinates information on non-regulated utility interruptions during an event. Specific reporting requirements (807 KAR 5:006, Section 26 and 27) are currently in place for the regulated electric utilities. Section 27 (c) Loss of service for four (4) or more hours to ten (10) percent or 500 or more of the utility's customers, whichever is less, must be reported to the PSC. Information includes the number of customers without service, probable cause of the failure, personnel and resources dedicated to the problem, and an estimated time of service returning. A map of the Electric Distribution Service Areas can be found in Section 6.1. A PSC outage report template can be found at the end of the Disruption Tracking Section, 5.4. Utilizing the PSC reporting system and Environment for Analysis of Geo-Located Energy Information (EAGLE-I). The PSC and SEO form a coordinated situational awareness of statewide outages along with routine communication with regulated and non-regulated utility partners through Ready-Op.

2.7 Energy Assurance Advisory Group (EAAG)

The Kentucky Energy Assurance Advisory Group (EAAG) is composed of public-sector advocates, local government representatives, supporting state agencies, private-sector associations, public-sector associations, and industry and utility partners along with relevant state and federal associations.

The organizations on the EAAG are responsible for communicating information and coordinating resources to their constituents and vice versa. These organizations will also represent the EAAG and their constituencies at regional and national meetings that deal with the same type of energy issues. The EAAG periodically meets to discuss energy issues and policies that affect the state.

2.8 Kentucky Agencies

The Cabinet for Health and Family Services (CHFS) provides funding and program oversight for the Low-income Home Energy Assistance Program (LIHEAP), while the Kentucky Housing Corporation (KHC) provides program oversight for the Weatherization Assistance Program (WAP) and coordinates community action agency and citizen advocacy issues.

The Office of the Attorney General (OAG) assists in customer complaints, consumer protection, and issues requiring legal assistance. It also investigates price and service complaints, except for specific price complaints against utilities under the jurisdiction of the PSC.

The Department of Agriculture's responsibilities include working with agricultural producers and commodity groups to monitor fuel or electricity disruption effects within sector such as events affecting propane for the poultry industry or other industry impacts. In addition, the Department is responsible for supporting accurate weights and measures of fuel and assisting with Reed Vapor Pressure (RVP) waivers.

The Kentucky Department for Public Health (DPH) is responsible for developing and operating state public health programs and activities for the citizens of Kentucky. The mission of DPH is to improve the health and safety of people in Kentucky through prevention, promotion, and protection.

The Department of Aging and Independent Living (DAIL) in the Cabinet for Health and Family Services is the designated State Unit on Aging under the Older Americans Act. Their mission is to develop community-based systems of care that foster independence and quality of life of older persons and young functionally impaired adults. Services include Homecare, Adult Day/Alzheimer's Disease Respite, Ombudsman Services, Senior Employment Personal Care Attendant Services, Benefits Counseling, Caregiver support, and other services such as congregate and home-delivered meals and supportive services.

The Kentucky Transportation Cabinet (KYTC) serves as the lead agency to determine if waivers of Federal Motor Carrier Safety Administration (FMCSA) regulations are appropriate and/or required. Coordination for such waivers is issued by the KYTC Department of Vehicle Regulation.

The major mission of the Kentucky Office of Homeland Security (KOHS) is to lead the Commonwealth's coordination and collaboration efforts with public and private preparedness partners to ensure a ready and prepared Kentucky. Specific energy-related tasks for KOHS are related to counter-terrorism, critical infrastructure, buffer-zone protection, and community safety and security and federal-grant administration. The KOHS also has administrative oversight of the Kentucky Intelligence Fusion Center (KIFC). In addition to other security activities, the KIFC serves as a 24/7 traffic and incident-management center that monitors highway construction, maintenance, weather, and other events affecting traffic flow and highway safety.

The Department for Local Government (DLG) assists in the coordination of energy issues and concerns with municipalities and county judges. DLG is particularly adept in the dissemination of information and training of local government officials.

2.9 Federal Agencies

States interact with many agencies to help protect citizens or assets during times of energy shortages or emergencies. The federal agency that states generally work with more than any other in this capacity is the Department of Energy (DOE). The Energy Information Administration (EIA) is the chief federal agency that compiles energy data and statistics. In addition to other energy information, DOE also maintains a secure site, ISERnet, for state agencies and other responders to share information on responding to and planning for energy disruptions.

The Office of Cybersecurity, Energy Security, and Emergency Response (CESER) mission is to maintain unique sector-wide situational awareness; discover and mitigate vulnerabilities and cyber threats; and orchestrate response and recovery operations through capacity building, partnerships, research, and information sharing to safeguard against all hazards and protect our nation's energy system. CESER focuses on emergency planning and response. It is also the primary federal agency for formulating strategies to protect critical infrastructure under the National Infrastructure Protection Plan.

CESER has regional ESF-12 coordinators that facilitate incident coordination across government and with the private sector to enhance response and recovery efforts and coordinate federal capabilities to mitigate the impact of energy disruptions. Formal incident coordination processes and procedures, including the deployment of cyber assistance capabilities, are aligned with the National Incident Management System (NIMS) and National Response Framework (NRF) in place. In the event of a cyber-incident, DOE will exercise its emergency authority for cyber incidents based on these clearly defined processes and procedures. Ongoing activities include training, exercises, and information sharing.

DOE Environment for Analysis of Geo-Located Energy Information (EAGLE-I) system is an interactive geographic information system (GIS) that allows users to view and map the nation's energy infrastructure and obtain near real-time informational updates concerning the electric, petroleum, and natural gas sectors within one visualization platform. EAGLE-I provides capabilities for monitoring energy infrastructure assets, reporting energy outages, displaying potential threats to energy infrastructure, and coordinating emergency response and recovery. EAGLE-I is a tool developed by a set of institutions from the United States that enables users to locate scientific resources around their country. It uses an ontology to map the resources (such as scientific equipment) to their location facilitating reuse and collaboration.

The following tables provide an overview of the many federal departments and agencies that play a role in energy security. Many of these agencies have roles and responsibilities that extend beyond the energy sector. Each agency's energy-related activities have been categorized as applying to electricity, liquid fuels, or natural gas. Agencies that safeguard the cybersecurity and physical security of energy infrastructure are also indicated.

Agencies' energy security activities may involve:

- Energy emergency preparedness and response, including hosting and participating in preparedness planning and exercises and deploying responders or resources during emergency events.
- Information sharing and situational awareness, including publishing data and threat information and issuing situation reports during emergency events.
- Development and enforcement of standards and regulations for energy industry safety and security. During emergency events, some of these standards and regulations may be waived to facilitate faster response and restoration.

Department or Agency		Sector	Preparedness & Response	Situational Awareness	Standards & Regulations
White House		Electricity, Liquid Fuel, Natural Gas, Cyber and physical security	✓	✓	
DHS	FEMA	Electricity, Liquid Fuel, Natural Gas	✓	✓	
	CISA	Cyber and physical security	✓	✓	
	Coast Guard	Liquid Fuel, Natural Gas	✓		✓
	TSA	Liquid Fuel, Natural Gas, Cyber and physical security	✓		✓
	CBP	Electricity, Liquid Fuel, Natural Gas			✓
DOE	CESER	Electricity, Liquid Fuel, Natural Gas, Cyber and physical security	✓	✓	
	OE	Electricity		✓	✓
	EIA	Electricity, Liquid Fuel, Natural Gas		✓	
	FERC	Electricity, Liquid Fuel, Natural Gas			✓
DOT	FMCSA	Electricity, Liquid Fuel			✓
	PHMSA	Liquid Fuel, Natural Gas	✓		✓
EPA		Electricity, Liquid Fuel, Natural Gas			✓
IRS		Liquid Fuel			✓
DOD	USACE	Electricity, Liquid Fuel, Natural Gas	✓		✓
NRC		Electricity	✓	✓	✓
DOJ	FBI	Cyber and physical security	✓		
DOI	DOI BSEE	Liquid Fuel, Natural Gas		✓	✓

Electricity | Liquid Fuel | Natural Gas | Cyber and physical security

Figure 10: Federal Agencies Energy Security Activities

Department or Agency		Energy Security/Emergency Response Role
White House		The White House—particularly the National Security Council—participates in public briefings and interagency situational awareness activities. The President also has the authority to declare a national state of emergency.
Department of Homeland Security (DHS)	Federal Emergency Management Agency (FEMA)	FEMA coordinates federal incident response and recovery activities. FEMA's duties during an event include assisting the President in carrying out the Stafford Act, operating the National Response Coordination Center (NRCC), supporting all Emergency Support Functions (ESFs) and Recovery Support Functions (RSFs). FEMA mission assigns the Defense Logistics Agency (DLA) to provide fuel support to federal responders and, if requested, SLTT responders and critical infrastructure. FEMA funds Public Assistance (PA) disaster funds, hazard mitigation projects through the Building Resilient Infrastructure and Communities (BRIC) Program, Hazard Mitigation Grant Program (HMGP), and others.
	Cybersecurity and Infrastructure Agency (CISA)	CISA leads the national effort to understand, manage, and reduce risk to cyber and physical infrastructure. CISA manages the Pipeline Cybersecurity Initiative, leveraging expertise from government and private partners to identify and address cybersecurity risks to pipeline infrastructure. CISA publishes best practices for cybersecurity protection. During a cyber incident, CISA assists impacted infrastructure, helps investigate the responsible actors, and coordinates the national response to significant cyber events.
	U.S. Coast Guard	The U.S. Coast Guard is the principal federal agency responsible for maritime safety, security, and environmental stewardship in U.S. ports and inland waterways used for the movement of energy products, including petroleum, natural gas, and coal. The Coast Guard reviews and approves security assessments and security plans developed by vessel owners and terminal operators, and inspects terminals for compliance with security requirements. The Coast Guard's role is particularly important during hurricanes and other severe weather that can disrupt energy supplies (primarily liquid fuels) into and out of U.S. ports.

Department or Agency		Energy Security/Emergency Response Role
	Transportation Security Administration (TSA)	TSA oversees the physical security and cybersecurity of all U.S. pipelines. TSA issues directives for owners and operators of pipelines to better secure pipelines against cyberattacks. TSA also oversees security at marine ports, where oil and gas marine terminals, petroleum refineries, and other energy infrastructure may be located. TSA conducts background checks and issues federal identification cards (called TWIC® cards) to workers accessing secure areas within port boundaries, including fuel truck drivers, refinery workers, and other energy industry workers. TSA may waive TWIC requirements during energy emergencies to facilitate energy restoration and response activities.
	CZM2 (CBP)	CBP is the primary federal agency tasked with ensuring the security of the nation's borders. CBP is responsible for enforcing and administering laws and regulations to control and oversee vessel movements in to, out of, and between U.S. ports. CBP enforces the Merchant Marine Act of 1920, also called the Jones Act, which generally prohibits the transportation of merchandise between two U.S. ports in any vessel not built in, documented under the laws of, and owned by citizens of the United States. Applications may be made to CBP for the Secretary of Homeland Security to grant a Jones Act waiver, which can help facilitate the delivery of fuel and equipment during energy shortages.
U.S. Department of Energy	Office of Cybersecurity, Energy Security, and Emergency Response (CESER)	CESER's mission is to enhance the security of U.S. critical energy infrastructure to all hazards, mitigate the impacts of disruptive events and risk to the sector overall through preparedness and innovation, and respond to and facilitate recovery from energy disruptions in collaboration with other federal agencies, the private sector, and State, local, tribal, and territory governments. CESER's preparedness and response activities include SLTT capacity building, energy security and resilience planning, hosting energy emergency exercises and deploying ESF-12 responders to impacted regions during emergencies. CESER facilitates interagency coordination, shares situational

Department or Agency		Energy Security/Emergency Response Role
		awareness products, and provides emergency response support to SLTT governments. CESER also advances research, development, and deployment of technologies, tools, and techniques to reduce risks to the Nation's critical energy infrastructure posed by cyber and other emerging threats. CESER administers programs that can be used to mitigate impacts to energy infrastructure and energy supply, and to provide resources during energy emergencies: • The Federal Power Act Section 202(c) grants DOE the power to temporarily order connections of facilities, and generation, delivery, interchange, or transmission of electricity during grid emergencies. • The Strategic Petroleum Reserve is a federally owned emergency supply of crude oil. Volumes can be released to mitigate the impact of crude supply disruptions. • The Northeast Home Heating Oil Reserve and Northeast Gasoline Supply Reserve provide emergency supplies of heating oil and gasoline, respectively.
	Office of Electricity (OE)	OE provides national leadership to ensure that the Nation's energy delivery system is secure, resilient and reliable. Through research and development, OE develops new technologies to improve electric infrastructure. OE also oversees the Federal and state electricity policies and programs that shape electricity system planning and market operations.
	Office of Enterprise Assessments	The Office of Enterprise Assessments oversees four federal Power Marketing Administrations (PMAs) - Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA) and Western Area Power Administration (WAPA) – that operate electric systems and sell the electrical output of federally owned and operated hydroelectric dams in 34 states.
	U.S. Energy Information	EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its

Department or Agency		Energy Security/Emergency Response Role
	Administration (EIA)	interaction with the economy and the environment. EIA's data can be used in energy security planning and energy emergency response activities. EIA publishes state energy profiles, data products related to energy supply, demand, infrastructure, and prices, as well as GIS maps.
	Federal Energy Regulatory Commission (FERC)	FERC is an independent agency that regulates the interstate transmission of electricity, natural gas, and oil. FERC's role includes oversight of the transmission and wholesale sale of electricity in interstate commerce, transportation of oil by pipeline in interstate commerce, and proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects. During energy emergencies, FERC also has emergency authority under the Interstate Commerce Act to direct companies to provide preference or priority in transportation, embargoes, or movement of traffic. This authority can be used to direct interstate pipeline operators to prioritize shipments of specific fuels to address shortages.
U.S. Department of Transportation	Federal Motor Carrier Safety Administration (FMCSA)	FMCSA sets safety requirements for interstate commercial drivers, such as hours of service requirements limiting how long drivers can be on the road before a mandatory break. During energy shortages, FMCSA can waive these requirements to facilitate the delivery of specific energy products, most often liquid fuels, or to facilitate the movement of utility crews, trucks, and other resources involved in the restoration of electric power.
	Pipeline and Hazardous Materials Safety Administration (PHMSA)	PHMSA regulates pipelines and rail tank cars to advance the safe transportation of petroleum, natural gas, and other hazardous materials. The agency establishes national policy, sets and enforces standards, educates, and conducts research to prevent incidents. The agency also prepares the public and first responders to reduce consequences if an incident does occur. During pipeline incidents (explosions or spills), PHMSA investigates and issues corrective action orders to pipeline operators before pipeline service can resume. During energy shortages, PHMSA can issue emergency special permits and

Department or Agency		Energy Security/Emergency Response Role
		waivers of certain regulations to facilitate the pipeline supply of fuel to the affected region. PHMSA also regulates rail tank cars that carry petroleum, biofuels, or liquefied natural gas.
U.S. Environmental Protection Agency (EPA)		EPA sets standards for certain fuels, including regulating the vapor pressure of gasoline, requiring reformulated gasoline in certain markets, and specifying the sulfur content in diesel fuel. These fuel specifications can be waived during emergencies to facilitate the supply of fuel into the affected region, or to provide fungibility of available supply within the affected region. EPA also regulates air emissions from energy infrastructure, including power generating facilities and fuel storage terminals. During events, EPA may choose not to enforce these regulations to facilitate power supply and fuel supply in the affected region.
Internal Revenue Service (IRS)		IRS collects federal motor taxes on diesel fuel used for on-highway transportation. Diesel used for off-highway purposes (heavy machinery, generators, farm equipment, etc.) is not subject to tax and is dyed red. In coordination with EPA, the IRS can choose to not collect the penalty typically imposed on using non-highway diesel in on-road vehicles (although the IRS still collects tax on this fuel).
Department of Defense (DOD)	U.S. Army Corps of Engineers (USACE)	USACE assists FEMA during disaster response, including installing generators and delivering generator fuels in communities through its Temporary Emergency Power Mission and sending responders to assist in disasters and provide situational awareness.
U.S. Nuclear Regulatory Commission (NRC)		The NRC is involved in emergency preparedness and response involving nuclear facilities or materials. The NRC also publishes a daily status report on all nuclear power reactors.
U.S. Department of Justice (DOJ)	Federal Bureau of Investigation (FBI)	The FBI leads investigations into cyber attacks and intrusions. The FBI collects and shares intelligence and engages with victims while working to unmask those committing malicious cyber activities.

Department or Agency		Energy Security/Emergency Response Role
U.S. Department of the Interior (DOI)	Bureau of Safety and Environmental Enforcement (BSEE)	BSEE has responsibility for the safety of the environment and conservation of offshore resources. BSEE administers the Oil Spill Preparedness Program and provides support for oil spill response efforts. During hurricanes and other inclement weather in the Gulf of Mexico, BSEE publishes data on the offshore oil and gas rigs that have been evacuated, as well as the amount of production that has been temporarily shut in. BSEE also leads the development of workplace safety and environmental compliance strategies for offshore renewable energy projects on the Federal Outer Continental Shelf.

Other Information Resources

Resource: CESER Energy Waivers Library
CESER's Energy Waivers Library provides additional detail on regulatory relief granted by federal agencies during energy disruptions. The library also lists contact information for each agency and provides examples of past uses of each waiver.

Resource: CESER Roles and Authorities
CESER's Roles and Authorities webpage outlines the various executive branch and DOE authorities that establish CESER's role in securing the Nations' energy infrastructure, maintaining situational awareness, discovering and mitigating cyber threats, and orchestrating response and recovery operations.

Resource: Power Outage Incident Annex (2017)
For more detailed descriptions of federal agency roles during a long-term power outage, refer to **Table 10: Roles and Responsibilities in a Long-Term Power Outage Incident** in FEMA's Power Outage Incident Annex (2017).

Resource: National Incident Management System (2017)
FEMA's National Incident Management System (NIMS) provides a consistent nationwide template that guides all levels of government, nongovernmental organizations and the private sector through the command and coordination of incidents, resource management, and information management. This framework is applicable to emergency responders and other emergency management personnel, NGOs, the private sector, and elected and appointed officials responsible for making decisions regarding incidents.

Figure 11: Descriptions of Federal Energy Security & Emergency Response Roles

Not listed in the table above but nonetheless critical to state coordination are the agencies listed below.

The **U.S. Department of Agriculture (USDA)** responsibilities include propane for crop drying, protecting livestock, and supporting accurate weights and measures. The Rural Development Utilities Program (RDUP) is also housed at USDA. The RDUP provides funding and tracks energy consumption data for rural electric cooperatives.

The **U.S. Department of Commerce (DOC)** is an excellent resource for demographics used in developing emergency planning documents. DOC also houses the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) (formerly the Mineral Management Service) and the National Oceanic & Atmospheric Administration (NOAA). The BOEMRE regulates the oil and gas production fields in the Gulf of Mexico. NOAA provides weather-related information including time-sensitive data for tracking hurricanes, wildfires, winter storms, and other emergencies.

2.10 Regional Coordination

Energy Emergency Response

The **Energy Emergency Assurance Coordinators Program** (EEAC) is a cooperative effort between the U.S. Department of Energy's (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER), the National Association of State Energy Officials (NASEO), the National Association of Regulatory Utility Commissioners (NARUC), the National Governors Association (NGA), and the National Emergency Management Association (NEMA).

The EEAC Program provides states with a means of sharing and receiving credible, accurate, and timely information with other states and DOE leading up to and during energy emergencies.

Structured communications are essential for understanding the severity, magnitude, and consequences of energy disruptions regardless of the causes.

EEACs serve as points of contact for DOE in the event of an emergency. Membership is made up of representatives from state energy offices, public utility commissions, state ESF-12 responders, emergency management agencies, homeland security agencies, local governments, and governors' offices. Additional guidance can be found here.

Kentucky SEO-EEC has designated a primary and secondary EEAC contact who have planning and/or response roles during energy emergencies. These individuals are registered on ISERnet, which DOE hosts. States should review and update their EEAC contacts annually.

National Response Framework

In 2008, the U.S. Department of Homeland Security released the National Response Framework (NRF), which establishes a comprehensive approach to preparing for and providing a unified response to disasters and emergencies. It describes specific authorities and best practices for managing incidents that range from severe but localized to large-scale terrorist attacks or catastrophic natural disasters.

A foundational principle upon which the NRF rests is engaging partnership across all jurisdictional levels—federal, state, and local. This partnership provides unity of effort that respects jurisdictional authorities and operational capabilities and ensures efficient incident management and effective use of resources.

During energy disruptions and emergencies, the U.S. Department of Energy (DOE), as the Federal lead for Energy through Emergency Support Function 12 – Energy (ESF-12), provides coordination across local, state, tribal, territorial, and federal government entities; nongovernmental organizations; and the private sector to enhance response and recovery efforts. In addition to conducting regular touchpoints with industry entities and the Federal interagency, DOE achieves this by hosting regional coordination calls for state energy entities or participating in regional coordination and information-sharing calls for State Energy Offices hosted by the NASEO Energy Security Committee prior to and during energy emergencies. KY SEO, as a member of the EEAC and the NASEO Energy Security Committee, participates in these calls to share and receive information with US DOE CESER and impacted states.

DOE also provides timely and accurate situational awareness through the release of event-specific and monthly Situation Reports (SitReps) which are designated as Official Use Only. KY

SEO, as a member of the EEAC, is a recipient of and contributor to these SitReps which provide for a common operating picture in regions impacted by hazards and whose energy security, delivery, or infrastructure systems have been compromised.

NASEO Energy Security Committee

The Kentucky SEO-EEC is an active member of the NASEO Energy Security Committee: a State Energy Office-led committee which provides technical assistance, peer-to-peer learning, resources, and logistical support to State Energy Offices in support of their energy emergency response and energy security, resilience, and hazard mitigation activities. NASEO hosts two monthly calls which contribute to regional coordination and information sharing. The first, NASEO's Energy Security Committee Calls, provide an opportunity for participating State Energy Offices to learn about innovative and novel approaches and resources for energy security planning and energy emergency response planning. They also serve as an opportunity to solicit State Energy Office input on regional and national energy security priorities. The second call, NASEO's State Hazards and Operations Rundown Call, is a round-robin-style forum wherein State Energy Offices provide updates to the Committee on ongoing energy emergency responses in which the state is involved, including tactics, best practices, and lessons learned. It also serves as a regular forum for State Energy Offices to share information pertaining to imminent, expected, or ongoing hazards, which allows for proactive regional coordination and information sharing.

NEMA-NASEO Regional Petroleum Shortage Collaboration

The Kentucky SEO-EEC is an active member of the state-driven Southeast/Midwest Petroleum Shortage Response Collaborative (SPSRC/MWPSRC), a collaboration with the National Association of State Energy Offices (NASEO) and the National Emergency Management Association (NEMA), with support from the U.S. Department of Energy (DOE) Office of Cybersecurity, Energy Security, and Emergency Response (CESER). Due to the reliance of imported fuels into the Commonwealth via pipeline and truck, cooperation and coordination with other states in the region, and states reliant on the same petroleum infrastructure, is of utmost importance. Created to facilitate the development of a regional catastrophic fuel response framework, this multistate collaborative benefits from deliberate examination, dissection, and cross-referencing of existing state and regional response plans, concepts, and annexes, and leverage peer-learning to improve respective state plans and ultimately provide a faster and consistent response throughout the region. The SPSRC/MWPSRC includes many key players in the energy-emergency management nexus with the unique task of regional catastrophic fuel planning (including State Energy Offices, State Emergency Management agencies, liquid fuels industry, and federal partners). When two or more states are impacted by an incident the region may elect for the multi-state implementation of measures and programs (as appropriate) to facilitate a coordinated and collaborative response effort. Participation in the SPSRC/MWPSRC acknowledges of the need to work together and share resources to best address state and regional petroleum shortage preparedness and response needs.

NARUC-NASEO Regional Micro-Grid Working Group

The Kentucky SEO-EEC is an active member of the NARUC-NASEO Micro-grids State Working Group to share public- and private-sector best practices to advance beneficial micro-grid development and take advantage of technical expertise from the U.S. Department of Energy (DOE).

The Working Group is hosts and facilitates discussions between State Energy Offices and PUCs to explore micro-grid technologies and applications, policy and regulatory frameworks, and financing models to understand the full range of benefits that micro-grids can provide to owners/ operators, ratepayers, and other stakeholders. A key objective of the Working Group is to highlight and draw lessons from existing micro-grid projects. NARUC and NASEO are jointly leading this work in close collaboration with the DOE Office of Electricity and are relying on state input to guide this collaborative initiative. This group meets quarterly.

Southeast Regional EV Information Exchange

The Kentucky SEO-EEC is an active member of the Southeast Regional EV Information Exchange group that convenes bi-monthly to provide a coordination touch point for Southeast SEOs to share information and best practices as well as to identify potential areas for collaboration on topics including, but not limited to: EV infrastructure planning (siting and securing of site hosts, permitting, pricing, signage, minimum operating standards, accessibility, ownership models, etc.); policy development; and program implementation.

In addition, the group fosters ideas on how to promote electric transportation solutions in communities that are rural, low-income, or that face disproportionate air quality burdens; the role of EV infrastructure during evacuations; and considerations regarding the use of EVs to build resiliency into power supply delivery.

Kentucky's Electric Vehicle Infrastructure Deployment Plan (EVIDP) was developed in accordance with the National Electric Vehicle Infrastructure (NEVI) Formula Program Guidance that was issued by the Joint Office of the U.S. Department of Transportation and U.S. Department of

Energy (Joint Office). Combined, these efforts resulted in a plan that provides a thoughtful and flexible framework for developing a statewide charging network across the Commonwealth.

Kentucky's EVIDP was developed by the Kentucky Transportation Cabinet (KYTC) in close coordination with Kentucky's Energy and Environment Cabinet (EEC). The agencies established a steering committee that included the Public Service Commission (PSC) and the Federal Highway Administration (FHWA) to provide oversight and direction for the plan. Work on the plan began in January 2022 and the plan was submitted to the Joint Office in July 2022.

The nation's transportation system is beginning its most significant transformation since the Interstate System was established. The Federal Bipartisan Infrastructure Law (BIL), enacted as the Infrastructure Investment and Jobs Act (IIJA), passed in 2021 provides investments to help modernize infrastructure assets and support emerging technologies including electric vehicles (EVs). The resulting changes will provide long-lasting infrastructure and mobility improvements including supporting the adoption of electric vehicles by developing a national network of electric vehicle chargers.

In parallel with the federal initiatives, major automotive manufacturers have announced $7.8 billion in investments in EV battery production in Kentucky. This includes $5.8 billion and 5,000 new jobs to establish BlueOvalSK in Hardin County and $2.0 billion and 2,000 new jobs at Envision AESC in Warren County. These projects will position Kentucky to be the EV battery production capital of the United States. They also position Kentucky's residents and businesses to be major beneficiaries of this industry transformation.

One of the new Federal policy and funding initiatives included in the IIJA was the creation of the National Electric Vehicle Infrastructure (NEVI) Formula Program which provides funding to states to deploy EV charging infrastructure to support this automotive industry and technology shift to EVs. The guidance issued for the NEVI Formula Program required that states develop an Infrastructure Deployment Plan outlining how they would utilize the formula funding.

Kentucky has developed an EV Infrastructure Deployment Plan (EVIDP) that addresses the federal guidelines with partnerships across agencies and stakeholders.

Regional Exercises

The Kentucky SEO-EEC participates in energy emergency preparedness exercises, many of which are regional in nature and involve a multitude of State Energy Offices, State Emergency Management, industry, and federal participants. These exercises have allowed for KY SEO to review, validate, and critique its energy emergency response plans, policies, and procedures, including the Energy Security Plan, the State Emergency Operations Plan, and the Continuity of Operations (COOP) Plan.

These exercises also serve as unique opportunities for participants to expand their energy emergency response networks within their region and explore robust, hypothetical, yet realistic, scenarios that assist in regional preparedness and continuous improvement. In recent years, KY SEO has participated in the following exercises:

- GRID EX Exercise hosted by TVA (2023)
- NASEO-NARUC Micro-grid Action Planning Workshop (2023)
- NEMA-NASEO Regional Petroleum Shortage Workshop (2023)
- NASEO Energy Security Boot camp – National Workshop (2023)
- Operation Catfish – Southeast Regional Exercise (2022)
- Shattered Cheddar – Midwest/PADD 2 Regional Exercise (2022)
- Fractured Freeze – Multi-Regional Exercise (2022)
- Mission Moon Pie – Southeast Regional Exercise (2019)
- Shaken Fury – Multi-Regional Exercise (2019)
- Clear Path VII – US DOE Regional Exercise (2017)

3.0 Emergency Operation Design Concept

3.1 Emergency Operation Concept

A perfect system for the management of energy emergencies does not exist. Potential emergencies are so numerous that it would not be practical to prepare response plans for all possible scenarios. Effective Energy Security preparedness and emergency response management can be achieved through meticulous advanced preparation. This section outlines the Commonwealth's approach to effectively manage energy resources under a diverse set of potential threats.

The National Association of State Energy Officials (NASEO) has compiled State Energy Assurance Guidelines. Kentucky's Plan is based around these guidelines. "Quick Guidelines: Ten Things You

Should Know to be Prepared", which are contained within NASEO's guidelines are outlined below:

- Make sure you and your staff are prepared to deal with the needs of policy makers.
- Know your state's energy profile and interdependencies.
- Know the geography and demographics of your energy infrastructure.
- Know your key government and energy contacts.
- Maintain a good working relationship with private and public sector contacts.
- Be prepared to work with the media.
- Know the legal authorities that support your response.
- Understand how you can effectively respond.
- Maintain an alternative budget for emergencies.
- Keep your Energy Security plans up to date.

The U.S. Department of Energy (DOE) has released an Energy Security Plan framework developed to provide clarity and detail on the six elements outlined in Section 40108 of the Infrastructure Investment and Jobs Act (IIJA) hereafter referred to as the Bipartisan Infrastructure Law (BIL). The DOE goal is to support states and provide additional clarification beyond the text of the BIL.

The framework provides a logical flow of information by organizing the six elements into practical sections that reduce redundancies. DOE understands that states are working from existing energy security plans and that each of those plans is different. DOE anticipates that states will use different approaches to address the six elements described in the BIL, and the framework is intended to provide examples and to serve as a reference only.

The Guidelines and Framework can be found in Appendix D, attachment #1.

Administration of the Plan is based heavily on information acquisition, definition of organizational responsibilities, and the efficient movement of information. Specific information will be compiled on the state's overall energy system through the Kentucky Energy Profile. The Profile addresses the types and amounts of fuels used, fuel sources, and the sectors where they are used. It will also examine the generation, transmission, and distribution systems for the various power sources. Specific attention is also paid to the end uses of energy supplies in the Commonwealth. Obtaining accurate information is also vital to assessing the vulnerabilities and consequences that exist at all points in the system.

In order for information from the Profile to be useful, it must be applied. In the case of energy management, organizational responsibilities are divided among many governmental agencies, private businesses, and support organizations. The Energy Security Plan is a reference that identifies which group or organization has primary responsibility or can help resolve a specific energy issue or concern. Organizational roles and responsibilities are defined and contact information for the key personnel responsible for the operation of the group, is provided.

This Energy Security Plan does not attempt to alter current agency roles or functions but instead to facilitate the free flow of information and data between agencies for use during emergencies. Through the early identification, coordination, and continual sharing of information, energy issues and concerns can be resolved efficiently and effectively, and at the lowest operational level.

Information concerning potential energy emergencies must be channeled and shared within the Commonwealth and among all providers. This free exchange of information will aid in helping all participants maintain perspective on the energy situation. See section 4.3 for communication protocol.

3.2 Continuity of Operations

The Energy and Environment Cabinet (EEC) has essential operations that must be performed or rapidly resumed in a disaster or emergency. While the impact of an incident cannot be predicted, planning for operations under such conditions may mitigate the effects of the disaster or emergency on people, facilities, and EEC services. To that end, the EEC has prepared a Continuity of Operations Plan (COOP) to serve as a guide for sustainment or resumption of essential services affected by a disaster.

This Plan establishes guidance to support EEC essential functions when a disaster or emergency threatens or affects EEC operations to the point that changes to the delivery of EEC services or the relocation of EEC personnel or operations are required. This Plan provides guidance for when the EEC may need to implement COOP activities related to an incident that affects essential functions, roles of staff, facilities, or delivery of services.

This Plan describes how the EEC will execute essential functions during and after a disaster or emergency that disrupts normal operations. This Plan is intended to guide the EEC during an actual incident; however, specific actions will depend on the situation. This Plan serves as a consolidated location for critical information related to the delivery of essential functions and resources that facilitate services.

3.3 Phased Response Contingency

The Commonwealth's response to energy emergencies is divided into four defined phases. Each phase describes the appropriate level.

- Phase I – Monitoring
- Phase II – Situation Assessment and Preparation
- Phase III – Emergency Response
- Phase IV – Emergency Assessment

The dividing line or time of transition between phases is not precise. While based largely on a quantitative set of criteria, the actual decision to transition between phases is generally qualitative. With input from KYEM and supporting agencies, the Energy Security Coordinator will make the determination on when to move to the next phase based on the current conditions.

While not typically the case, transitioning between phases does not necessarily have to follow in numerical order. A severe disaster or terrorist event could easily precipitate an immediate emergency response. It is also possible that the need arises to manage multiple but varied events that warrant designation as separate phases.

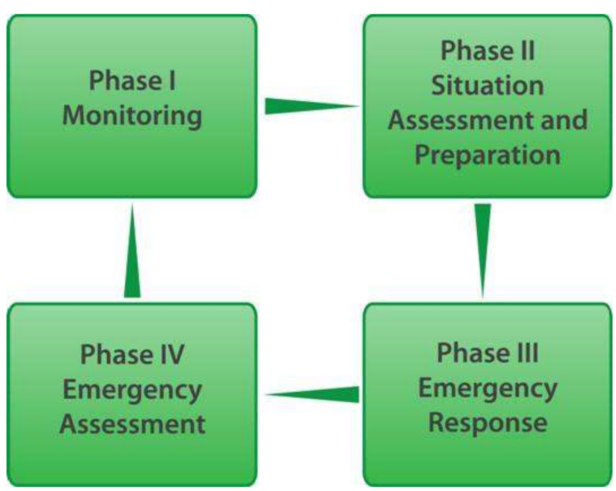


Figure 12: Phases for Managing an Energy Shortage

Detailed energy emergency descriptions of potential issues and proper response actions for each phase are provided below. The Energy Security Coordinator will assess the severity of the emergency then determine the appropriate response action to undertake. Successful implementation of one management phase may well prevent the need to implement the next phase.

Monitoring – Phase I

Phase I activities are related to general data acquisition and preparation. This phase is the normal state of affairs without energy deficiencies. Activities include: monitoring of state, regional, and world energy activities; making and renewing contacts with energy providers, suppliers, and government groups; developing new strategies for emergency plan implementation; assisting in the development of regional and local energy plans; revising the statewide energy profile; updating individual components of the emergency plan; and conducting training exercises for key personnel regarding plan implementation.

Situation Assessment and Preparation – Phase II

Phase II activities involve an intensification of the components outlined in Phase I. This phase is fundamentally an early warning stage. Any number of conditions or events (weather, price escalation, human error, etc.) can necessitate preparatory activities.

As information is monitored, particular attention is paid to issues that have the potential to negatively affect the supply and distribution system. The main purpose of the Preparation Phase is to determine the nature, extent, duration, and consequence of any imminent emergency as quickly as possible.

The Energy Security Coordinator, as the designated state point of contact, will continue data and information collection efforts to ensure the most accurate current energy profile is in hand. The SEO-EEC will then analyze the information to determine the potential magnitude and duration of the energy emergency.

If warranted, the Energy Security Coordinator will notify all affected program partners of the current situation. Greater emphasis is placed on continual information sharing and an increased level of dialogue.

If it is determined that a pending emergency does not exist at this point in time, the Energy Security Coordinator can continue to monitor and evaluate at Phase II levels. If this is not necessitated, then efforts can revert to the Monitoring phase

Emergency Response – Phase III

Phase III is a call to action. Emergency response is required when the decision has been made that specific government action is required to ensure the health, safety, welfare, and economic well-being of the citizens of the Commonwealth. Should the SEO-EEC determine that market and energy providers are unable to quickly and adequately address this situation without government action, the SEO will review the circumstances and determine the appropriate actions.

Possible actions could range from continued monitoring to declaration of a state of emergency. At a minimum, procedures will continue in an orderly process to follow steps as outlined in this Plan. The course of action may require implementation of only one specific action or the comprehensive execution of ESF-12.

In addition to Phase 3 activities, the following actions may be implemented:

- Increase the level of communication among state agencies and other affected energy industry participants.
- Employ programs that maximize energy supplies or minimize demand, and closely monitor the situation for desired results. These programs could be either voluntary or regulatory in nature.
- If the emergency is multi-state or national in scale, designated representatives can obtain information on how to share data with the Energy Emergency Assurance Coordinators (EEAC) through the EEAC's website: https://www.naseo.org/eeac. Interested parties can register as EEAC on ISERnet and use the contact list provided to share information. Additional information on the EEAC can be found in section 2.10 of this plan.
- Call together with specific or multiple energy management departments or organizations to discuss contingency actions.
- If the implemented actions are ineffective and the situations worsen, it may be necessary for KYEM to recommend to the Governor that they should declare a State of Emergency under KRS Chapter 39A.

- If all resources available to the Commonwealth prove not to be adequate in rectifying the situation, the next option is to request federal assistance through the declaration of a State of Emergency. KYEM would request this from the Governor. KYEM will be the primary agency to coordinate all actions in a state of emergency. The following federal assistance may be requested without disaster declaration: HOS wavier, Coast Guard ice breaking, temporary waiver of vehicle fuel air quality requirements, RVP waiver, and use of the Strategic Petroleum Reserves (SPR).

Emergency Assessment – Phase IV

During the Emergency Assessment phase, energy systems and commerce will be returning to normal conditions. The Governor can rescind any formal declarations or voluntary requests at this time. Monitoring activities of the Plan can return to pre-emergency status.

As the emergency is resolved, state and other responding agencies should evaluate all response plans that were implemented to determine the effectiveness of all responses. Evaluations should include:

- A description of the emergency.
- A chronology of the actions taken to rectify it.
- An assessment of the mitigation efforts with detail given to the specific actions taken.
- Recommendations for improvement.

Each responding agency should conduct its own evaluation of actions taken during the emergency. The SEO-EEC will review these assessments and examine how they conform to the activities outlined in the Plan.

The primary purpose of the assessment phase is continuous improvement. After each use of the Plan, whether in practice or real-life application, the system will be revised to make it more effective for the next use.

3.4 Emergency Activation Levels

In addition to a phased response plan, determining the appropriate level of action based on the severity of the incident is a crucial step in evaluating the proper emergency response. The following classification system will be used as a guide to aid in shaping the Commonwealth's response. SEOC activations are based on the level of operational schemes as listed below. SEOC activation does not need to be sequential. For planning purposes, the activation levels do not specifically take into account the percentage reduction in fuels or the duration of the incident, rather it addresses the resources required to remedy the situation.

Level 5 - Normal Operations: Level 5 is the normal, day-to-day, SWP duty status. This is the lowest level of an incident or event, and can be generally managed using the Duty Officer (DO) and the Manager on Call (MOC) and does not require deployment of more than one (1) state resource. The incident or event is of limited duration and usually closed within one (1) operational period (12-hours).

Level 4 Modified - Virtual Monitoring: This is for an incident or event that requires a higher level of management than just the MOC and DO but does not require the activation of the SEOC. The Operations Section Chief (OSC), Planning Section Chief (PSC), Kentucky National Guard Joint Operating Center (KYNG JOC), and Area Managers are monitoring the situation virtually through WebEOC. If the event deteriorates, the OSC coordinates with the KYEM Assistant Director for Operations or KYEM Director and recommends a SEOC activation level. The incident or event is of a limited duration and usually closed out within two (2) operational periods.

Level 4 - This requires a higher level of management than Level 4 Modified. This level of incident or event usually involves multiple resources but is not a long-term event. A limited formal activation of SEOC structures may be required, but only to maintain situational awareness and adequately report actions taken by deployed assets. SEOC staffing includes, at a minimum, the SEOC Manager, OSC, PSC, KYNG JOC, and an operations officer. The incident or event is of a limited duration and usually closed out within three (3) operational periods.

Level 3 - Partial Activation: This level of incident or event is of greater complexity than the previous levels and requires immediate activation of the SEOC structure to manage multiple resources over an extended period to meet significant needs of local first responders and emergency management agencies. This requires the activation of select ESF representatives and has a significant impact on KYEM Frankfort staff. Deployment of an Incident Management Assistance Team (IMAT) to support local operations may be necessary. The incident is of an extended duration and usually managed through three (3) or more operational periods. The procedures outlined in ESF-12 will be activated and the SEO-EEC will coordinate all activities to assure the duration and intensity of the emergency is minimized.

Level 2 - Full Activation: This level of incident or event requires all ESF state partners. Multiple regional assets across the Commonwealth may provide resources and could include the introduction of a federal resource. The incident is of an extended duration, not being closed out within a clearly defined number of operational periods. This incident may require the activation of a local/county/state Incident Management Team (IMT) and an IMAT to supplement the SEOC staff and field operations. The SEO-EEC may invite the Energy Efficiency Advisory Group (EEAG) to meet and review the pending energy situation, as appropriate. The Plan will help the SEO-EEC to coordinate and resolve energy problems and issues experienced by the citizens and businesses of the Commonwealth.

Level 1 - Full Activation with Federal Partners: This level of incident or event is catastrophic. These incidents significantly affect the Commonwealth and require the full activation of all local, county, and state assets and the full integration of the SEOC with all required federal resources. This type of incident spans multiple operational periods from days to weeks to possibly months. An earthquake of 5.5 magnitude along the NMSZ is an example of a catastrophic Level 1 event, as well as the 2009 Kentucky Ice Storm that impacted the entire state.

3.5 Utility and Service Provider Response and Restoration Stages

A central tenant to the SEO-EEC ability to assess and support response and restoration is understanding the utility response and restoration process.

Kentucky has a complex network of electric utility providers spanning public and private. The graphic below details the general steps to restoring power.

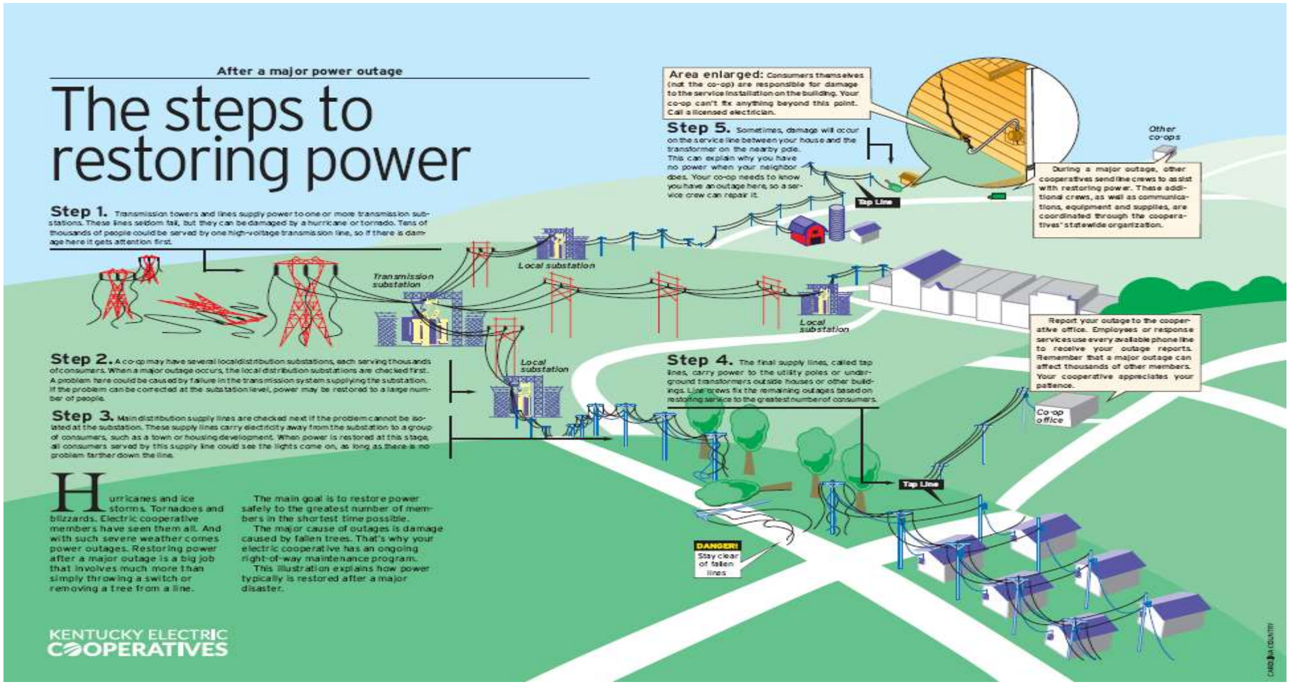


Figure 13: Steps to restore Electric Grid

During times of a power disruption, it is imperative that local communities understand what the restoration priorities are for the critical infrastructure being affected. Online outage maps can be conduits for reporting and finding out about the cause of the outage and repair time estimates for the public.

For hazardous liquid and gas pipeline breaks, The Pipeline Association for Public Awareness issues the Pipeline Emergency Response Guidelines. The general steps to a pipeline incident response include:

- Securing the scene
- Identifying the hazard
- Assessing the situation
- Obtaining assistance from trained personnel
- Responding to protect people, property, and the environment and
- Working cooperatively with the pipeline operator

While the pipeline operator concentrates on isolating the pipeline, responders concentrate on isolating and removing ignition sources and moving the public out of harm's way. The protection of people is always the highest priority. Protective actions are those steps taken to preserve the health and safety of emergency responders and the public during a pipeline incident.

For Natural Gas disruptions, multiple steps require close collaboration between utilities and customers to provide a safe restoration of service. In large-scale interruptions, natural gas supply must be turned off in the affected areas to allow for repairs and to ensure public safety. The graphic below details the general steps to restoring natural gas.

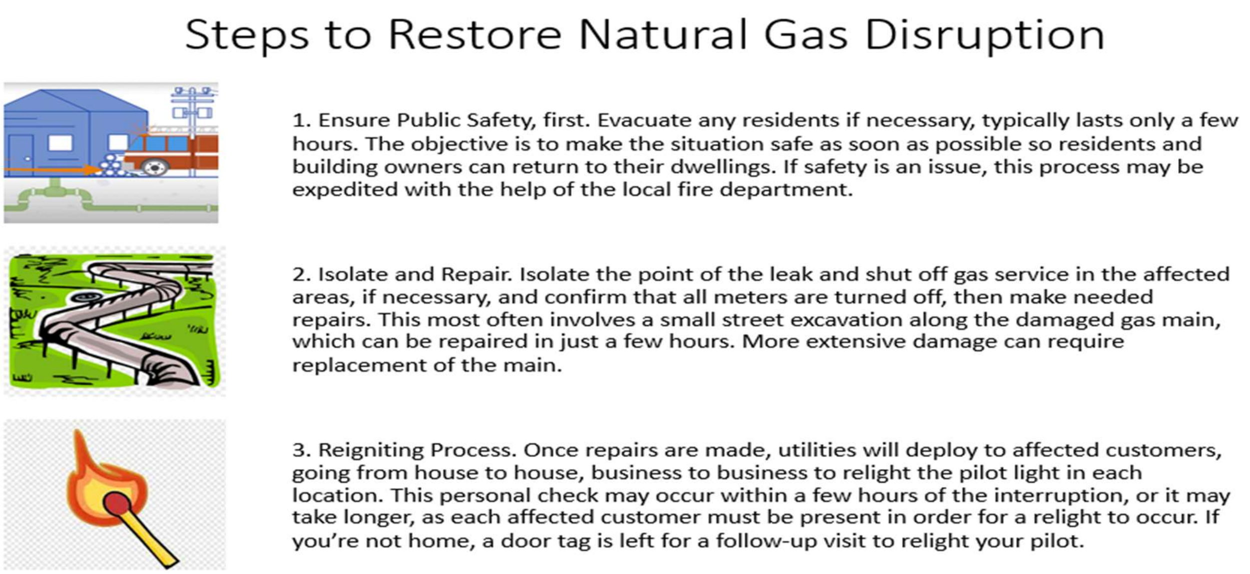


Figure 14: Steps to Restore Natural Gas

4.0 Communication and Public Information

4.1 Introduction

During an emergency, the ability to gather accurate information and disseminate it to responding agencies and the general public is of utmost importance. When a situation occurs where a lack of information exists on the severity of a crisis, people naturally assume the worst-case scenario. This reason alone is why a strong integrated public information program is paramount to emergency response management. Presenting timely and accurate information can ease fears by eliminating confusion and uncertainty.

Of equal importance to providing information to the public at large is the necessity to provide timely and accurate information to agencies and individuals actively involved in emergency response. These groups may include federal, local and state government agencies, first responding organizations, elected officials, energy providers, transportation companies, and charitable and human service groups. In addition to providing information to these groups, it is vital that a system is enacted that allows for the two-way movement of information and data. By establishing a point of contact and enacting basic procedures for managing multi directional information flows, an environment will be created to ensure that all participants are working together with current and accurate data.

While this section addresses the primary functions undertaken by the State Energy Office (SEO) in the management of public communication, it should be noted that once an emergency is declared, primary responsibilities for information accumulation and distribution falls under the direction of ESF-15. Communication management at that point will operate through the Commonwealth Joint Information Center (CJIC). The KYEM Information Officer will serve as coordinator. ESF-15 is found in Annex (A) of the Kentucky State Emergency Operations Plan (SEOP).

4.2 Communication Aims

Since communication is the sharing of ideas or the presenting of information, the fundamental goal of any communication or public relations program is how to do this most effectively. Communication during emergency response will contain the following guiding principles:

- Present a highly visible and calm front to reduce the possibility of a panic response during the disruption.
- Provide accurate information on the nature and scope of the emergency.
- Provide essential information on where citizens can obtain vital supplies and services to aide in coping with the emergency.
- Establish an effective multi-dimensional information exchange between all parties involved with energy production, transmission, and distribution, and those involved with directing emergency response management at all government levels.

4.3 Communication Plan Elements

As stated previously, effective two-way communication and information sharing between all levels of government, private sector energy industries, the media, and the public is imperative for successful emergency management. To avoid confusion during an emergency, it is important to have established needs identified before the actual emergency. These include establishing communication procedures, identifying responsible individuals, procuring necessary equipment, and identifying operational facilities. Kentucky's COOP includes the following elements:

- Contact - While external communication is generally a more formalized activity that will pass through KYEM before dissemination, internal energy-related communication and operation agencies will establish separate, specific internal procedures. The SEO-EEC shall act as the primary point of contact for gathering and disseminating information related to any energy disruption. For energy interruptions, the Energy and Environment Cabinet's Public Information Officer (EEC-PIO) shall serve as the primary contact for public communication activities. The SEO-EEC will research, obtain, analyze, and distribute relevant and accurate energy information on a timely basis.

- Equipment and Facilities - The severity and geographical distribution of the emergency will affect the equipment and facility needs related to emergency management. For most disruptive events, existing equipment and facilities will support communication and information efforts. For catastrophic events, it may be necessary to move operations to the SEOC. Basic equipment needs include the following:

    - Computers with internet connectivity to communicate with all persons and groups involved in the emergency management activity. They are also important in acquiring and processing large amounts of information when modeling changing situations or potential solutions.

    - Landline telephone system preferably with a toll-free capability to allow for easy access when reporting information from remote locations.

    - Cell phones, fax machines, satellite phones, two-way, and ham radios may all be useful tools to be employed in exchanging information. Energy stakeholder contact information is maintained by the SEO-EEC. Agreements with KYEM and the EEC Emergency Response Team (ERT) have been reached to contact team members or energy providers by satellite phone in the event that conventional communications fails.

    - The existing print, broadcast, Internet, and social media are vital in the one-way distribution of information. Taped or live telecasts can be used to both inform and educate the populace relating directly to the emergency or available assistance programs. Depending on the scale and severity of the event, this information may be distributed by the Governor's Office, KYEM, or at the specific agency level. For all declared emergencies, all publicly distributed information will pass through the Division of Emergency Management for approval.

- Procedural Considerations - Information and data will be reviewed by the SEO-EEC, processed, and transferred as necessary.

4.4 Communication and Outreach

- State Outreach - The SEO-EEC will utilize WebEOC, a web-based crisis management system designed for supporting the Incident Command System (ICS) method of response management for significant incidents and providing a unique toolset for supporting daily operations in the Regional Response Centers and the HQ Emergency Operations Center to disseminate information to KYEM. For Official Use Only (FOUO). For more information, contact KYEM.

Figure 15: ESF-12 Public Private Sector Communication Protocol

- Private Partner Outreach - The SEO-EEC will use ReadyOp, a disaster management tool deployed for efficiently and effectively planning, managing, communicating, and direct activities within a single organization or in a unified command structure involving multiple organizations, to communicate with energy partners and other ESF partners. One of the unique features of ReadyOp is the custom forms that can be created and shared electronically as needed. Designed to handle the fast-paced, demanding communication challenges of ICS, ReadyOp's flexibility supports daily and exercise/response activities for a single organization as well as unified, multi-location agencies and operations.

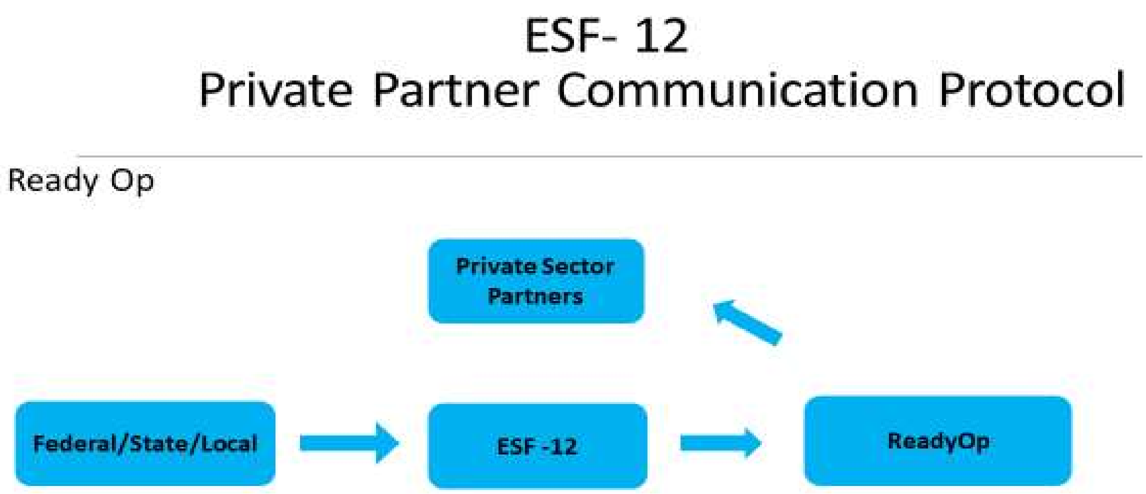


Figure 16: ESF-12 SEO Communication Protocol

- Publications/Public Outreach - In addition to disruption-specific communications, the SEO-EEC and the PSC will utilize print, broadcast, Internet, and social media applications to distribute information on issues in the energy arena. This may include scientific research, fuel reports, program and policy directives, energy conservation directives, and news stories relating to energy events. These publications can be used to both inform and educate and may be helpful during a disruption event – especially one of a lasting duration. Current offerings include:
- Land, Air & Water, Kentucky Energy & Environment Cabinet's Webzine
- Naturally Connected, A blog of the Kentucky Energy and Environment Cabinet
- Electronic Newsletter of the SEO-EEC
- Kentucky Public Service Commission website (press releases, outage information and utility service area maps)
- Social Media – FaceBook, Twitter, and YouTube
- Kentucky Energy and Environment Cabinet's Office of Energy Policy website

The Kentucky Energy and Environment Cabinet Office of Communications (EEC-OOC) procedures for press releases are as follows:

1. Press releases are prepared by the State Energy Office PIO (or other agency) and forwarded to the EEC-OOC Communications Director for review and editing. Pending

final edit approvals, the EEC-OOC Communications Director forwards the press release to EEC Secretary for approval.
2. Once approved by the EEC Secretary, the EEC Communications Director forwards the press release to the Governor's communication staff for further approval.
3. Once approved by the Governor's office, the EEC- OOC posts the press release on **GovDelivery** for distribution.
4. EEC-OOC director and staff manage social media/story-ideas/blog-posts.
5. EEC Office of Communications Director and staff for writing and publication manages the EEC Blog, "Naturally Connected" and the "Land Air and Water" webzine.

5.0 Energy Profile

5.1 Energy Usage in Kentucky

One of the first steps undertaken to prepare an effective Energy Security plan is the development of an energy profile. The energy profile provides an indication of the state's dependence on specific fuel types along with the acquisition, processing, transportation, distribution, and marketing systems for those fuels. The data will be used to develop measures that will reduce or lessen the impact of energy emergencies and effectively assist in system operation and restoration during an energy shortage.

Kentucky has a robust network of energy resources and is both a major producer and consumer of energy. In 2020, Kentucky was ranked seventh in the United States in industrial electricity consumption per capita. In 2020, it ranked 15th in total energy consumption per dollar of state Gross Domestic Product (GDP).

Kentucky has over 10,000 miles of electric transmission lines, over 1,700 electric substations, 50 operating power plants, and two wholesale regional power markets plus the Tennessee Valley Authority (TVA).

In 2020, natural gas was used to generate 23% of the electricity produced in Kentucky. Hydropower generated approximately 7% of the electricity produced in Kentucky. Petroleum generated less than 1% of electricity. Other renewable sources generated less than 1% of the electricity produced in Kentucky. Coal was used to generate 69% of the electricity produced in Kentucky.

Coal is the largest energy source in the state. Kentucky ranks seventh in production in the United States mining 24.3 million tons in 2020. Most of the coal produced in the state is exported to the east coast. Of that used within the state, nearly all goes to producing electricity.

In 2020, Kentucky produced 71 Billion Cubic Feet (Bcf) of natural gas–less than one percent of the nation’s total. The industrial sector is the largest user of natural gas in the state. Over one-third of the total consumption has gone to serve industry. Kentucky has 32,741 miles of natural gas, hazardous liquids, and hydrocarbon gas liquids pipelines, 20 active natural gas storage areas, and two processing plants. Kentucky has over 2,500 fuel distributors including approximately 240 propane distributors.

There is one operating petroleum refinery in the state with a combined processing capacity of about 283,000 barrels per calendar day. There are also four biofuel plants and one ethylene cracker.

While most crude enters via pipeline from the gulf coast, there is a nominal amount of crude from Kentucky and surrounding states refined here. The state’s consumption of petroleum products exceeds the national average by 18%.

The Kentucky energy profile can be divided into two main elements. One is a depiction by fuel source of the provider industry with supplemental information on the support structure for that energy source. The other is a description of how and where energy is used. This assessment can also include an evaluation of the vulnerability connected to its use and location.

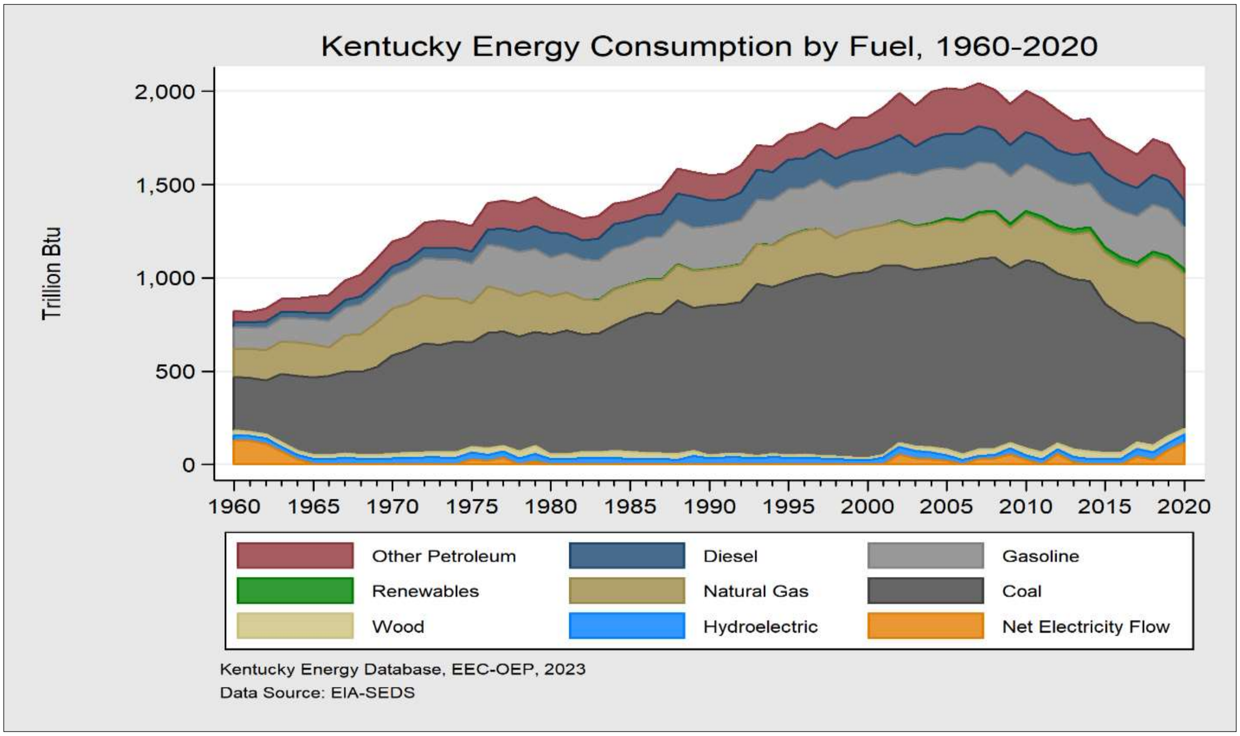


Figure 17: Kentucky Energy Consumption by Fuel, 1960-2020

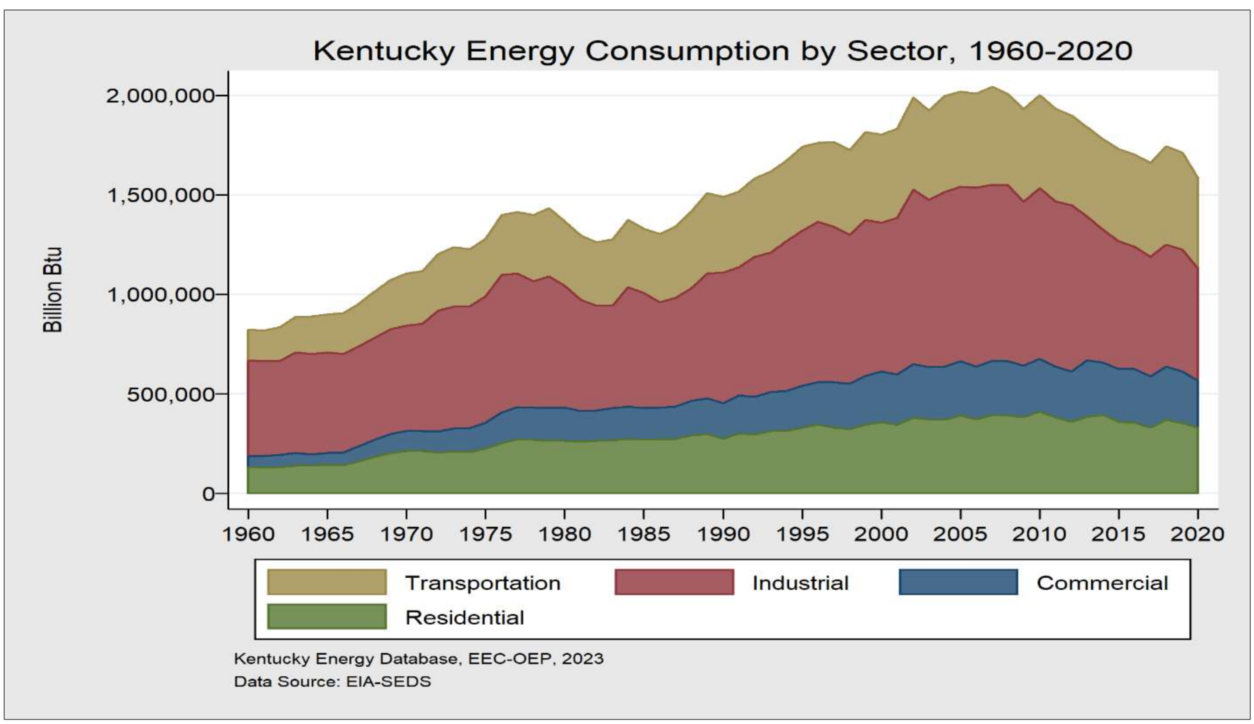


Figure 18: Kentucky Energy Consumption by Sector, 1960-2020

The Energy Information Administration (EIA), a statistical information clearinghouse for the federal government, prepares and compiles much of this data and is a major resource for relevant information. Other information is industry- or location-specific and must be obtained directly from the source. Categories of data include a timeline of usage by source and sector, details of raw material supply, system of volume throughput, material storage volumes and capacities, and transportation providers and routes. Energy emergency plan data may be comparable to or overlap with other more general energy plan data, but it will typically differ due to the focus being on provider and the response to emergencies. Portions of the data released will often need to be general in nature in order not to reveal specific critical assets.

For the ease of use of the Plan, critical data is included in section 6.0-Energy Commodities. This will allow for quick retrieval of vital information in times of energy emergencies. Other necessary, but less critical, information will be included in the Plan's appendices.

5.2 Critical Infrastructure

The identification and understanding of critical infrastructure assets in the Commonwealth is not a direct emergency response activity; it is an examination of the energy infrastructure prior to a disruption. It is important to know where critical infrastructure points are and what alternatives exist that are vital to overall Energy Security efforts.

Both government and private-sector energy providers strive to ensure that production, transmission, and distribution systems are secure and reliable. This assurance, however, is becoming increasingly difficult as the size and interdependency of energy networks increase. Identification and understanding of the critical nodes allow providers to establish a more robust system by reducing vulnerabilities, deterring threats, minimizing the consequences of an attack, lessening natural disaster effects, and improving recovery times.

Given that it's difficult to protect against or completely eradicate all potential hazards, effective emergency plans must prioritize swift and efficient responses to mitigate the adverse consequences of any unforeseen event.

Some of the components to consider are:

- Physical Assets
- Threat Environment (Human and Natural)
- Existing Policies, Procedures, and Plans
- Cyber Security Systems

- Operational Security Networks
- Risk Characterization
- State, Regional, and Local Roles and Responsibilities
- Energy Efficiency and Renewable Energy Systems

This Plan is strongly based on the provision of information and utilization of existing networks and expertise for the identification of and response to energy disruptions. Critical infrastructure identification and protection follow the same format. For the purposes of the Plan, critical node identification has been incorporated from the Department of Homeland Security (DOHS) National Infrastructure Protection Plan. More precisely, it comes directly from the Energy Sector-Specific Plan. The Energy Sector-Specific Plan details how the National Infrastructure Protection Plan risk management framework is implemented within the context of the unique characteristics and risk landscape of the sector. Each Sector Risk Management Agency develops a sector-specific plan through a coordinated effort involving its public and private sector partners. The DOE is designated as the Risk Management Agency for the Energy Sector. Due to their delicate and sensitive nature, sites and protection mechanisms are not listed directly in this document but have been utilized to develop the Commonwealth's overall energy emergency response. A secure web portal of critical infrastructure, as identified by DOHS, is maintained by the US DOE and available for EEAC reference.

The Homeland Infrastructure Foundation-Level Data (HIFLD) Subcommittee Online Community addresses improvements in collection, processing, sharing, and protection of national geospatial information across multiple levels of government in order to help provide a common foundation for data visualization and analysis.

HIFLD Open includes only publicly available critical infrastructure layers. As part of the HIFLD mission to build a more transparent and collaborative ecosystem for information sharing, the HIFLD Open Portal is integrated with the Geospatial Platform through Data.gov and other data providers.

For layers deemed sensitive or requiring further access restrictions, HIFLD Secure serves as the portal for these datasets. HIFLD Secure contains FOUO and licensed data that is available for download on the DHS Geospatial Information Infrastructure (GII) located at https://gii.dhs.gov. The HIFLD data enhancement process is producing higher-quality versions of legacy HSIP layers that are immediately accessible on the HIFLD Secure portal and include over 125 static data layers.

5.2.1 Cybersecurity

Cybersecurity, which has been a critical component of Energy Security for many years, is not limited to smart grid activities. Prior to widespread deployment of internet-connected devices within energy systems, operators relied on computer software to assist system operators in managing the complex system. However, with expanded integration of remote sensing and direct communications to the software, the vulnerability to malicious cyber-attacks has multiplied significantly. This is primarily due to the increased number of entry points and greater reliance on automation. Modern energy systems' reliance on data movement and information transfer expands and magnifies the possible threats to and vulnerabilities in the system. Cybersecurity plans are essential for the physical security of generation, transmission, and distribution infrastructure.

Cyber with Energy

Energy systems (electric, oil, and natural gas) within Kentucky use computing technologies to manage business systems and to control and monitor the processes and transportation of energy from production/generation to end use. The energy sector relies heavily on both information technology (IT) systems and operational technology (OT) systems.

OT systems include industrial control systems (ICS) that consist of purpose-built hardware, software, and data networks developed specifically for industrial customers. These systems were designed and built using tools and technology created before the Internet and technology boom of the late 90s. While these older systems are still in use, they have evolved and adopted newer technologies, including IT technologies built to allow internet connections.

Today the energy sector is technology driven, and these changes have resulted in many benefits including improvements to efficiency, resiliency, and flexibility. However, cybersecurity vulnerabilities and the capabilities of malicious actors have also changed over the past 20 years. Cyber threats are not limited to personally motivated individuals. Threats also come from well-financed criminal and nation-state groups focused on profit, political gain, or power. The skill level and ability of these groups to compromise Internet-connected, Internet-adjacent, or even traditional ICS assets that were never designed to connect to the internet continues to grow.

Technologies

OT systems interact with the physical environment or manage devices that interact with the physical environment. These systems monitor or control physical devices, processes, and events. Examples include:

- Energy Management Systems and Supervisory Control and Data Acquisition (SCADA)
- Oil refinery, gas processing, and electricity generation distributed control systems (DCS)
- Pipeline pump/compressor stations and electrical substations
- General industrial control systems used in energy processes

A key area of distinction between IT and OT systems is that a cyber incident within energy OT systems can result in a physical consequence in addition to potential losses of data or damage to an organization's reputation. Some differences in the possible consequences/impact of an attack on an IT system compared with an OT system are described below.

	Information Technology	Operational Technology
Impacts	• Brand damage/ loss of confidence in company • Loss of personally identifiable information (PII) • Loss of business data • Customer/supplier payment issues	• Operator loses visibility into operations • Operator forced to switch to manual operations mode • Supply fails to meet demand • Disruption to basic daily activities – loss of power or access to fuel. • Health, safety, and economic impacts • Impacts from prolonged disruptions can cascade into larger consequences

Figure 19: Potential Impacts of a Cyber Attack on Energy Infrastructure

A cyber-physical event can cause loss of power or access to fuel, initiate prolonged cascading impacts, create potential risks to health and safety, and result in economic impacts to not just the company but to the people and businesses that rely on that energy. For cybersecurity best practices for industrial control systems, CISA and DOE created an infographic outlining key areas of consideration, listed in the above table.

For more than a decade, energy and utility organizations have been tasked with meeting standards from the North American Electric Reliability Corporation (NERC) and mandated by the Federal Energy Regulation Commission (FERC). NERC Standards provide a cybersecurity framework for the identification and protection of Critical Cyber Assets to support reliable operation of the Bulk Electric System. These standards recognize the differing roles of each entity in the operation of the Bulk Electric System, the criticality and vulnerability of the assets needed to manage Bulk Electric System reliability, and the risks to which they are exposed.

The U.S. Department of Homeland Security created the Pipeline Cybersecurity Initiative (PCI) and has charged the Cybersecurity and Infrastructure Security Agency (CISA) and the Transportation Security Administration (TSA) with assessing cybersecurity risks to the Nation’s pipeline infrastructure—with a focus on Oil and Natural Gas (ONG) pipelines. This effort aligns CISA’s cybersecurity resources, the TSA’s pipeline security relationships and authorities, and the Department of Energy (DOE) energy sector expertise with industry knowledge and experience to identify cybersecurity risks and develop risk strategies to prepare for, respond to, and mitigate major cyber events and strengthen the security and resilience of the Nation’s pipeline infrastructure.

The Kentucky Intelligence Fusion Center is created within the KOHS and codified into state law to improve intelligence sharing among public safety and public service agencies at the federal, state, and local levels.

The ultimate goal is to provide a mechanism where law enforcement, public safety officers and officials, and the private sector can come together with a common purpose to improve the ability to safeguard our homeland and prevent cybersecurity attacks and criminal activity.

The Commonwealth Office of Technology operates the Office of the Chief Information Security Officer and is responsible for IT security functions. The Office works with the entire enterprise to establish the best security practices and risk management processes, and deploys strategies aimed at protecting and securing the Commonwealth's data. The Office also plays a major role in promoting security awareness.

The National Association of Regulatory Utility Commissioners (NARUC) has developed the Cybersecurity Manual, a comprehensive suite of cybersecurity tools, to help Public Utility Commissions (PUCs) gather and evaluate information from utilities about their cybersecurity risk management and preparedness. Components of the Cybersecurity Manual can be used individually but are designed to work together. NARUC's intent is to provide a comprehensive set of assessment tools that, when applied, provide a consistent, complete view of utilities' cybersecurity preparedness.

The National Association of State Energy Offices has also issued the Enhancing Energy Sector Cybersecurity: Pathways for State and Territory Energy Offices. State Energy Offices' roles in cybersecurity vary across the nation. Some have an active or a formal role while others do not. The SEO-EEC's role in Kentucky in cybersecurity is limited to coordinating with state government agencies and across the public private sector nexus on situational awareness of cyber security events.

On April 13, 2016, the PSC issued Order 2012-00428 on Consideration of the Implementation of Smart Grid and Smart Meter Technologies. In that order, the Commission concluded that:

"The Commission agrees with the Joint Utilities that a mature, effective cybersecurity process is one that is continuously evolving to address new cyber threats. However, the Commission believes that each utility should have some form of cybersecurity plan in place beyond the FERC or NERC mandatory standards. Therefore, the Commission will require that the Joint Utilities develop internal procedures addressing cybersecurity."

Given the sensitivity of cybersecurity concerns, the Commission also concluded that:

"The utilities should be allowed to keep their procedures confidential. The Commission, therefore, will not require each utility's actual internal procedure be filed; rather each utility will be required to certify the development of cybersecurity procedures. The utilities will be required to make a presentation describing their procedures to the Commission (and the AG), should he wish to attend. In addition, the Joint Utilities will be required to continue to make cybersecurity presentations every two years to the Commission through the Track Meeting process."

See Appendix I for a Cyber-Security PSC order 2012-00428.

Cybersecurity Threats

The Annual Threat Assessment that the Office of the Director of National Intelligence (ODNI) released in 2022 emphasizes, as it has in the past, that cyber threats from nation states remain acute. ODNI's concerns are focused on Russia, China, Iran, and North Korea, all of whom currently possess the ability to remotely damage infrastructure in the US or compromise supply chains. We know that adversaries – whether politically, socially, or financially motivated – are targeting our nation's energy infrastructure and the digital supply chain. Graphics below show categories of different kinds of threat actors and different kinds of cyber-attacks used by attackers.

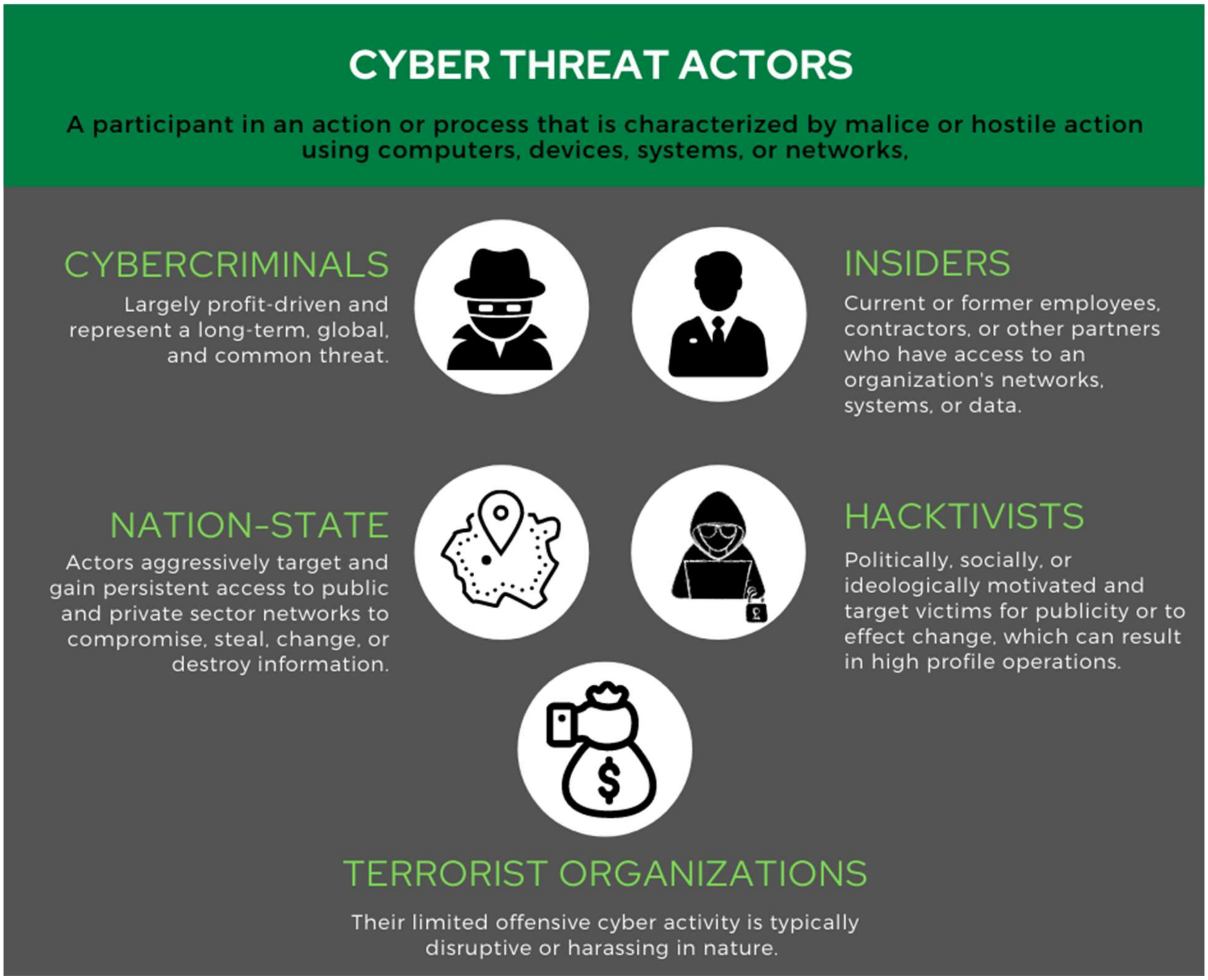


Figure 20: Cyber Threat Actors

The energy sector is uniquely significant in that it serves as the backbone for all other critical infrastructure sectors, providing the essential power and fuel required for continuity of operations. Unfortunately, this makes the Nation's energy infrastructure an attractive target for cyber-attacks. While 100% security is not possible, many steps can be taken to harden OT systems to mitigate against these threats.

Understanding the current and evolving threat landscape as well as possible consequences of a cyber-physical event can help state officials and energy owners and operators understand risks. Knowledge about risks can then be used to prioritize investments, such as purchases, staff resources, and training, based on the kinds of threats and vulnerabilities that pose the greatest risks to an organization. Investments can be focused on areas that can mitigate the highest risks. Because the majority of the nation's critical infrastructure is owned and operated by private companies, both the government and private sector have a common incentive to reduce the risks of disruptions to critical infrastructure. The National Infrastructure Protection Plan (NIPP) recognizes that public-private partnerships are vital to keeping critical infrastructure safe and secure, including from cyber-attacks.

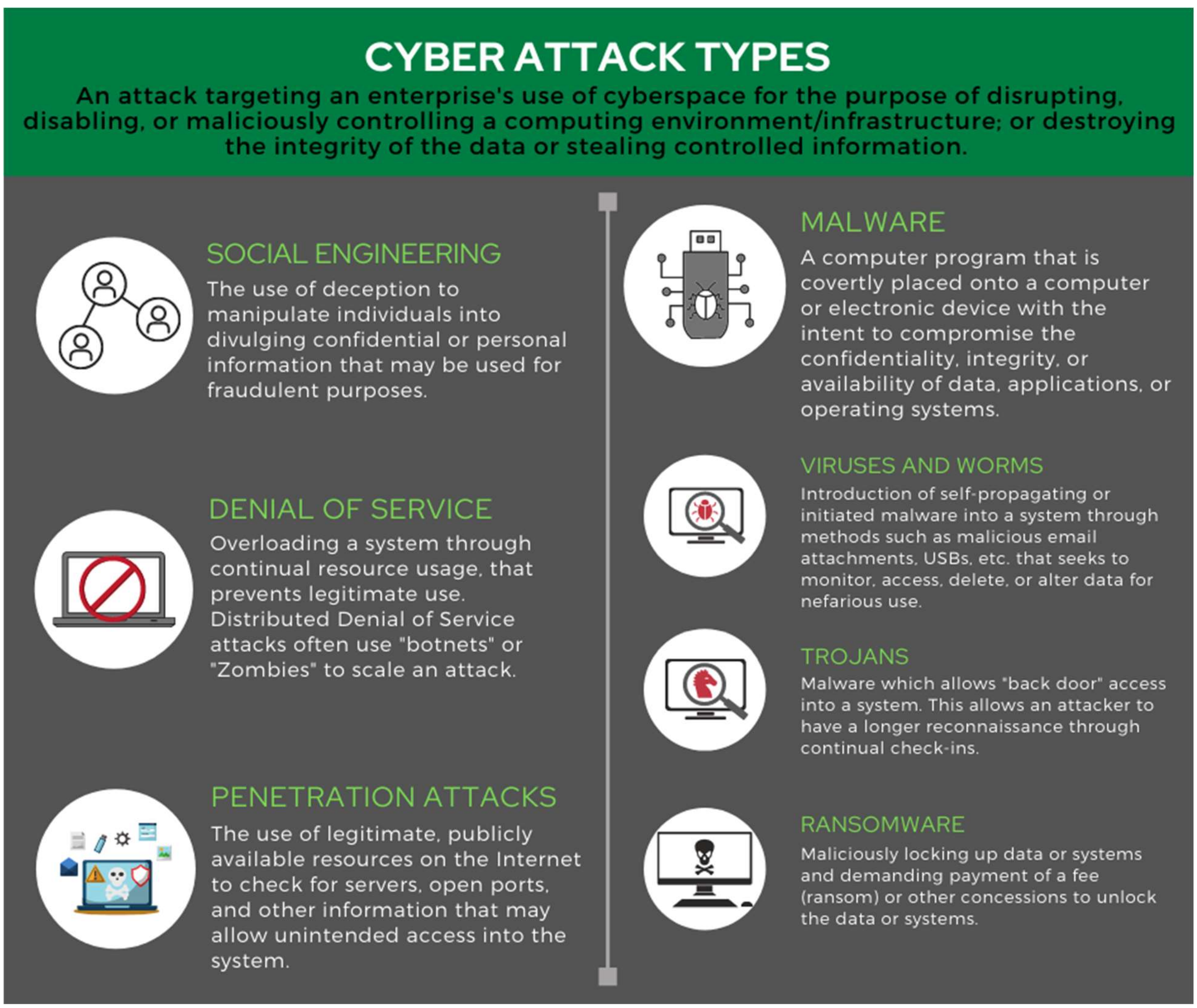


Figure 21: Cyber Attack Types

Federal and State Cyber Information Sharing

Cybersecurity information sharing is vital and ideally bi-directional. This includes sharing cybersecurity best practices, guidance, and trends; information on emerging cyber threats and vulnerabilities affecting energy sector stakeholders; and real-time information sharing during the response and recovery stages following a cyber event.

Robust, timely, actionable information is crucial to all partners because each has a unique role to play in protecting critical infrastructure against cybersecurity threats as well as participating in a coordinated response should a cyber incident occur.

The Commonwealth of Kentucky engages in information sharing through a variety of mechanisms whereby the state receives, analyzes, and/or shares information with energy and emergency officials and energy industry partners. This may include but is not limited to the following:

- Actively monitoring announcements and alerts from Information Sharing and Analysis Centers (ISACs).
- Testing cyber information sharing mechanisms through exercises.
- Facilitating or attending threat briefings (unclassified or classified).
- Distributing actionable indicators or detection signatures of malicious activity, vulnerability information, courses of action (to proactively defend or to stop and remediate an attack), and cyber threat intelligence.
- Incentivizing industry participation in federal cyber information sharing programs
- Fusion center practices may include bi-directional information sharing with the sector, briefings, or other outreach.
- Public utility commission holds formal or informal discussion with utilities about cybersecurity strategies, plans, and challenges.
- State facilitates informal energy CISO or industry group calls to share cybersecurity updates, trends, and questions.

CESER-Supported Resources for Assessing Cyber Maturity

The Department of Energy's Cybersecurity Capability Maturity Model (C2M2) enables organizations to voluntarily measure the maturity of their cybersecurity capabilities in a consistent manner through a publicly available tool.

The American Public Power Association (APPA) developed the Public Power Cybersecurity Scorecard, an online self-assessment tool for municipal utilities to evaluate their cybersecurity programs and overall posture. This tool is based on C2M2 and builds upon the assessment with additional resources.

The National Rural Electric Cooperative Association (NRECA) developed the RC3 Cybersecurity Self-Assessment. The assessment, available either hardcopy or online, is designed to help cooperatives understand their cybersecurity posture and is part of the larger Rural Cooperative Cybersecurity Capabilities (RC3) Program. The RC3 program develops and provides tools and resources focused on improving the cybersecurity capabilities of cooperatives. The program also provides opportunities for collaboration, education, and training.

The National Association of Regulatory Utility Commissioners (NARUC) has developed a suite of cybersecurity resources for public utility commissions (PUCs), including *Understanding Cybersecurity Preparedness: Questions for Utilities*. These resources may be useful in preparing an SEO for a conversation with their state's PUC about cybersecurity, the overall maturity levels of the state's regulated utilities, and where gaps need to be addressed.

Resource	Members	Description
Multi-State Information Sharing and Analysis Center (MS-ISAC)	ESF-12 Leads	The MS-ISAC is dedicated to improving the overall cybersecurity posture of state, local, territory and tribal (SLTT) governments, and is a resource for information on cyber threats to critical infrastructure. **Kentucky** members of the MS-ISAC can share threat information to the energy sector when appropriate.
Electricity Information Sharing and Analysis Center (E-ISAC)	Electricity owners and operators in North America Approved individuals at states with energy emergency response roles	The E-ISAC provides information and resources to help the North American electricity industry prepare for and defend against both cyber and physical security threats.

[Oil and Natural Gas Information Sharing and Analysis Center (ONG-ISAC)]()	Public and private ONG companies, select collaborators and partners, subject to membership requirements.	The ONG-ISAC serves as a central point of coordination and communication to aid in the protection of exploration and production, transportation, refining, and delivery systems of the oil and natural gas (ONG) industry, through the analysis and sharing of trusted and timely cyber threat information, including vulnerability and threat activity specific to ICS and SCADA systems.
[Downstream Natural Gas Information Sharing and Analysis Center (DNG-ISAC)]()	Natural gas utility companies.	The DNG ISAC serves natural gas utility (distribution) companies by facilitating communications between participants, the federal government and other critical infrastructures.

Figure 22: CESER-Supported Resources for Assessing Cyber Maturity

Note: The U.S. Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) intends to expand this cyber-specific state resource based on state feedback and needs in late 2022.

5.3 Energy Information and Analysis

Information and the ability to manage it properly are vital to any emergency response effort. This Plan is heavily weighted toward information and data management that will assist direct responders in emergency management activities. Three separate but interrelated undertakings have been developed that will be utilized to provide information and analysis of energy disruptions that occur in the Commonwealth. They are:

- the development of a comprehensive database
- a statewide energy profile
- GIS and Data visualization tools for understanding existing energy modeling platforms

5.3.1 Data Collection and Organization

The SEO-EEC has assembled a comprehensive database detailing energy, environmental, and economic statistics to provide quantitative analysis and policy interpretation of issues related to Kentucky's energy infrastructure. A product of this effort, the Kentucky Energy Database is a summary of time series data sets encapsulating energy-related statistics for the Commonwealth for the period from 1950 to 2022.

The majority of the variables located in this database were acquired from publicly available resources, primarily the DOE State Energy Data System (SEDS). This data system is produced and maintained by the U.S. Energy Information Administration (EIA). Since the SEDS does not contain many critical variables (particularly economic, socioeconomic, and environmental) required for a holistic analysis of energy systems, many other Kentucky subject-specific data sets were incorporated into the database to provide a more comprehensive system to utilize.

This database is the first comprehensive effort of this nature to be developed in Kentucky and will serve a number of purposes. Among them are:

- Serve as an impartial repository of energy statistics for the public, researchers, and policy makers.
- Provide an understanding of the dynamics of energy consumption and production activities within the Commonwealth.
- Support the Commonwealth Energy Security Plan that identifies potential threats to energy systems in Kentucky, and facilitates the restoration of energy supplies in the event of an emergency.

A direct outcome of the database is the Kentucky Energy Profile 2023. The summary statistics of the Kentucky Energy Database provide an annual snapshot of energy consumption and production within Kentucky.

5.3.2 KY Energy Profile

In order to ensure the Commonwealth's energy systems are operating normally, the first step is to define "normal operations". To understand normal operations, the SEO-EEC utilizes the Kentucky Energy Profile for emergency planning and disruption tracking purposes. This profile summarizes the various energy systems currently operating in Kentucky.

The Profile includes data on energy production and usage in various forms across all energy sectors. In addition, it examines in specificity the production, generation, and transmission systems associated with all energy commodities. Particular attention is paid to network elements with critical system functionality. The profile includes information on the geospatial distribution of energy providers and facilities within the state, along with cataloging contacts for corporations and individuals responsible for their operation.

The foundation of the Kentucky Energy Profile 2023 consists of one summary time series data set and four supporting multidimensional panel data sets, each with a different unit of observation. The profile is a platform where statistics and time series analyses can easily be used to generate answers to energy-related questions of interest across many topical areas. The profile provides a comprehensive assessment of energy consumption and production within the state by supplying detailed summary statistics and identifying time series trends. The information can be developed into charts, quantitative tables, analytic graphics, and maps.

In addition to and in conjunction with profile development, the SEO-EEC also monitors various sources for information on energy systems at the local, state, national, and international levels. Information collected or examined includes reports from federal and state agencies, professional association forecasts, academic publications, news reports, and direct observation when possible. The SEO-EEC will compare this information against the base year established in the profile to determine inconsistencies, issues, and trends. In the event that problems are identified, they will initiate the procedures outlined in this Plan and dictate that actions be taken to address the problems in a timely manner. The 2023 Energy Profile can be found in Appendix E.

5.3.3 Energy Risk Assessment and Vulnerabilities

Risk assessments assist decision makers with securing and building resilient infrastructure, while providing a better understanding about the impacts of disruption to energy infrastructure. Identifying vulnerable energy infrastructure nodes and understanding the interdependencies between community lifelines and susceptibility to an energy disruption are critical to emergency planning and emergency response.

Determining the risk associated with energy systems and energy infrastructure is a complex, continuous, and ever-changing process that involves the whole community. All disasters start and end at the local level, therefore, local governments, emergency response planners, critical facility owners, and emergency managers should first understand the complexities of the community’s energy needs and capabilities. Understanding this basic data helps tailor engagement strategies and shape programs to meet the various needs for energy resilient investments that ultimately lead to a more efficient use of existing resources, regardless of the size of the incident or community constraints.

The Office of Cybersecurity, Energy Security, and Emergency Response (CESER) has developed State Energy Risk Profiles that examine the relative magnitude of risks at a State level, highlighting energy infrastructure trends and impacts. The profile presents both natural and man-made hazards with the potential to cause disruption of the electric, petroleum, and natural gas infrastructures.

Below are example data sets and maps that highlight Kentucky's risks and hazards overview 2009-2019 from this profile and the Energy Infrastructure Risk application. Please refer to Appendix E of the EA Plan, attachment #1 for the full version of the KY Energy Sector Risk Profile, and section 1.5.1 for examples of energy sector interdependencies.

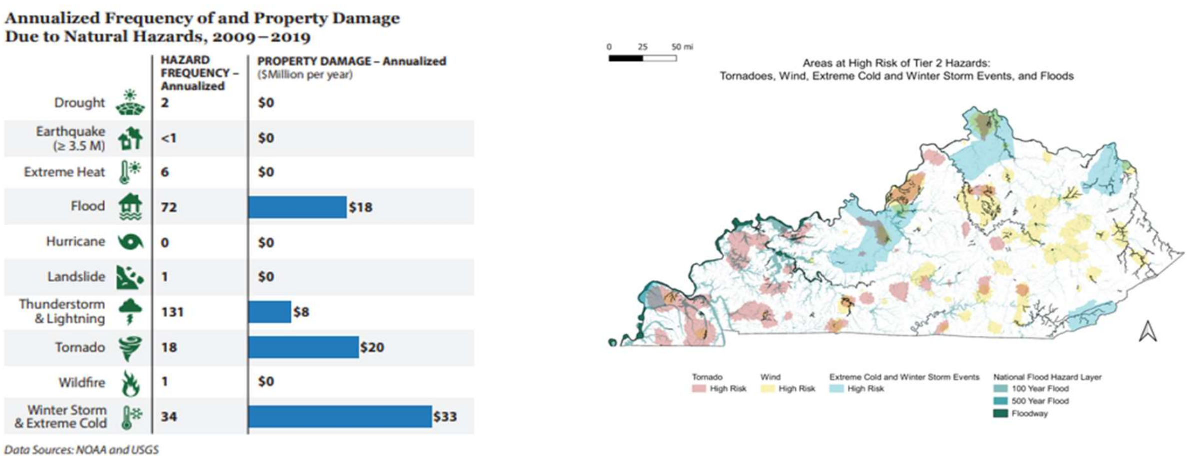


Figure 23: Kentucky Risks and Hazards Overview 2009-2019

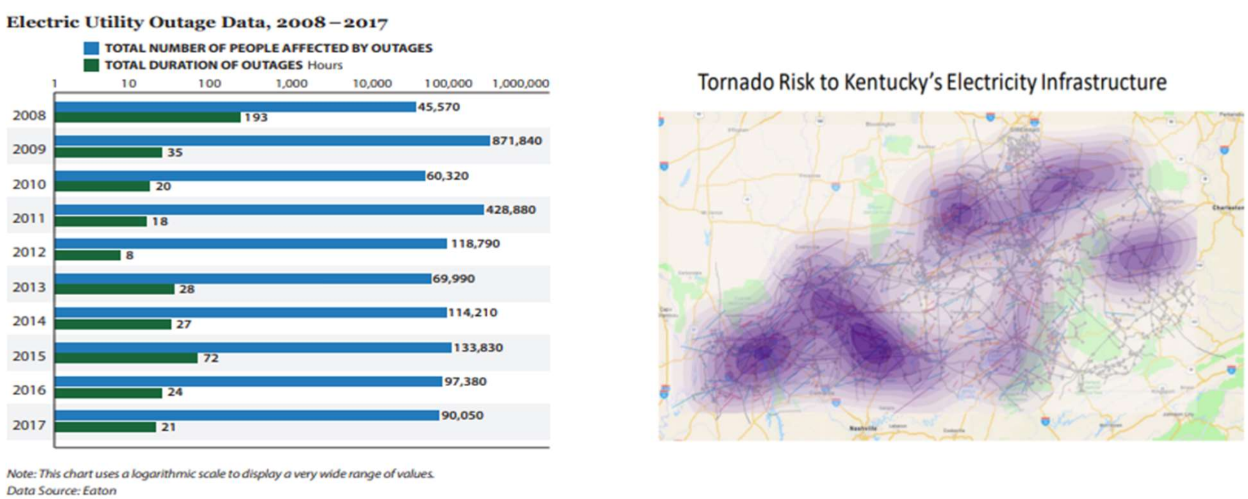
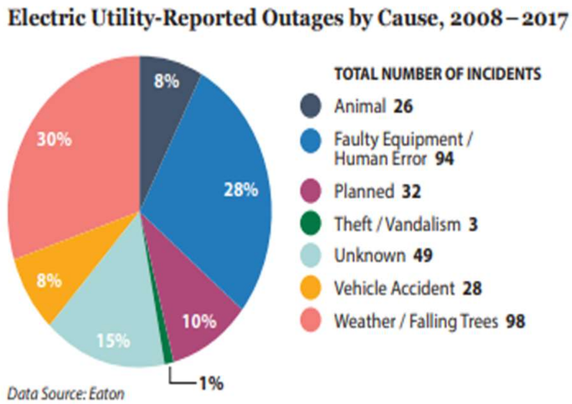


Figure 24: Electric Outages and Tornado Risk Areas



Worst performing circuits for each utility (based on SAIDI values)

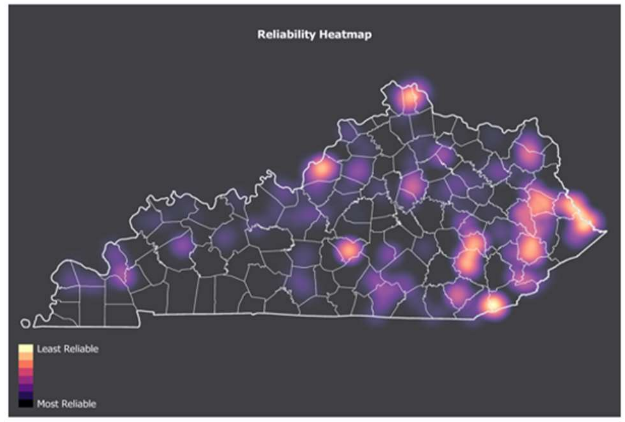
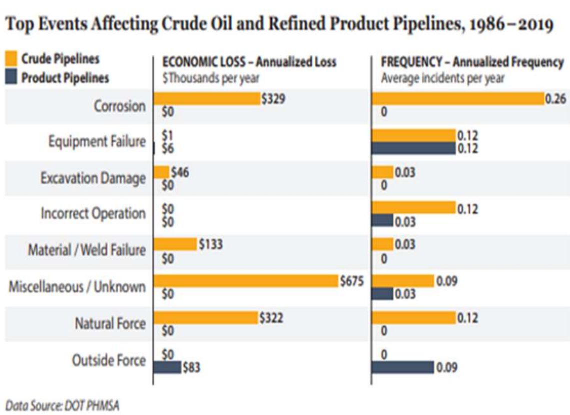


Figure 25: Electric Outages and Reliability Heat Map



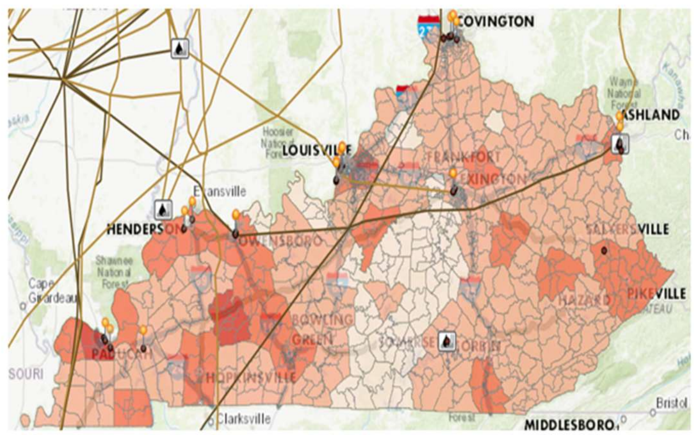
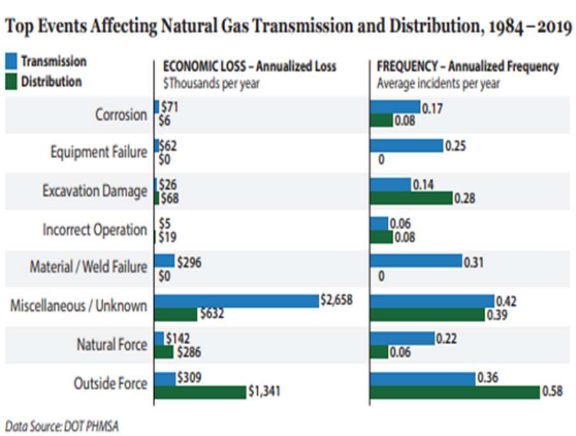


Figure 26: Petroleum & Crude Oil Pipeline and Annual Flooding



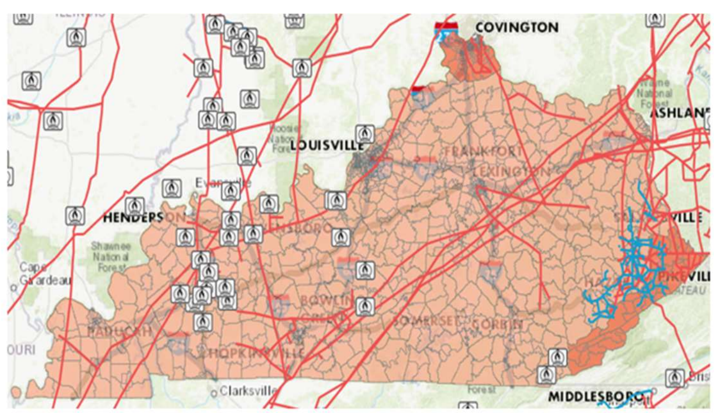


Figure 27: Natural Gas Transmission & Distribution and Winter Weather

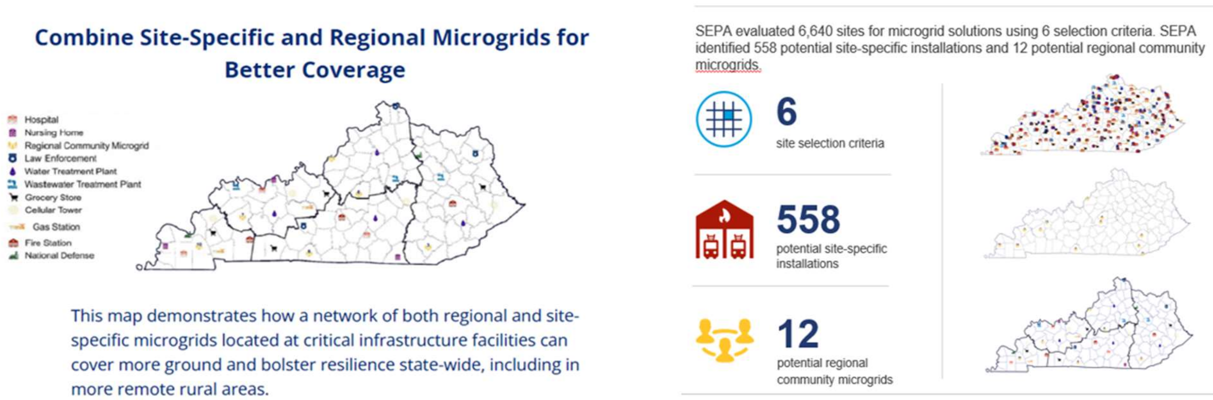


Figure 28: Kentucky Micro-grid Deployment Map 2021

Vulnerabilities

The EEC-SEO utilizes The FEMA National Risk Index for data collection and understanding risks and vulnerabilities in our communities. The National Risk Index is a FEMA online mapping application that identifies communities most at risk to natural hazards. These maps visualize natural hazard risk metrics that include expected annual losses from natural hazards, social vulnerability, and community resilience. The National Risk Index's interactive web maps are at the county and Census tract level and made available via geographic information system (GIS) services for custom analyses. This data presents a holistic view of community risk to natural hazards and supports resilience efforts by providing an overview of multiple risk factors.

In the National Risk Index, risk is defined as the potential for negative impacts as a result of a natural hazard. The equation behind the index is illustrated below.

Figure 29: FEMA National Risk Index Metrics

An illustration of vulnerabilities for the 18 natural hazards for the Commonwealth of Kentucky is depicted below. These vulnerable areas are viewed in context to supply chain infrastructure for the various energy commodities contained within these geographic areas. Supply Chain diagrams can be found in Section 6.0: Energy Commodities of this plan.

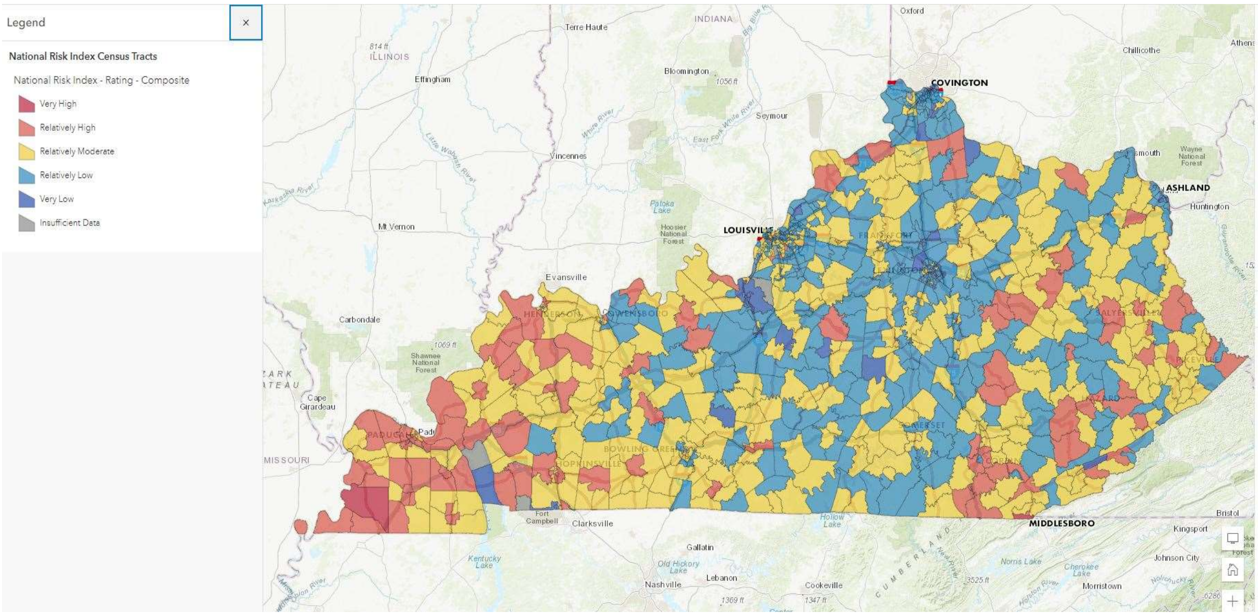


Figure 30: Kentucky ALL Hazards Map

5.3.4 Identification of Potential Threats

Recognizing that preparedness is a shared responsibility, the National Preparedness System calls for everyone—not just government agencies—to be involved in preparedness efforts. Community-wide involvement is an important principle in preparedness that entails involving stakeholders throughout preparedness development and ensuring preparedness materials reflect their roles and responsibilities.

The Threat and Hazard Identification and Risk Assessment (THIRA) is a three-step risk assessment process that helps the Commonwealth's communities understand their risks and what they need to do to address those risks.

Kentucky communities will use the THIRA to identify their threats and hazards and the effect on their holistic community, impacts that could take place, and capabilities that each community should have in preparation for the possible impacts of their identified threats. KYEM oversees the THIRA processes with local communities.

The data from the THIRA process is used in determining Kentucky's jurisdictional capability gaps. The process becomes the Stakeholder Preparedness Review (SPR). During the SPR process, communities complete a self-assessment of their current capability levels against the targets identified in the THIRA. Using the targets from the THIRA, communities identify their current capability and how that capability changed over the last year, including capabilities lost, sustained, and built.

Communities will identify capability gaps related to planning, organization, equipment, training, and exercises, and indicate their intended approaches to address those gaps while also maintaining their current capabilities.

From a statewide perspective, the Commonwealth is subject to threats from a variety of natural and man-made disruptions.

Potential Energy Disruption Causes

- Natural Disasters
  - Earthquakes
  - Fires
  - Flooding
  - Ice
  - Wind
  - Snow
  - Extreme Heat and Cold
  - Hurricanes
- Production or Supply Variations
  - Market Forces
  - Curtailments
  - Labor Disputes
  - Import or Export Restrictions
  - Cyber attacks
- Regulatory Changes
  - Environmental
  - Labor
  - Tax Structure
- Energy Price Changes
- Reports or Alerts from Energy Providers
- Terrorism Warnings or Actions
- Pathogenic Threats

Kentucky disaster events

In the past two decades Kentucky has been impacted by 34 severe storms, 27 flooding events, eight fire events, seven tornado events, five snowstorms and three severe ice storms, totaling 31 presidentially declared disasters that resulted in significant damages to critical infrastructure across the state and billions in damages. Specific disaster events are listed below.

On January 26, 2009 precipitation began as light freezing drizzle and freezing rain over an entire area, but changed into sleet then snow overnight. Up to 9 inches of snow and two inches of ice accumulated over the 2 day event. Subsequent high winds delivered the second half of the one-two punch that paralyzed much of Kentucky and created a dangerously beautiful "Frozen State". The storm caused Kentucky's largest power outage on record, with 770,000 homes and businesses without power and wide spread property damage due to falling trees, large tree limbs and power lines weighed down by ice, totaling over 1 billion in damages. Electric and heat went out for days and even weeks in some of the state. Such basics as food, water, and gas were difficult to obtain. The commonwealth lost 36 citizens and for the first time, the entire Kentucky National Guard was deployed.

Fort Knox, the United States Bullion Depository, is a fortified vault building operated by the United States Department of the Treasury, and stores over half the country's gold reserves, was caught completely off guard and unprepared as they went without power and water for up to 10 days. Leadership at that time vowed to never allow a crisis of this type to reoccur. With that decision came the need for a surge of installation-wide strategic thinking focusing on energy and infrastructure resilience.

Fort Knox partnered with Nolin Rural Electric Cooperative Corporation (RECC) to deliver an energy security micro-grid project that incorporates 44 MW of new power generation, comprised of 8 MW of CHP natural gas generators, 16 MW of peak-shaving natural gas generators, and 20 MW of diesel emergency backup generators. The newly installed CHP generators are deployed at three different sites on post, chosen for being critical infrastructure and prime locations for the thermal load produced by the CHP systems. Natural gas is partially supplied from the Devonian Shale that lies underneath Fort Knox, through a utility privatization contract held by Nolin RECC. This allows for the capability to operate independently from external power sources.

Fort Knox, Kentucky, is a uniquely capable installation that even has the ability to produce its own power and water. The installation is the foundation for military readiness and resilient infrastructure, ensuring our forces are ready when called upon. Fort Knox learned the hard way in regard to resilience, but has emerged as a leader within the DOD.

On December 10, 2021 a violent, long-track tornado entered western Kentucky shortly before 9:00 p.m. CST. The EF-4 tornado reached speeds of 190 mph and covered over 165 miles in about three hours, claiming 81 lives and injuring over 500 people in eight counties. The tornado was the deadliest in U.S. history to occur in the month of December. Its path length of 165 miles was the ninth longest tornado path ever recorded in the U.S. It's documented that 3,000 structures were damaged and 1,800 destroyed, including an entire factory in the City of Mayfield, resulted in damage costs up to $315 million.

Peak statewide electric outages reached 100,000 + with three utilities not reporting due to catastrophic damage to communication systems. Both generation and transmission cooperatives, two IOU's, TVA and multiple electric utilities were heavily impacted due to critical transmission damage to over 10,000 utility poles, numerous transmission lines down, and extensive damage to power distribution systems. The City of Mayfield substation and water tower were completely destroyed, along with its historic district and city water systems.

With the power grid compromised and critical facilities and services without power, multiple requests for generators poured in from across this region. Due to catastrophic damaged to the energy infrastructure, restoration was prolonged and the request for emergency fuel quickly followed. The SEO-EEC and KYEM coordinated with the Kentucky Petroleum Marketers Association (KPMA) for emergency fuel procurement contracts.

This event exercised the states capability to develop and procure a Statewide Master Agreement with an emergency fuel provider so counties can request fuel deliveries during an emergency directly from supplier.

Between December 23-26, 2022 dangerous winter weather conditions swept over the majority of the Central and Eastern U.S., bringing the coldest recorded Christmas in decades to major cities. By December 25, more than 55 million were under wind chill alerts. The storm, known as Winter Storm Elliott and the freezing temperatures led to a surge in heating demand that pushed utilities and grid operators to the brink. Friday, Dec. 23rd, was the coldest day of the year in Louisville at negative 5 degrees, according to the National Weather Service of Louisville. The demand for home heat broke many utility's record for daily total energy usage. PJM issued an Emergency Load Management Reduction Action and a NERC level EEA2 was issued. PJM utilities in Kentucky include Duke Energy, Kentucky Power, and East Kentucky Power Cooperatives. This resulted in demand response actions and voluntary energy conservation measures from customers.

As a result of generator and natural gas system failures, the Tennessee Valley Authority and LG&E and KU were among the utilities that engaged in rolling blackouts to avert significantly more widespread power outages. Winter Storm Elliott highlighted the vulnerabilities of Kentucky's natural gas infrastructure and the impact of a regional weather that strains capacity of neighboring utilities. FERC and Regional Grid Operators along with all impacted utilities have initiated after action and reliability measures to protect against a future event.

Finally, on March 3, 2023, an intense low pressure system produced severe weather and historic gradient winds to the Lower Ohio Valley. Wind gusts of 60-80 mph produced wide spread wind damage and snapped more than 1,000 utility poles and threw trees and other debris on power lines. The peak outage was approximately 550,000 statewide. All 26 of Kentucky's electric cooperatives sustained damage in this event, with the smallest co-ops reporting damages totaling 1 million alone. This is the third-most significant weather event in 20 years in terms of total system impact and the number of customers affected, ranking behind the 2009 ice storm and 2008 windstorm. While significant and historic, restorations efforts highlighted how response and restoration activities have improved with repeated exercises and events. Mutual aid crews poured in from 60 sister co-ops in 11 states to support power restoration, which occurred over 4 days rather than over weeks as experienced a decade earlier.

Specific threats to the energy sector are illustrated below.

Threats and Potential Impacts to Energy

Hazard	Power	Natural Gas Liquid Fuels
Cyber Incident	Informational technology and operational technology systems can be impacted; this can include company data, payment and scheduling systems, sensors, and control systems.	
Drought	Reduced hydroelectric generation due to low water levels. Reduced efficiency at thermoelectric generation facilities if there are constraints on steam or cooling.	May limit drilling activity if alternative water supply is not available. Impacts to biofuel feed stocks from low moisture in soil. Low water levels can prevent barge traffic on inland waterways. May limit drilling and refineries operations if alternative water supply is not available.
Dam Failure	Damage to downstream infrastructure due to flooding and debris. Hydroelectric power generation may be disrupted, which may also reduce black start capabilities.	Unearthing and rupturing of pipelines. Unearthing and rupturing of pipelines.
Earthquake	Damage to infrastructure. Examples: power generation facilities, transmission poles, etc.	Examples: pipeline rupture, processing plants, well sites, compressor stations. Examples: pipeline rupture, refineries, well sites, pumping stations.
Equipment Malfunction	Line arcing, power surges, corrosion, or moisture on equipment can cause equipment to malfunction or go offline.	Corrosion, material failure, excess pressure buildup, or control malfunctions can cause supply disruptions,
Extreme Heat	Increased demand for cooling. Depending on the available capacity, this can cause ISOs to operate below reserve margins. Increased risks of wildfires from power lines.	Can reduce efficiency at refineries.

Flood	Damage to equipment exposed to water and debris. Examples: power generation equipment, control center buildings, transmission lines.	Examples: processing plant units, LNG export facilities, underground pipelines. Examples: refinery process units, tanks underground pipelines.
Landslide	Damage to nearby infrastructure due to debris or foundation impacts.	
Man-made Damage	Deliberate physical attacks on or takeovers of infrastructure. Human error can cause facilities to run outside of designed parameters. Transmission lines may be impacted by individuals hitting power poles, cutting trees down, or striking underground wires.	Third-party strikes of pipelines can rupture lines.
Pandemic	Shifts in demand and reduced worker availability.	
Tropical Cyclone	Damage to infrastructure from high winds, debris, and flooding. Examples: power generation facilities, transmission poles, etc.	Examples: pipeline pumps, tanks. Examples: pipeline pumps, tanks. Production facilities and refineries may shut down ahead of storm for personnel safety. Shoaling in ports can prevent ship and barge traffic to terminals.
Thunderstorm and Lightning	Blown transformers and downed trees may impact power lines.	Power outages may impact select electric compressor operations. Power outages may impact refinery, terminal, or pumping operations.
Tornado	High winds can cause damage to power lines and power generation facilities.	High winds can cause damage to processing plants, compressor stations, metering and regulating stations, and other above-ground facilities. High winds can cause damage to refineries, terminals, and other above-ground facilities.
Wildfire	Damage to power lines and power generation facilities. Utilities may shut off power to prevent wildfires (e.g., high temperatures and high winds).	Combustible material if exposed, primarily impacting above-ground infrastructure.
Winter Storm and Extreme Cold	Freezing in cooling towers preventing electric generation. Rail freezing impacting feedstock to power generation (e.g., coal). Increased demand for heating can add strain to available capacity causing RTOs/ISOs to operate below reserve margins.	Freezing may impact non-weatherized equipment, which can cause production shut-ins. Increased demand for heating can strain capacity. Freezing for non-weatherized equipment (including frozen product within the piping system), malfunctioning flow control equipment, flaring, and production shut-ins.

Increased back-up generator demand.

Figure 31: Threats and Potential Impacts to Energy

5.3.5 Energy Modeling

The SEO-EEC relies on a number of external models developed by outside entities to perform more advanced or specialized data analysis needed by the Cabinet, including but not limited to:

- State and Local Planning for Energy (SLOPE) Platform from the National Renewable Energy Laboratory
- Engage from the National Renewable Energy Laboratory
- Greenhouse Gas Inventory from the Environmental Protection Agency
- The Jobs and Economic Development Impact models from the National Renewable Energy Laboratory

The data and modeling team at the SEO-EEC is constantly evaluating and discovering new applications from trusted entities like the nation's national laboratories to better inform and serve stakeholders within the state. The SEO-EEC goal is to integrate the latest technology and modeling techniques to achieve the strategic goals as outlined in the state energy strategy and the EEC strategic plan.

5.4 Energy Supply Disruption Tracking

This section describes the process by which the SEO-EEC will maintain a historical record of energy disruption events. Through observing and recording the type and duration of disruptions, the responding organizations, and the specific restoration efforts, a historical perspective on the factors behind disruptive events can be ascertained. Over time, this information will be evaluated to identify trends and vulnerabilities and to refine response methods and mitigation plans.

The Energy Disruption Tracking process is viewed as a collection of energy disruption events, with details of each individual disruption. It should be noted that tracking individual disruptive events in detail is one of the primary functions delineated in the State Energy Security Plan and referenced in the tracking log described below. The Energy Security Plan establishes the procedure for the identification of disruptions or emergency events and describes the process for the compilation of situational reports. Collectively, these events create a chronological record of the factors that contribute to energy supply disruption and restoration efforts; therefore, they can be utilized to make improvements to both specific energy sectors and the overall energy system.

To recognize threats that may lead to an energy disruption event, it is important to understand the normal status of energy systems and continually monitor events that affect the energy system stability. The SEO-EEC staff created and maintain an Energy Profile to define the normal condition and monitor news, weather reports, industry publications, and other sources to identify situations that may impact energy deliverability in the Commonwealth.

If irregularities or concerns arise, the SEO-EEC will contact trade groups, membership organizations, energy suppliers, transporters, and brokers to determine the potential impact to system operations.

Each time a threat is identified, and the ESF 12 is activated, the SEO-EEC will record pertinent data in the Energy Disruption Log. If the threat escalates into a significant disruption event, a detailed situational report will be developed. After each event is closed, the SEO-EEC will analyze the log and prepare an After Action Report (AAR). If the threat is minimal, only a basic log entry is necessary for situational awareness.

5.4.1 Energy Disruption File Log

The ability to effectively respond to and facilitate the restoration of energy systems during disasters relies on the ability of local, state, and federal government agencies and private sector electricity and fuel providers to have access to timely, accurate, and actionable information about the status and potential impacts of energy sector disruptions. This information can be accessed through DOE EAGLE-I system and the National Pipeline Mapping system. Refer to Section 2.9.

While monitoring the overall energy network is a deliberate and continuous process that is critical to an Energy Security Plan, emergency event disruption tracking is usually related to a precise event or explicit incident.

To ensure that all energy disruptions are documented, the SEO-EEC Energy Security Coordinator will log each one based on procedures established in the Energy Security Plan, detailing the circumstances surrounding the event. This will allow the SEO-EEC to examine the causes of outages over time in an effort to determine if there are similar causal characteristics. It will also allow for continuity in program operation and performance through staff changes. Once the disruption has been identified and mitigated, the situational report will be filed along with the disruption-tracking log.

The disruption file log will be utilized to better understand the "triggers" most often responsible for the initiation of interruptions. The list below is not meant to be exhaustive; however, it will serve as a guide in determining events that warrant increased monitoring efforts. Ultimately, the SEO-EEC will rely on best judgment to decide when to heighten the monitoring effort. See Appendix E, Kentucky Energy Profile 2023.

Disruptive events may differ in magnitude and impact, yet for tracking purposes, each one will be treated with equal significance. Information gathered by the SEO-EEC can differ by situation, but at a minimum, will include the commodity type or transmission mode affected; the geographic area or location affected, if identifiable; the disruption cause; the time of the occurrence; the expected duration the event; and the rectifying actions undertaken. The Energy Disruption Log can be found in Appendix F.

The PSC-regulated electric utilities will be tracked in a separate system that is maintained by the PSC. A sample PSC outage log is also attached at the end of this chapter.

Regulated electric utilities as defined in KRS 278.010 are required under 807 KAR 5:006(27) to report any outages that affect more than 500 customers and last more than four hours to the PSC. KRS 278.010 defines a retail electric supplier in Kentucky as "any person, firm, corporation, association, or cooperative corporation, excluding municipal corporations, engaged in the furnishing of retail electric service. Therefore, the Tennessee Valley Authority by nature and their associated local power companies are not regulated by the PSC.

These outage reports will be submitted daily until service is restored. Reporting will normally be submitted through the "PSC Outage Reporting System" but may also be submitted by email or telephone. Specific information in the report includes the name of the utility, a specific contact, time of the incident, geographic area involved, the number of customers affected, a description of restoration efforts, and an estimated completion time. Once the service is restored, the provider must submit a report detailing the causes of the problem, efforts taken in restoration, and future mitigation efforts.

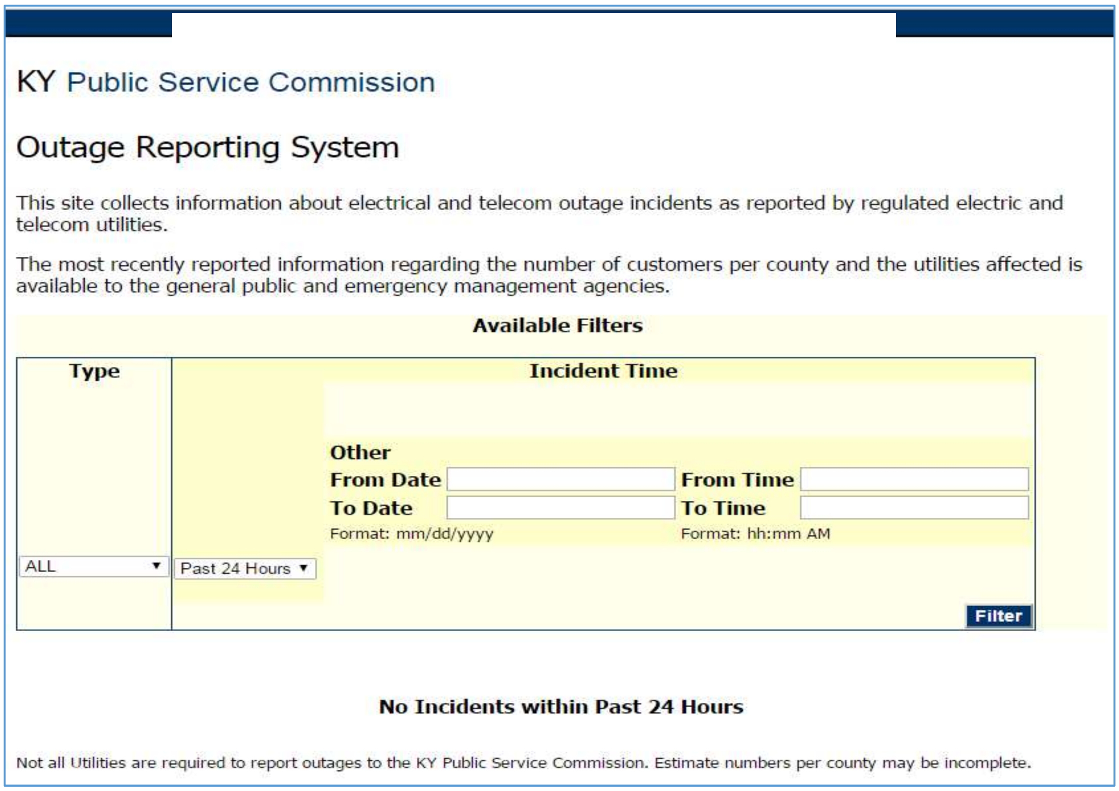


Figure 32: Public Service Commission Outage Reporting Screen

Outage information from non-regulated utilities is tracked via EAGLE-I and through routine communication via ReadyOp and the public private sector partners. In addition, the PSC and SEO-EEC coordinate outage information to form a statewide outage assessment.

5.4.2 Situational Reports

For minor disruptions, a file memorandum or email notation may be all that is necessary to properly identify and document the occurrence. In this case, the SEO-EEC will simply place this information in the ESF-12 file log. There will be particular incidences, however, that will require more in-depth investigation and data collection. Normally these will be large-scale events affecting many people or significant geographic areas or lasting for extended durations. For these events, a separate and more descriptive situational report will be compiled.

The report will follow the same format as required for tracking disruptions in the file log but will collect and compile the information on a much more in-depth basis. As established in the Energy Security plan. In addition, this summary will actively seek out information pertaining to the event from related sources such as news reports, email communication, emergency first responders, etc. The situational report will assist the SEO-EEC in determining a course of action in the initial emergency response and will be logged in WebEOC during an SEOC activation.

5.4.3 After Action Report

Additionally, further examination of the data will be conducted by the SEO-EEC to conclude whether response measures were administered correctly and to determine if there are actions that can be taken to mitigate possible future problems or occurrences and ultimately long term energy disruptions. The SEO-EEC evaluates the strengths and accomplishments as well as the challenges and barriers of the objectives listed below and suggests mitigation measures or partnership opportunities to minimize future long term energy disruptions.

- Monitor, collect, analyze, and disseminate information on energy networks with the Commonwealth.
- Access information on existing state and federal databases regarding energy supplies and demand.
- Develop and maintain relationships with all public and private energy industry personnel.
- Establish contact with and request information on supply and demand from producers, distributors, or trade organization of the energy commodity experiencing the disruption.
- Establish contact with county emergency management agencies in the affected areas; obtain information on current energy utilization conditions and needs.
- Communicate energy policies and directives, established because of an energy emergency, to energy sector partners.
- Communicate the needs and interests of ESF-12 energy sector partners during the event.
- Serve as liaison to national or regional organizations dealing with the same energy issue.
- Work with other ESFs on energy interdependencies and assist in policy development.

The AAR will be distributed through the chain of command, to the Secretary of the EEC and KYEM after each activation is closed.

5.4.4 Trade Groups

Trade groups, membership organizations, and professional associations most often represent large cross sections of energy providers, whose members most often have a diverse set of interests. These groups will often foresee potential energy delivery problems and can be a great asset for energy security. The SEO-EEC will stay in close contact with these groups through ReadyOp as a necessary aspect of monitoring issues on the energy forefront in Kentucky and around the world.

These groups' primary mission is generally dedicated to the promotion of increased market representation of a particular commodity; however, they are also customarily extremely knowledgeable about other issues related to that commodity. Industry and regulatory concerns have typically been cleared through the organization's membership prior to public disclosure; therefore, they can provide an expanded perspective derived from a large number of interests.

From an energy commodity-tracking standpoint, this allows the eyes and ears observing the energy environment to increase dramatically. The SEO-EEC will utilize its positive working relationships with these groups and associations to comprehensively monitor the Commonwealth's energy networks. Contact information can be found in Appendix C.

5.4.5 Energy Providers

Almost all energy in the Commonwealth is provided by private businesses. Utility companies and other energy generators, transmitters, and distributors offer invaluable first-hand information on the current state of energy affairs. Their insights provide an accurate depiction of the prevailing issue, especially from the supplier's perspective. More importantly, providers can relay the information on issues in real time from a front-seat perspective. These companies also have the knowledge and assets needed to mitigate and correct energy disruptions. The SEO-EEC and the Public Service Commission (PSC) will actively utilize existing relationships with the generation, transmission, and distribution companies that serve the state to gain an accurate representation of energy disruption events as they occur.

6.0 Energy Commodities and Contacts

The term "energy commodities" encompasses a range of resources such as coal, oil, natural gas, biofuels, and petroleum-derived products, with electricity being a derived commodity and are critical to our essential daily societal functions. Energy has attracted attention from investors as they seek to profit from the world's abundance of energy.

Electricity Supply

Process:

Electricity in Kentucky is provided to customers by PSC-regulated utilities, municipally owned utilities, and the Tennessee Valley Authority (TVA) and its distributors. All 26 electric Cooperatives in Kentucky are members of both the Kentucky Electric Cooperatives and the National Rural Electric Cooperative Association (NRECA): There are 24 distribution cooperatives that deliver electricity directly to member consumers and two "generation and transmission" cooperatives (G&T's) supply power to the distribution co-ops. Collectively, the electric cooperatives of Kentucky power the lives of 1.5 million people in 117 of 120 counties.

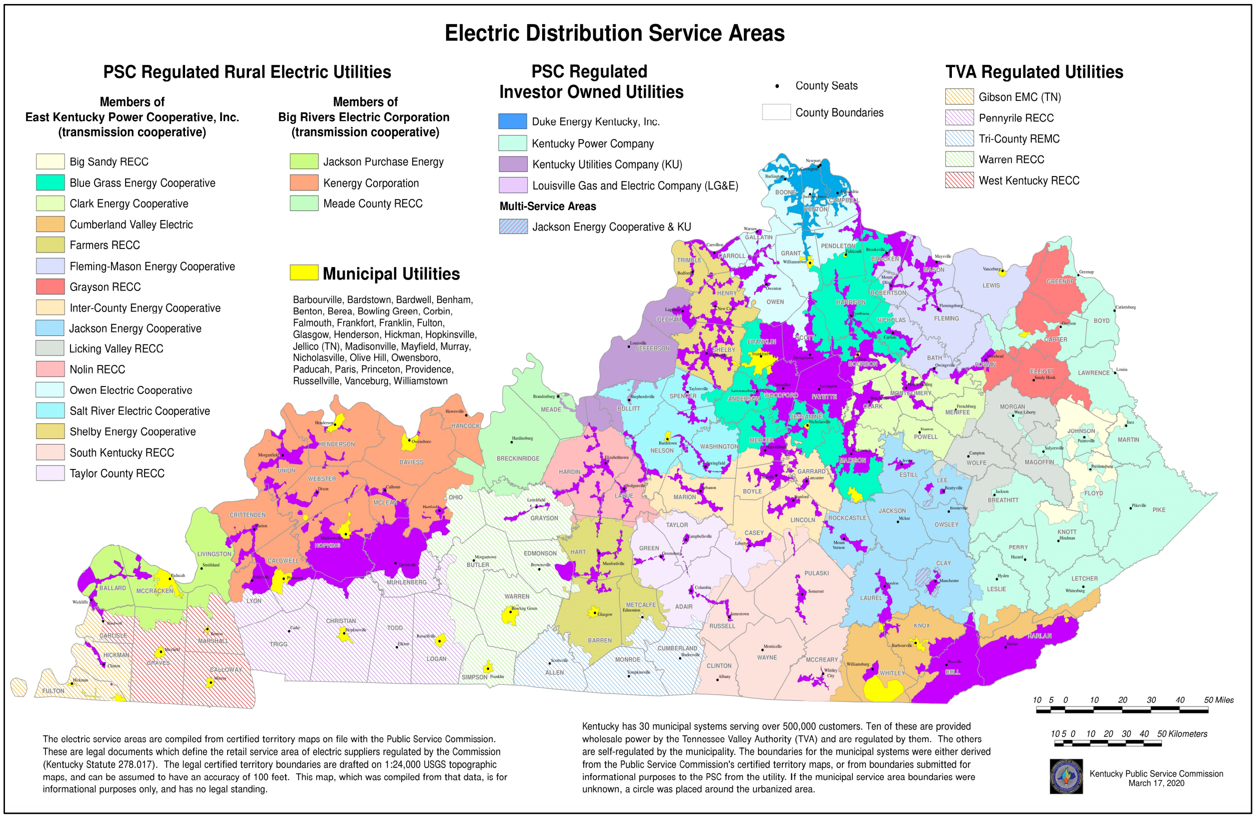


Figure 33: Kentucky Utility Service Map

6.1.1 PSC-Regulated Electric Utilities

Electric utilities that are regulated by the PSC fall into two categories: Investor Owned Utilities (IOUs) and Rural Electric Cooperative Corporations (RECCs). There are four investor-owned electric utilities that operate in Kentucky: **Duke Energy Kentucky**, **Kentucky Power Company** (a.k.a. American Electric Power), **Kentucky Utilities**, and **Louisville Gas & Electric**. Each of these companies generates the power to meet its respective customers' electricity demands.

Nineteen RECCs are regulated by the PSC. These "distribution" cooperatives typically receive power from their respective "generation and transmission" cooperatives at substations in the distributors' service territories. Sixteen of these RECCs jointly own and purchase power from **East Kentucky Power Cooperative:**

- Big Sandy RECC
- Blue Grass Energy Cooperative
- Clark Energy Cooperative

- Cumberland Valley Electric
- Farmers RECC
- Fleming-Mason Energy Cooperative
- Grayson RECC
- Inter-County Energy
- Jackson Energy Cooperative
- Licking Valley RECC
- Nolin RECC
- Owen Electric Cooperative
- Salt River Electric Cooperative
- Shelby Energy Cooperative
- South Kentucky RECC
- Taylor County RECC

The remaining three jointly own and purchase power from **Big Rivers Electric Corporation:**

- Jackson Purchase Energy Corporation
- Kenergy Corporation
- Meade County RECC.

6.1.2 TVA-Regulated Electric Utilities

The Tennessee Valley Authority (TVA) is a federally owned electric utility corporation in the United States. There are five electric cooperatives and eleven municipal utilities serving ratepayers in Kentucky that secure all of their electricity from the TVA. These cooperatives and municipal utilities then resell and distribute electricity to customers within their service territories. TVA regulates the rates and services of these utilities. Separately, the TVA also serves several large industrial customers directly.

TVA Electric cooperatives:

- Gibson Electric Membership Corporation
- Pennyrile RECC
- Tri-County Electric Membership Corporation (TN)
- Warren RECC
- West Kentucky RECC

-

TVA Municipal Utilities:

- Benton Electric System
- Bowling Green Municipal Utilities
- Franklin Electric Plant Board
- Fulton Electric System
- Gibson Electric Membership Corporation
- Glasgow Electric Plant Board
- Hickman Electric System
- Hopkinsville Electric System
- Mayfield Electric & Water Systems
- Murray Electric System
- Russellville Electric Plant Board

6.1.3 Self-Regulated Municipal Electric Utilities

Municipal electric utilities either self-generate electricity (by owning and/or operating generating facilities) or purchase power from various sources other than the TVA. There are 21 self-regulated Municipal electric utilities and they are self-regulated by their respective municipal governments.

- Barbourville Utilities
- City of Bardstown
- Bardwell City Utilities
- Benham Power Board
- Berea Municipal Utilities
- City Utilities Commission of Corbin
- City of Falmouth
- Frankfort Plant Board
- Henderson Municipal Power & Light
- Madisonville Municipal Utilities
- Madison Electric Dept.
- Morehead Utilities
- Nicholasville Public Utilities
- City of Olive Hill Utilities

- Owensboro Municipal Utilities
- Paducah Power System
- City of Paris Combined Utilities
- Princeton Electric Plant Board
- City of Providence
- Electric Plant Board of the City of Vanceburg
- City of Williamstown

6.1.4 Interstate Electricity Market

Kentucky participates in two wholesale marketers: the Midcontinent Independent System Operator (MISO) and PJM Interconnection. Both are operators of regional transmission systems and provide access to interstate wholesale power markets. These markets set reliability rules to ensure that a continuous and reliable power supply is provided to consumers by securing commitments from generators to meet customer demand on the power grid.

PJM coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. PJM's long-term regional planning process provides a broad interstate perspective that identifies the most effective and cost-efficient improvements to the grid to ensure reliability and economic benefits on a system-wide basis.

MISO is an independent, not-for-profit organization that delivers safe, cost-effective electric power across 15 states, including Kentucky. Electricity price and supply problems in Kentucky are referred to the PSC for jurisdictional companies. Problems with municipally owned systems should be taken to that municipality and the representing trade association.

PJM and MISO capacity market delivery year starts June 1 and ends the following year on May 31. Both markets allow for bilateral transactions and the self-scheduling of resources to lower the amount of capacity that must be purchased through the capacity market mechanisms. When the products' costs are too high or too low, each operator initiates discussions with stakeholders for potential solutions. Once a solution is finalized, it is submitted for approval to the Federal Energy Regulatory Commission (FERC), which regulates the interstate transmission of electricity.

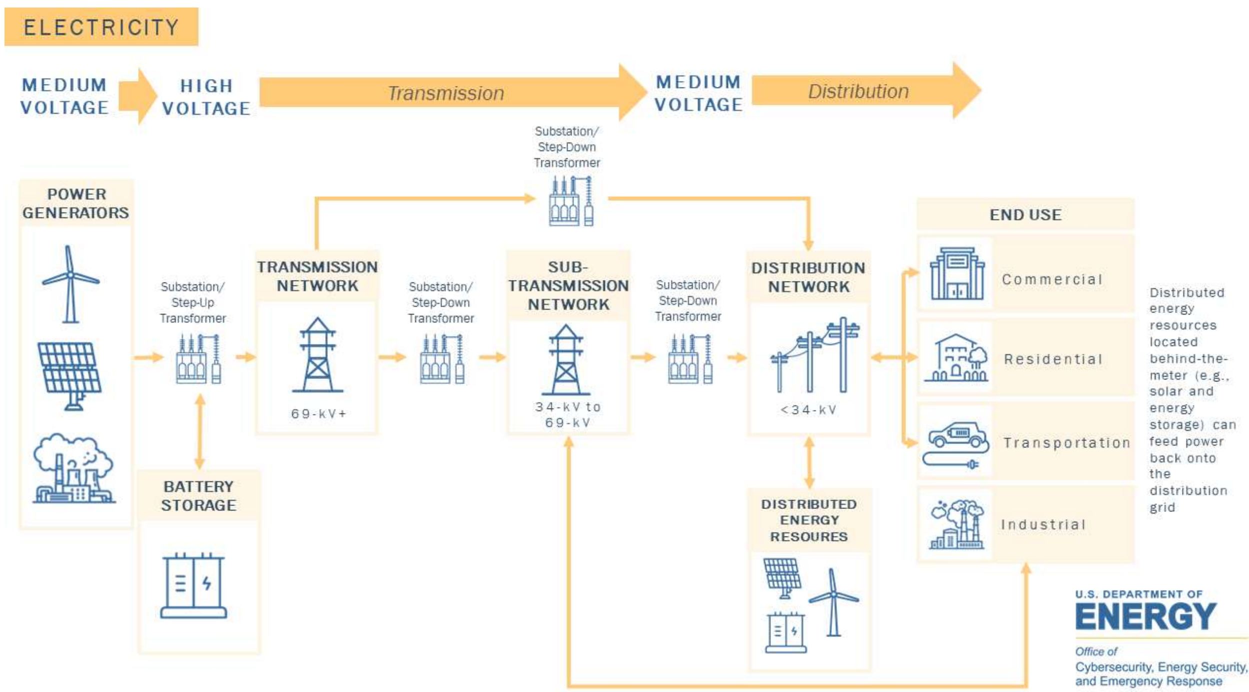


Figure 34: Electric Supply Chain

Electric Contacts:

State Government:

Public Service Commission - https://psc.ky.gov/
Division of Consumer Services - https://psc.ky.gov/home/complaint/

Federal Government:

Federal Energy Regulatory Commission - https://www.ferc.gov/
Tennessee Valley Authority - http://www.tva.gov/

Industry:

Kentucky Municipal Utilities Association - http://www.kymua.org/
Kentucky Electric Cooperative Association - https://kyelectric.coop/

6.2 Electric Transmission

Process:

The electric transmission system in Kentucky has been designed for the primary purpose of moving electricity from generation sources within the state to customers within the state. The transmission systems of the Generation and Transmission Utilities are interconnected so as to allow the flow of electricity among utilities and other generators both in state and out of state. The Midcontinent Independent System Operator (MISO) and PJM Interconnection (PJM) are the two interstate transmission operators for the Commonwealth. Refer to section 6.1.4 for details.

Transmission lines, for the purpose of Kentucky Energy Security and emergency management, are defined as lines operating at 69 kilovolts (kV) or more. Typical voltages include 69 kV, 138 kV, 169 kV, 345 kV, 500 kV, and 765 kV. Generally, the higher the voltage of the line, the more electricity the line carries to more customers.

Electric transmission lines are almost exclusively built aboveground for cost considerations and are thus subject to damage from windstorms, ice loading, vegetation, and other outside agents. When a transmission line is forced out of service, it can result in thousands of customers losing electricity. The time to repair a single transmission line and restore service can take from several hours to a few days. Events such as large ice accumulations or tornadoes can damage multiple transmission lines at once. When multiple transmission lines are out of service, full restoration can take weeks.

In the event of an electricity generation shortage, the transmission system can be utilized to import electricity from other utilities and other states. The amount of imports is limited by the interconnections between the utilities.

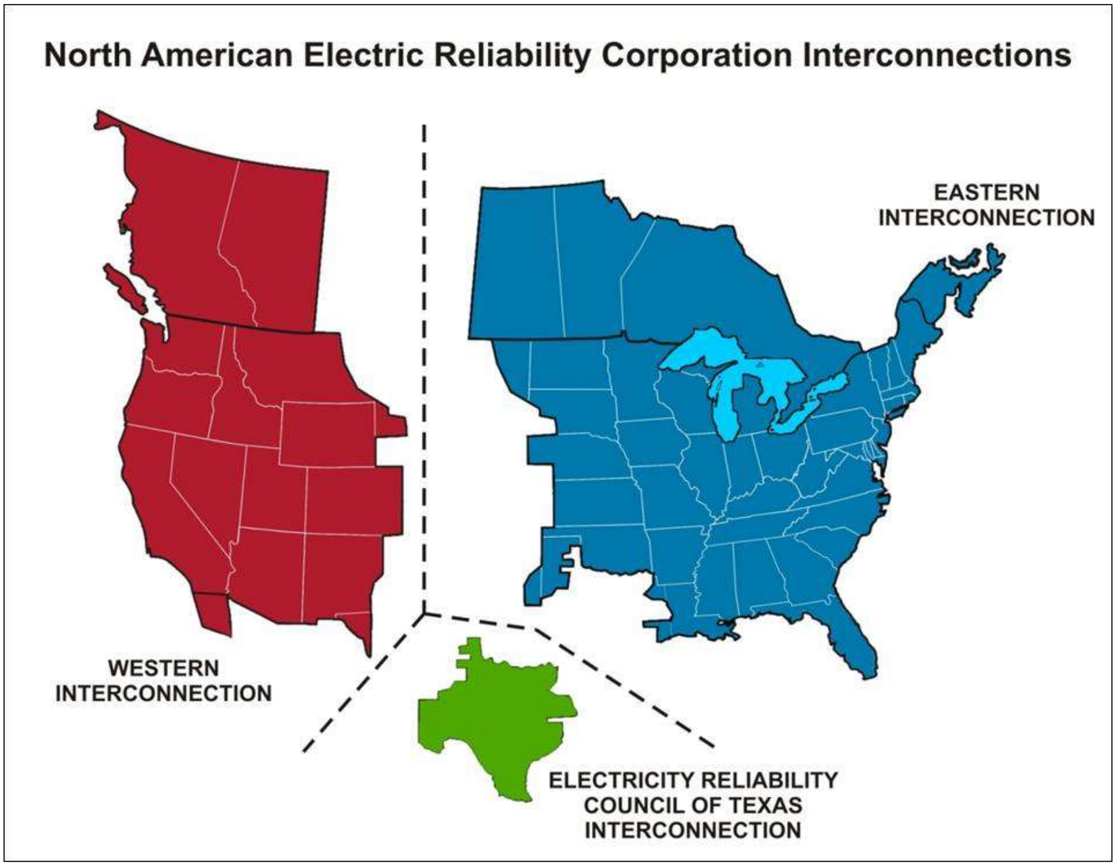


Figure 35: North American Electric Reliability Interconnections

Kentucky's Electrical system is interconnected with all of the other systems within the Eastern Interconnection.

Electric Transmission Contacts:
State Government:
Public Service Commission - http://psc.ky.gov/
Division of Consumer Services - http://psc.ky.gov/Home/Complaints
http://psc.ky.gov/Home/Consumer_Intra
Industry:
Kentucky Power - https://www.kentuckypower.com/
Duke-Kentucky - https://www.duke-energy.com/
LGE, KU - https://lge-ku.com/
East Kentucky Power - https://www.ekpc.coop/
Big Rivers - https://www.bigrivers.com/
TVA - https://www.tva.com/

MISO - https://www.misoenergy.org/
PJM - https://www.pjm.com/about-pjm

6.3 Natural Gas Supply

Process:

Natural gas–a colorless, odorless, gaseous hydrocarbon. It breaks to the surface with additional gases and liquids. Processing plants have to separate natural gas from oil. Removing the additional gases makes natural gas purer. The cryogenic expansion process refines natural gas to its final form. In general, natural gas processing includes the following steps:

- Condensate and Water Removal
- Acid Gas Removal
- Dehydration – moisture removal
- Mercury Removal
- Nitrogen Rejection
- Natural Gas Liquids (NGL) Recovery, Separation, Fractionation, and Treatment of NGL

Natural gas may be stored in a number of different ways. Most commonly, it is held in an underground reservoir, under pressure in three types of facilities. These underground facilities are depleted reservoirs in oil and/or natural gas fields, aquifers, and salt cavern formations. Sedimentary basins trap huge reservoirs of natural gas. In order to gain access to these natural gas reservoirs, a hole (sometimes called a well) must be drilled through the rock to allow the gas to escape and be harvested.

Some industrial and large commercial or institutional customers buy their gas directly from wellhead producers or gas marketers, and the gas is delivered to the customer by interstate pipelines (regulated and inspected by the Federal Energy Regulatory Commission (FERC) and Pipeline and Hazardous Material Safety Administration (PHMSA)) and the customer's local distribution company.

Compressor stations are an integral part of the natural gas pipeline network that moves natural gas from individual producing well sites to end users. As natural gas moves through a pipeline, distance, friction, and elevation differences slow the movement of the gas and reduce pressure. Compressor stations are placed strategically within the gathering and transportation pipeline network to help maintain the pressure and flow of gas to market.

Natural gas usage in the state is evenly divided by volume between residential and industrial users. The PSC regulates distribution rates and service terms for all investor-owned natural gas providers in the state. Municipally owned utilities systems are not subject to PSC regulation of rates and services. Both regulated and non-regulated natural gas providers are, however, inspected for pipeline safety pursuant to state and federal pipeline safety regulations.

Natural gas price and supply problems should be referred to the PSC for jurisdictional companies. Problems with municipally owned systems should be addressed directly by the municipality.

The EEC Division of Oil and Gas's mission is to regulate the crude oil and natural gas industry in the Commonwealth; protect the correlative rights of mineral owners, fresh water zones, and minable coal seams; and conserve and protect oil and gas reserves in Kentucky. The statutes and regulations of the Division of Oil and Gas require a permit to be obtained prior to any drilling activity. Please refer to the Oil and Gas Operator's Manual for all of the division's requirements regarding the drilling, producing, and plugging of oil and gas wells in the Commonwealth.

The Division of Oil and Gas maintains a well history database for each well containing data relative to the permit, operator, well location, pertinent dates, and well completion. Currently, there are 158,507 wells stored online. This information is shared with the Kentucky Geological Survey (KGS) to assist in the compilation of oil and gas data.

See Appendix J for Natural Gas Transmission Capacity and Appendix K for Natural Gas Distribution Utilities.

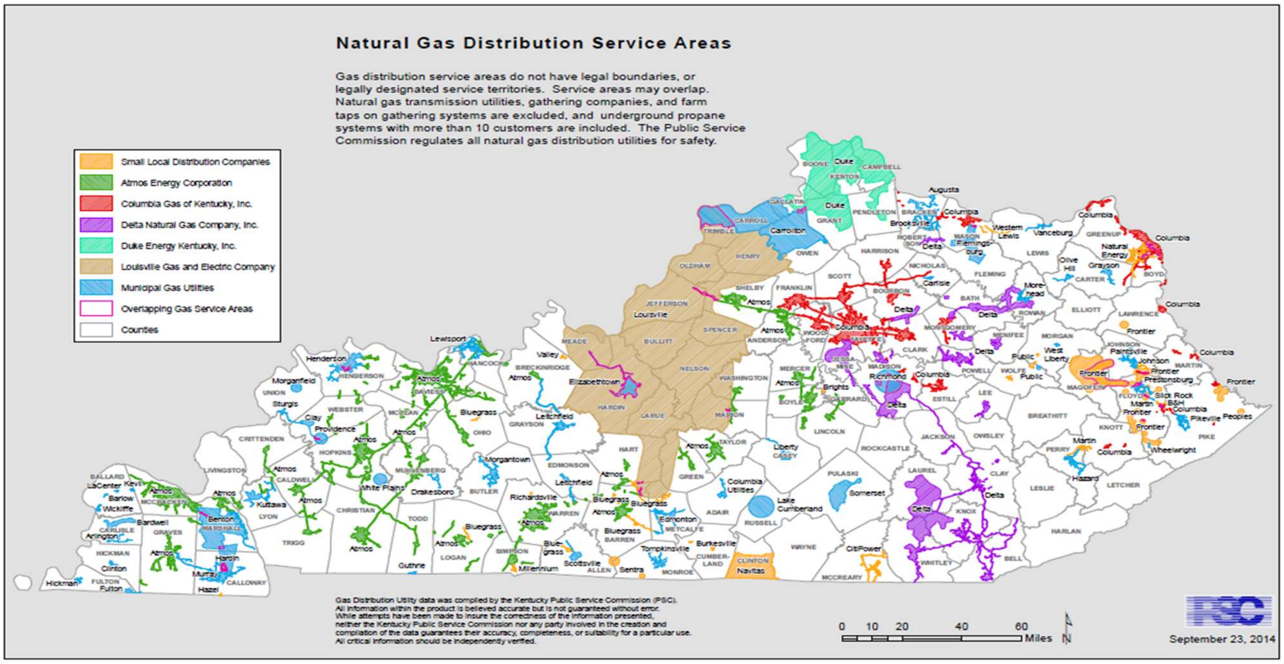


Figure 36: Kentucky Natural Gas Distribution Map

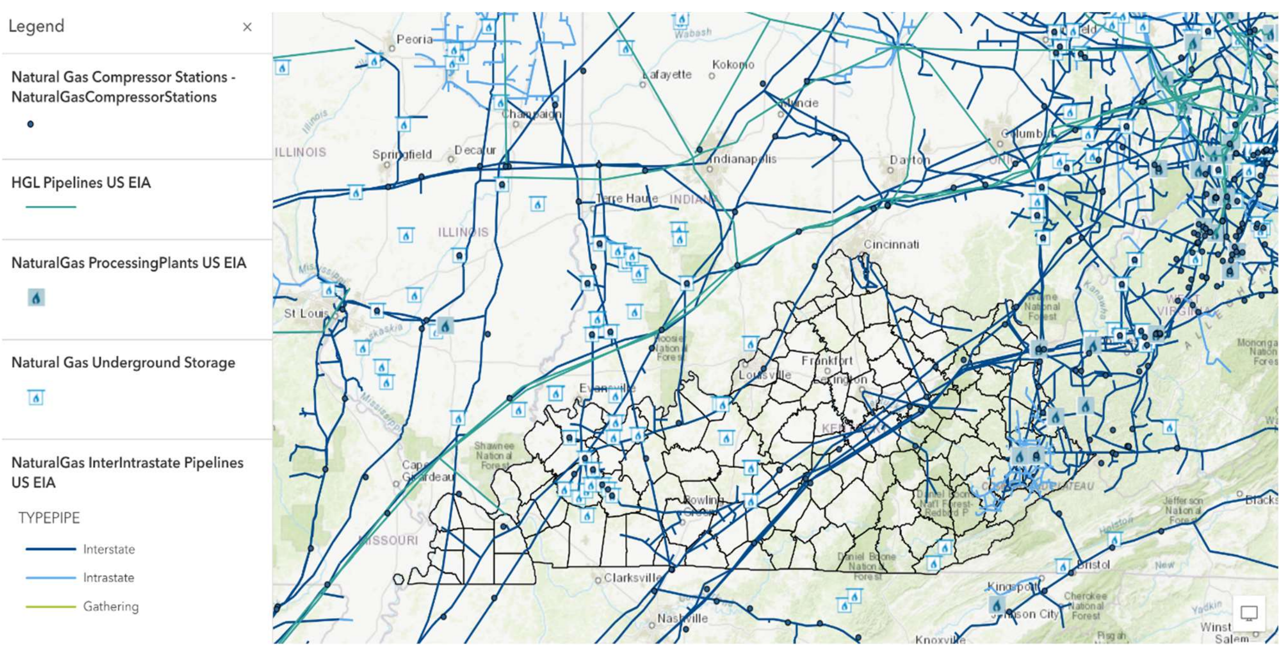


Figure 37: Kentucky Natural Gas Master Map

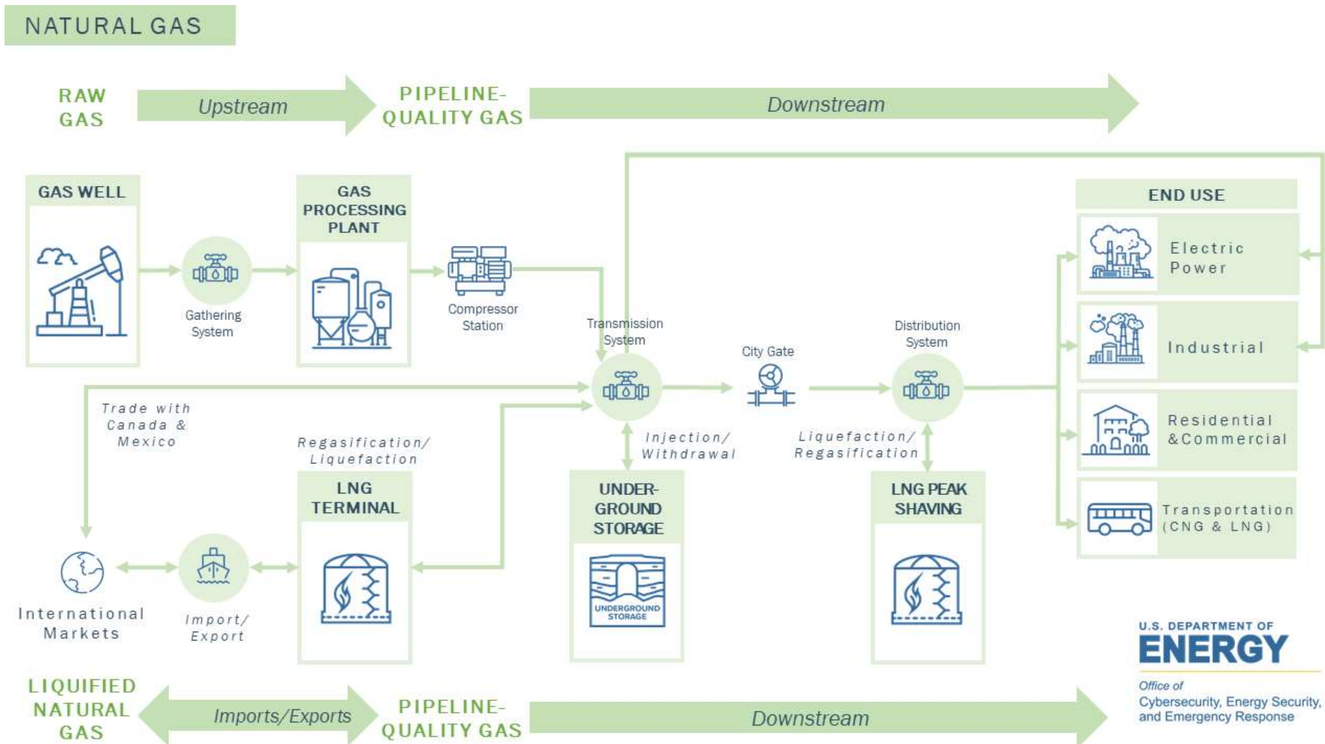


Figure 38: Kentucky Natural Gas Supply Chain

Natural Gas Contacts:
State Government:
Kentucky Public Service Commission - https://psc.ky.gov/
Division of Consumer Services - https://psc.ky.gov/home/complaint
Federal Government:
Federal Energy Regulatory Commission (FERC) - https://www.ferc.gov/
Pipeline and Hazardous Material Safety Administration (PHMSA) - https://www.phmsa.dot.gov/
National Response Center - https://www.epa.gov/emergency-response/national-response-center
FERC's Public Information Reference Room - https://www.ferc.gov/public-reference-room
DNR Oil and Gas - https://eec.ky.gov/Natural-Resources/Oil-and-Gas/Pages/default.aspx
Industry:
The American Gas Association - https://www.aga.org
Kentucky Gas Association - https://kygas.org
Kentucky Oil and Gas Association - https://members.kyoilgas.org/site_home.cfm

6.4 Coal

Process:

Kentucky's coal industry produced approximately 24.5 million tons of coal in 2020 and employed an average of 4,076 miners. Kentucky produces coal from two major fields: the Appalachian basin in the eastern part of the state and the Illinois basin in the western part of the state. Eastern and western Kentucky mines each produce roughly half of the state's coal.

Coal is used to generate 69% of the electricity in Kentucky and 22% of the electricity in the nation as a whole. Since it is one of the lowest-cost means of producing electricity available, continued use of coal helps keep electricity prices down. About 54% of the coal mined in Kentucky is exported to other states.

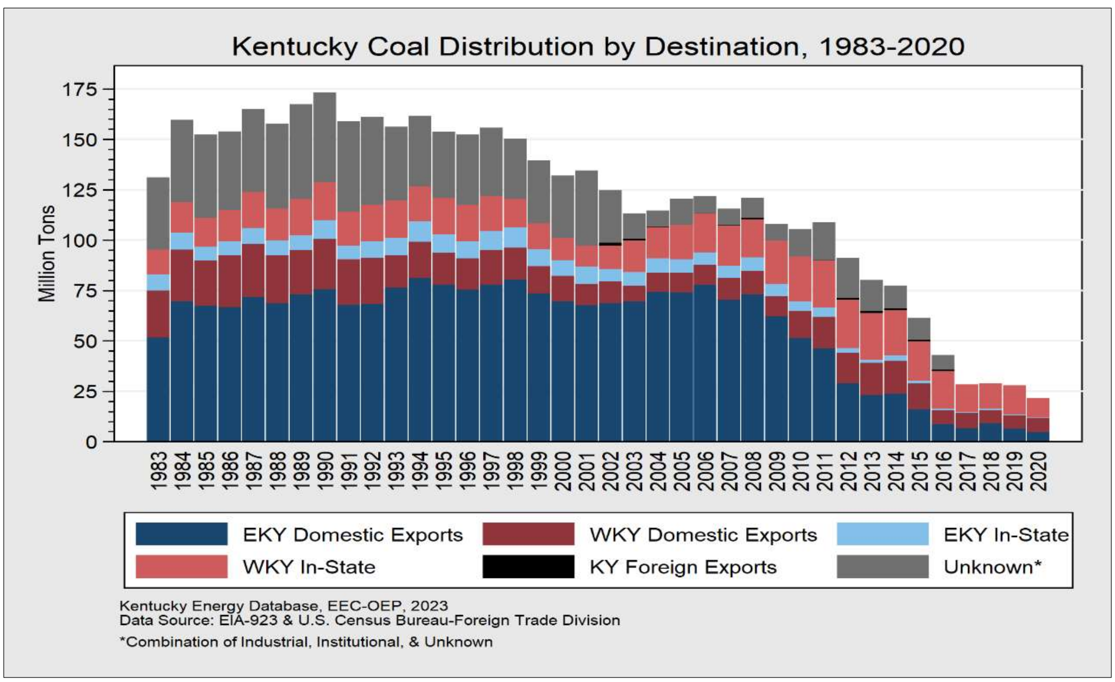


Figure 39: Kentucky Coal Distribution, 1983-2020

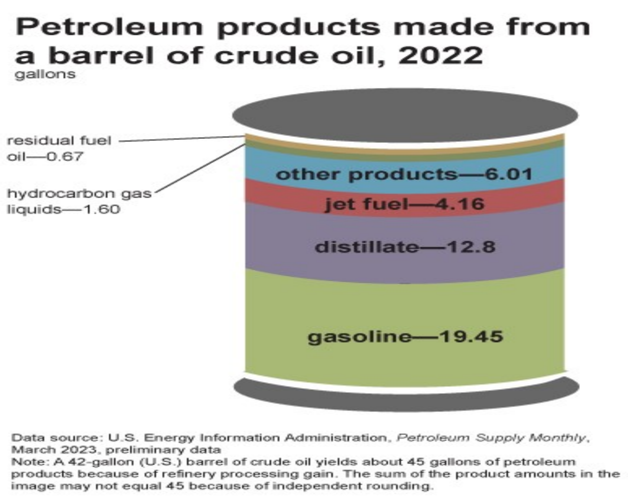
Coal Contacts:
State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - https://eec.ky.gov/
Kentucky Department of Natural Resources - https://eec.ky.gov/
Industry:
Kentucky Coal Association - http://www.kentuckycoal.org/

6.5 Petroleum and Natural Gas Liquids

Process:

Crude oil is turned into petroleum products through a refining process. Crude oil is called “sweet” or “sour” depending on the amount of sulfur it contains. High-sulfur crude is called sour. It is also called “light” and “heavy” crude depending on the molecular weight. As the name implies, light crude flows easily while heavy crude has a heavier, tar-like consistency.

Crude oil is transported by pipeline, barge, and tanker to refineries where it is distilled into various petroleum. The unit measurement for crude oil is in barrels (bbls). A barrel of crude equals 42 U.S. gallons. In a non-intuitive occurrence, a refined barrel of crude produces 44 U.S. gallons of finished petroleum products. While the finished product produced differs depending on the type of crude used, on average, gasoline, diesel, and jet fuel are the largest finished components by volume.



In 2022, 31% of the crude oil consumed in the United States was imported. Kentucky imports nearly 98% of crude oil

Figure 40: Products Made from a Barrel of Crude Oil 2022

Marathon Petroleum Corporation is an integrated downstream energy company headquartered in Findlay, Ohio. The company operates the nation’s largest refining system with more than 3 million barrels per day of crude oil capacity across 16 refineries, including Kentucky.

Crude oil is processed at Kentucky’s single refinery. The refinery is in the city of Catlettsburg in northeastern Kentucky on the western bank of the Big Sandy River and can process 291,000 barrels of crude oil per calendar day to processes sweet and sour crude oils into motor gasoline, distillates, asphalt, heavy fuel oil, and propane.

A smaller facility sited near Somerset, Kentucky is engaged in soybean oil processing and serves as a regional petroleum fuel terminal. In 2021, this site added capacity to produce biodiesel and biofuel blending operations.

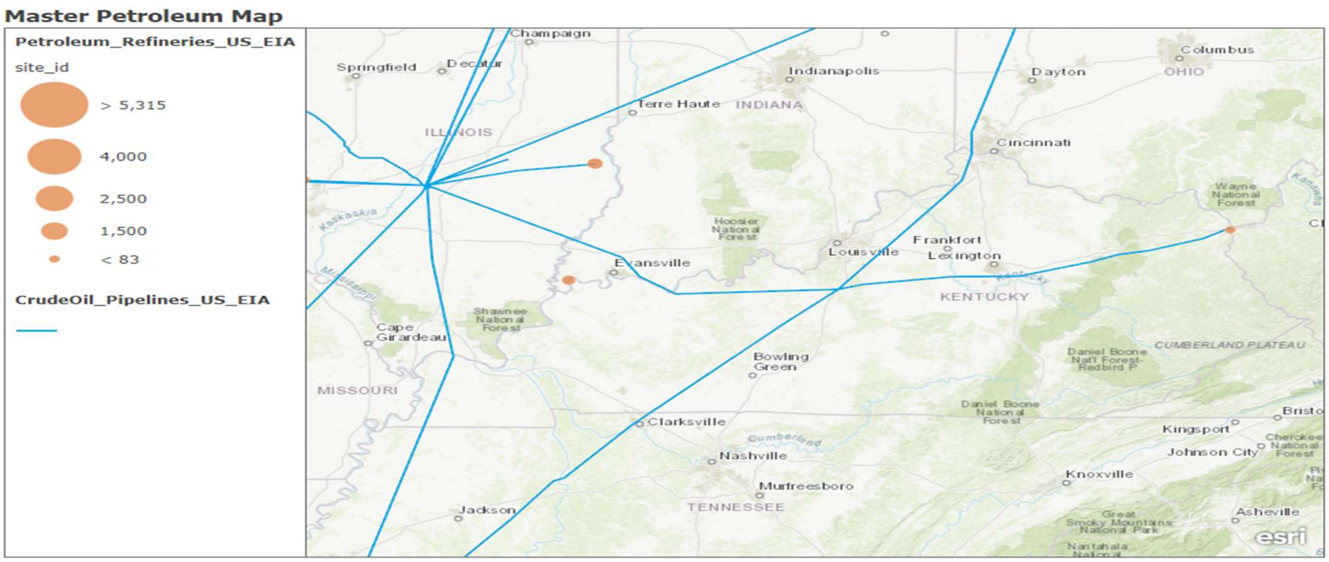


Figure 41: Kentucky Crude Oil Pipelines 2021

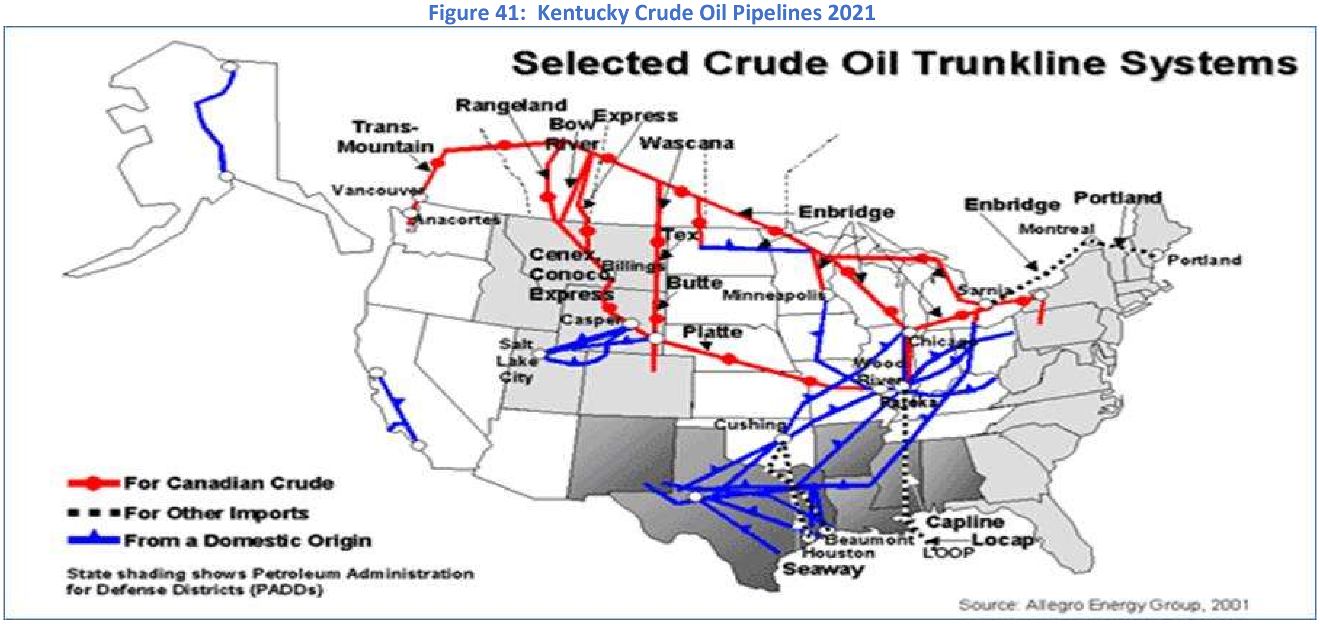


Figure 42: Selected Crude Oil Trunk line Systems

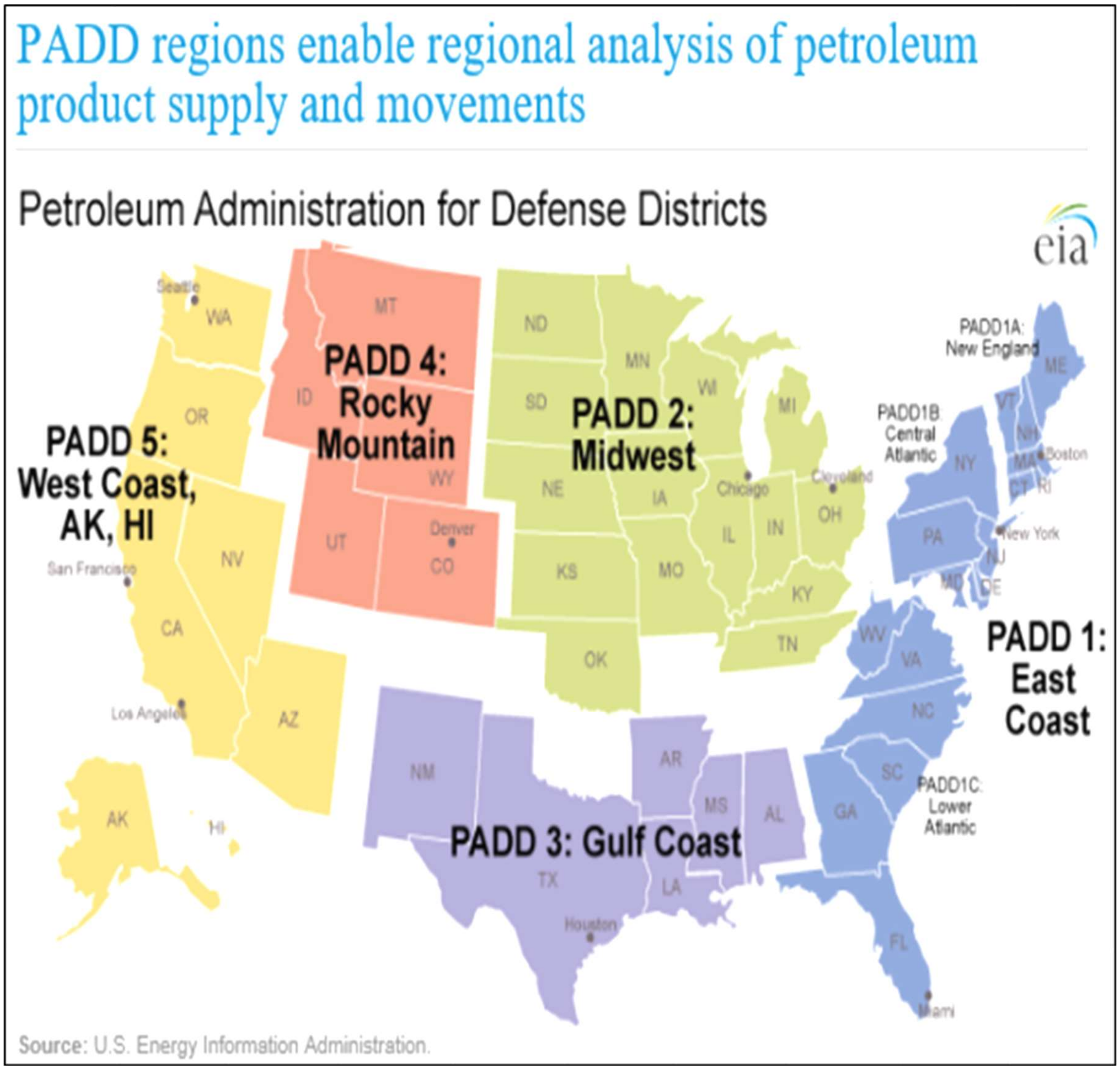


Figure 43: PADD Regions

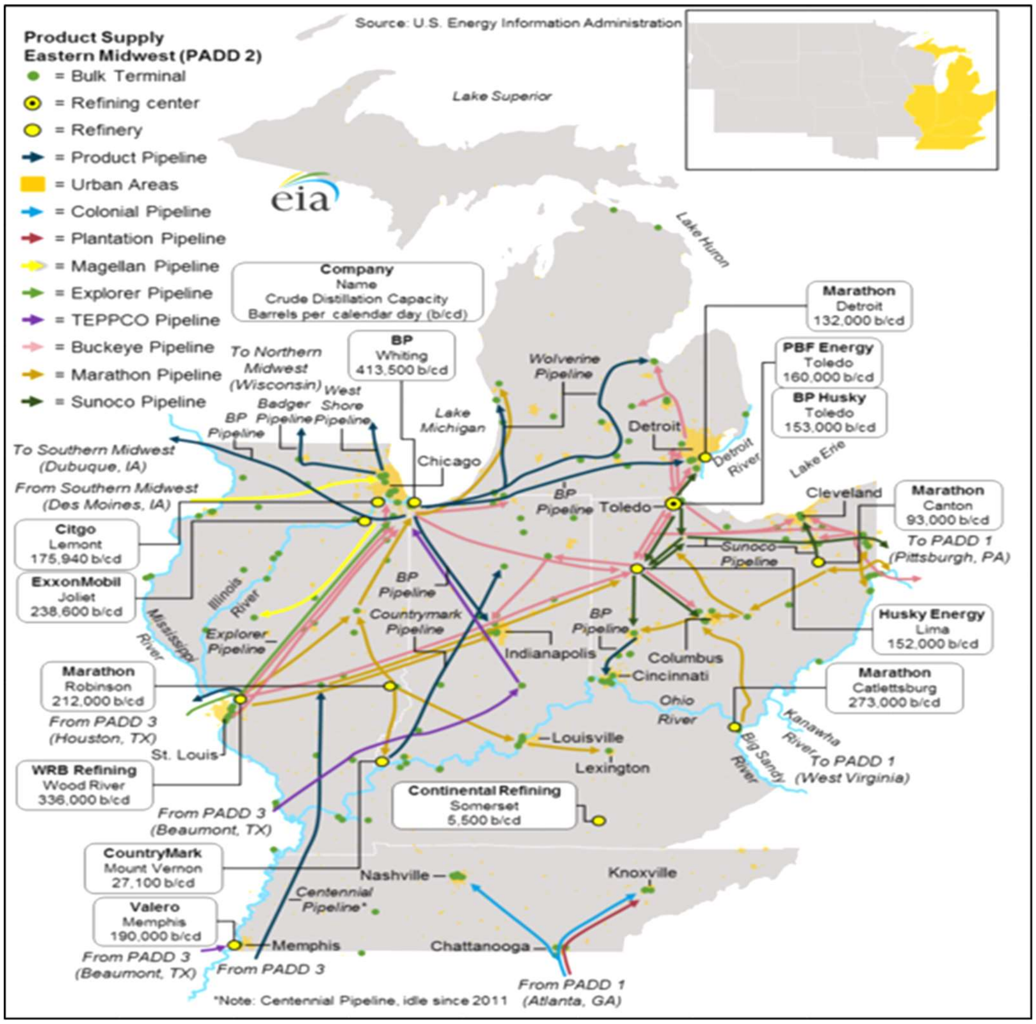


Figure 44: PADD 2 Petroleum Product Flow

In the event of a petroleum emergency, such as a pipeline break, cyber-security attack, or other such event, the SEO-EEC will activate the Kentucky Petroleum Shortage Annex (found in Appendix H).

Petroleum Contacts:
State Government:
The Energy and Environment Cabinets State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/
Federal Government:
Pipeline and Hazardous Material Safety Administration (PHMSA) - https://www.phmsa.dot.gov/

Industry:
Kentucky Petroleum Marketers Association - https://kpma.org/
American Petroleum Institute - https://www.api.org/

6.5.1 Gasoline

Process:

After gasoline is refined from crude oil, it must be shipped from the refinery to be distributed to consumers. Gasoline is shipped to terminal locations by pipeline, barge, rail, and truck. Gasoline is the most used transportation fuel in the state. In 2020, on average, each Kentuckian consumes 1.12 gallons of gasoline every day.

Terminals may accept gasoline from one or many sources making it nearly impossible for the consumer to distinguish where their product was produced.

From the main storage terminals, transport trucks move gasoline to jobbers or smaller marketing terminals. Jobbers and marketers ship gasoline to retail outlets, industry, and individuals where it sold as branded or unbranded. Branded outlets sell only the name-brand product while unbranded outlets may sell any brand. As mentioned earlier, the branded name does not necessarily mean the gasoline was produced by the company's refinery. The major difference in brands is in the additives that are generally mixed in at the terminal. Gasoline also changes with the season; vapor pressure increases in the winter to aid in vehicle starting. Shortages may occur when refiners are seasonally converting fuels.

Gasoline Contacts:
State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/
Kentucky Department for Environmental Protection - http://eec.ky.gov/Energy/
Kentucky State Fire Marshal - ksfm.ky.gov
CHFS - Hazardous Materials - https://chfs.ky.gov/agencies/dph/dphps/Pages/default.aspx
Industry:
Kentucky Petroleum Marketers Association - http://www.kpma.org/
Energy Marketers of America - http://www.pmaa.org/
American Petroleum Institute - http://www.api.org/
B.P. America - http://www.bp.com

Chevron Corporation - http://www.chevron.com
Phillips 66 - https://www.phillips66.com/
Gulf Oil - https://www.gulfoil.com/
ExxonMobil Corporation - https://corporate.exxonmobil.com/
Marathon Petroleum Company LP - https://www.marathonpetroleum.com/
Catlettsburg Refinery -
https://www.marathonpetroleum.com/Operations/Refining/Catlettsburg-Refinery/
Shell Oil Company - https://www.shell.us/
Marathon Pipeline - https://www.marathonpipeline.com/
Kentucky Grocers and Convenience Store Association - https://kgcsa.com/
Valero - https://www.valero.com/sites/default/files/valero-documents/US%20Pipelines%20and%20Terminals%20Overview.pdf

6.5.2 Diesel Fuel/Heating Oil

Process:

Diesel fuel and heating oil are closely related products. Together they are generally referred to as distillates. The primary difference is sulfur content. High-sulfur distillate is generally what is used for heating and often referred as "heating oil". Residential heating systems use both types of distillate. For homes and businesses that rely on heating oil, timely supply is essential. Occasionally, severe weather may make it difficult for retail heating oil dealers to service individual homes and businesses. This supply and demand issue has caused heating oil prices to vary greatly throughout the year, generally being higher in the winter reflecting the greater demand.

Diesel fuel is the primary petroleum product used in the transportation, agriculture, and manufacturing industries. Semi-trucks, trains, boats, barges, tractors, combines, bulldozers, and other large vehicles and machinery use diesel engines. Diesel engines are also used to power electric generators for utility peaking and for industrial, commercial, and institutional backup. While some agricultural and off-road construction equipment can use high-sulfur diesel, on-highway transportation vehicles must use a distillate fuel with a sulfur content of less than 0.05 percent (referred to as low-sulfur diesel). These same standards are slowly being phased in for off-road engines in mining, farming, rail, and marine industries. Low-sulfur diesel currently makes up about 95 percent of the total distillate sold.

Pipelines and barges are used to transport refined petroleum products to terminals where transport trucks move the product to jobbers or marketer terminals. Jobbers and marketers provide delivery services to their customers. Customers include service stations, industry, and private individuals.

See Appendix L for a list of Prime Supplier Contacts and Appendix M for a list of Motor Fuel Retailers.

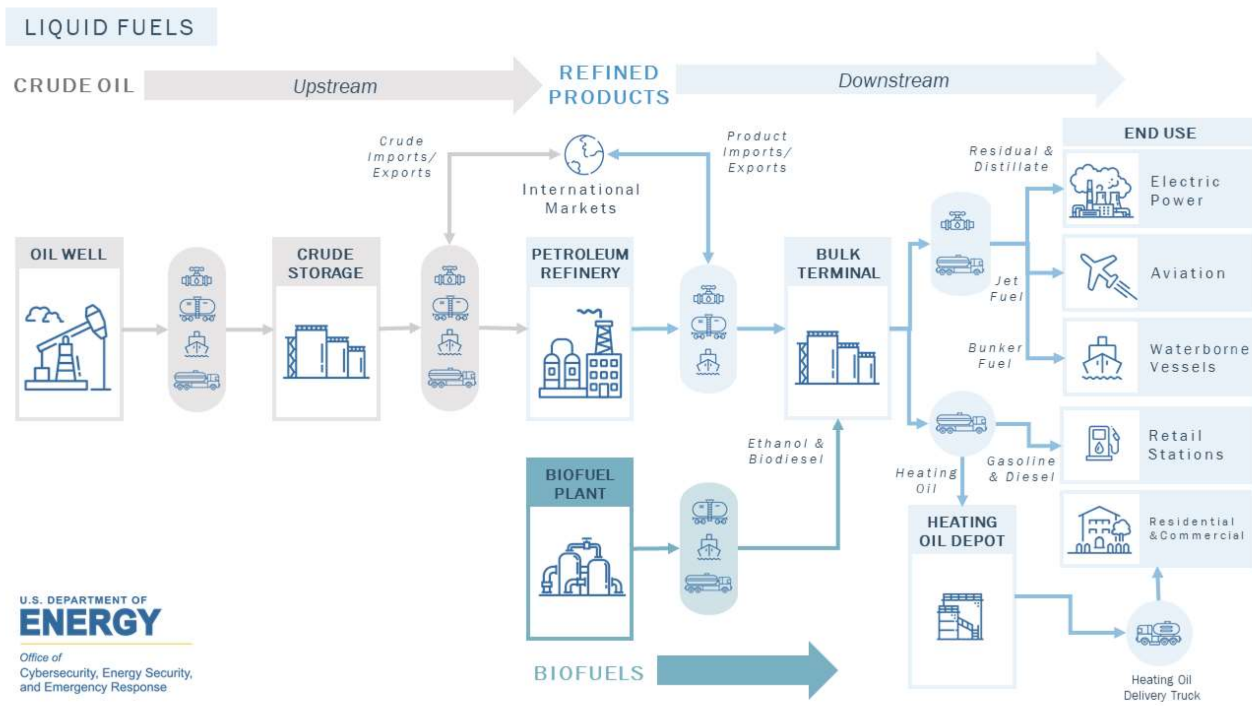


Figure 45: Liquid Fuels Supply Chain

Diesel Fuel Heating Oil Contacts:
State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/
Kentucky State Fire Marshal - ksfm.ky.gov
Industry:
Kentucky Petroleum Marketers Association - http://www.kpma.org/
Energy Marketers of America - http://www.pmaa.org/
American Petroleum Institute - http://www.api.org/
B.P. America - http://www.bp.com
Chevron Corporation - http://www.chevron.com
Phillips 66 - https://www.phillips66.com/
Gulf Oil - https://www.gulfoil.com/
ExxonMobil Corporation - https://corporate.exxonmobil.com/

Marathon Petroleum Company LP - https://www.marathonpetroleum.com/
Catlettsburg Refinery -
https://www.marathonpetroleum.com/Operations/Refining/Catlettsburg-Refinery/
Shell Oil Company - https://www.shell.us/

6.5.3 Kerosene/Jet Fuel

Process:

Kerosene is used as a home and agricultural heat source. It is mainly used for space heaters and cook stoves. It can also be used as an energy source in lamps.

A more refined kerosene product is called jet fuel. Jet fuel is used in the aviation industry to power jet aircraft and rocket engines.

Truck, pipelines, and barges transport kerosene. It is shipped to terminals where smaller transport trucks move it to customers. Customers include airports, grocery stores, service stations, industries, and individuals.

See Appendix N for a list of Oil and Aviation Distributors.

Kerosene/Jet Fuel Contacts:
State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) -
http://eec.ky.gov/Energy/
Kentucky State Fire Marshal - ksfm.ky.gov
Industry:
Kentucky Petroleum Marketers Association - http://www.kpma.org/
Energy Marketers of America - http://www.pmaa.org/
American Petroleum Institute - http://www.api.org/
B.P. America - http://www.bp.com
Chevron Corporation - http://www.chevron.com
Phillips 66 - https://www.phillips66.com/
Gulf Oil - https://www.gulfoil.com/
ExxonMobil Corporation - https://corporate.exxonmobil.com/
Marathon Petroleum Company LP - https://www.marathonpetroleum.com/
Catlettsburg Refinery -
https://www.marathonpetroleum.com/Operations/Refining/Catlettsburg-Refinery/
Shell Oil Company - https://www.shell.us/

6.5.4 Propane

Process:

Propane (liquefied petroleum gas) is used in approximately 10 percent of Kentucky homes. It is also used in home appliances such as air conditioning units, cook stoves, water heaters, fireplaces, generators, clothes dryers, and gas grills. Numerous industries use propane as a catalyst to heat industrial processes. Propane is the third-largest source of motor fuel in the U.S. and an approved clean fuel source used to power cars, trucks, buses, forklifts, lawnmowers, and other vehicles used in both on- and off-road applications. Propane is a major source of fuel for agricultural applications including heat for livestock buildings and greenhouses, irrigation pumps, crop drying, and weed control.

Pipelines and petroleum refineries provide propane supply. Distribution from these supply sources is by truck transport (approximately 9,000 gallons) or by rail car (approximately 30,000 gallons) to retail marketers. Marketers maintain storage facilities that support a regional customer base usually within a 50-75 air-mile radius. Marketers deliver propane to their customers using a delivery vehicle called a bobtail. These bobtails hold approximately 2,800 gallons of fuel and deliver to stationary customer storage tanks. Propane can also be transported in smaller (typically 20-, 33-, or 100-pound) cylinders.

Propane is stored under pressure in liquid form. Special operating and safety procedures are required for the storage and handling of propane gas.

See Appendix O for a list of Propane Distributors.

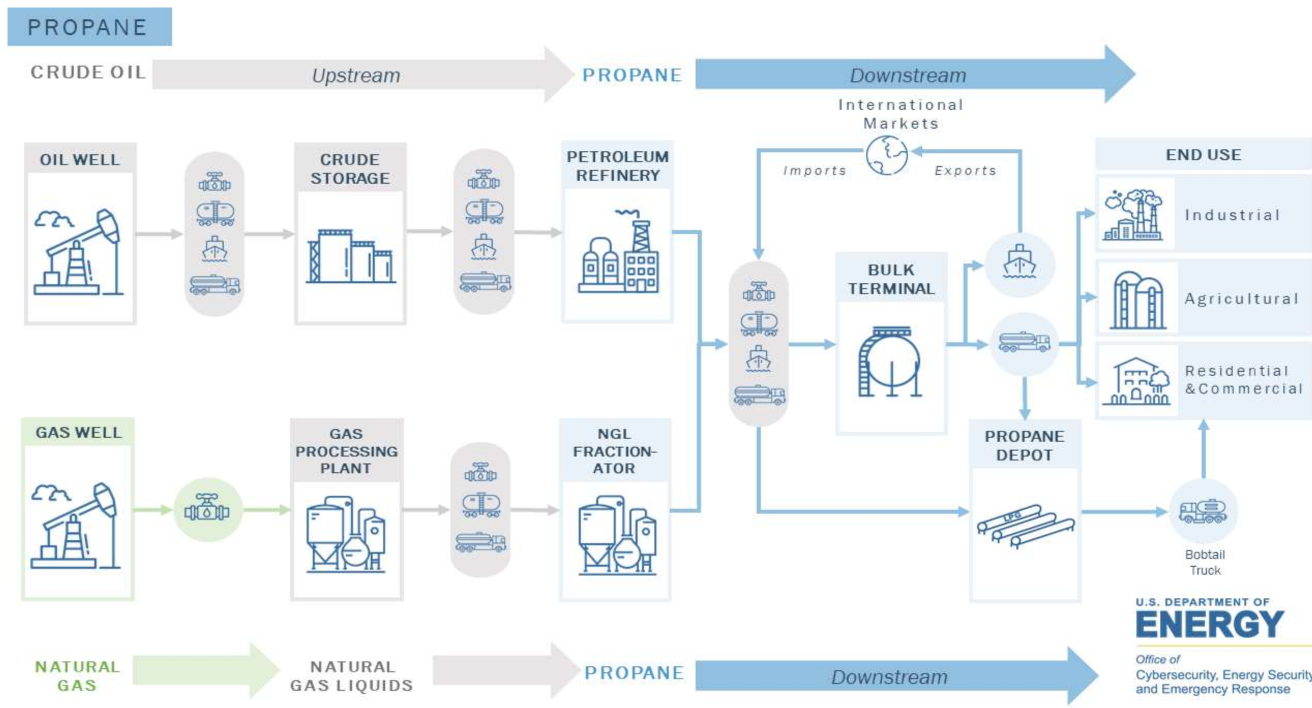


Figure 46: Propane Supply Chain

Propane Contacts:
State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/
Kentucky Transportation Cabinet - https://transportation.ky.gov/Pages/Home.aspx
Kentucky Emergency Management - https://kyem.ky.gov/Pages/default.aspx
Kentucky State Fire Marshal - ksfm.ky.gov
Industry:
Kentucky Propane Gas Association - http://www.kypropane.org/
National Propane Gas Enterprise Products Operating LLC - https://www.enterpriseproducts.com/
Todhunter Terminal - http://www.usa.com/frs/enterprise-todhunter-terminal.html

6.6 Biomass and Biofuels

Process:

Biomass (organic matter) can be used to provide heat, make fuels, chemicals, and other products, and generate electricity. Wood, the largest source of bioenergy, has been used to provide heat for thousands of years. However, there are other types of biomass that can be used to produce fuels, chemicals, and power. These include plants, agriculture, and forestry residues and the organic component of municipal and industrial wastes.

6.6.1 Biofuels

Process:

Biofuels are fuels made from biomass or its derivatives after processing. Biofuels such as ethanol and biodiesel offer a renewable alternative to oil for liquid transportation fuels. They can be made from virtually any plant-derived organic matter, agricultural crop, or from recycled materials like restaurant grease and sewage sludge.

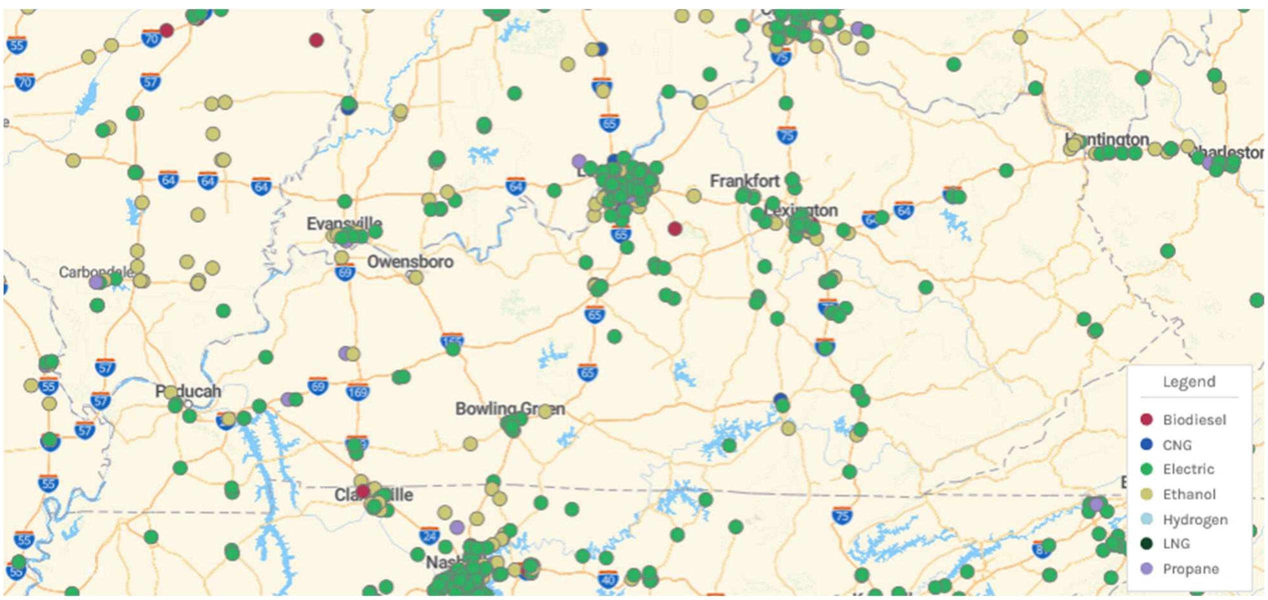


Figure 47: Alterative Fuel Locations

Contacts:

State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/
Kentucky Department of Agriculture Weights and Measures - https://www.kyagr.com/consumer/weights-and-measures.html

Industry:
Kentucky Clean Fuels Coalition - http://www.kentuckycleanfuels.org/
Renewable Fuels Association - https://ethanolrfa.org/
Advanced Biofuels Association - http://advancedbiofuelsassociation.com/

Continental Refining - https://www.conrefco.com/
Producers:
Commonwealth Agri-Energy - http://www.commonwealthagrienergy.com/
Parallel Products - https://www.parallelproducts.com/
Owensboro Grain - https://owensborograin.com/

6.6.2 Bio-based Products

Process:

Bio-based products are produced from renewable plant and animal sources and are generally presumed to be more environmentally benign than their petroleum-based counterparts. They are usually biodegradable and can be returned to the earth at the end of their useful life or recycled and used again.

The Renewable Chemical Production Tax Credit is a nonrefundable and nontransferable credit available for tax years 2021 through 2024 that may be applied against income taxes imposed by KRS 141.020 (individual income tax) or KRS 141.040 (corporation income tax) and the limited liability entity tax (LLET) imposed by KRS 141.0401 in an amount certified by the Department of Revenue.

Bio based Contacts:
State Government:
The Energy and Environment Cabinet State Energy Office (SEO-EEC) -
http://eec.ky.gov/Energy/
Division of Forestry - https://eec.ky.gov/Natural-Resources/Forestry/Pages/default.aspx
Kentucky Department of Revenue's Renewable Chemical Production Tax Credit -
https://revenue.ky.gov/Business/Pages/RenewableChemicalProductionTaxCredit.aspx
Federal Government:
U.S. Department of Agriculture -
https://www.biopreferred.gov/BioPreferred/faces/pages/BiobasedProducts.xhtml
Industry:
Kentucky Forest Industry Association - https://www.kfia.org/
Producers:
Bioproducts, LLC - http://www.bioproductsllc.com/
RedLeaf Biologics - https://redleafbiologics.com/
Smartwood USA - https://www.smartwood.world/

6.7 Transportation

6.7.1 Natural Gas and Hazardous Material Pipeline

Process:

Pipelines are an efficient method of transport for natural gas, petroleum fuels, and other chemicals. Almost all of the state's crude oil supply enters via pipeline. Finished petroleum products (gasoline, diesel, kerosene, jet fuel, and propane) are also most commonly transported into and out of the Commonwealth by pipeline. The other major commodity exclusively transported by pipeline is natural gas.

To aid supply reliability, crude oil and petroleum products can be received from areas that are north and south of the state. For the most part, transport lines have excess capacity. Only in periods of extreme winter conditions are there sometimes short-term propane supply lines allocations. Pipeline supply and distribution could be a major concern during a natural disaster such as an earthquake or hurricane that limits operation.

Several natural gas pipelines move natural gas within the Commonwealth. The PSC is under contract with the US Department of Transportation, Pipeline Hazardous Materials Safety Administration (PHMSA) to regulate safety issues related to intrastate hazardous materials pipelines. The PSC's responsibilities include natural gas distribution lines, oil and gas collection lines, and two finished petroleum product lines. The PHMSA retains primary responsibility for all interstate pipelines located in the state.

In the event of an intrastate pipeline disruption resulting from a leak, rupture, or explosion (Appendices J and Appendix K), the Kentucky PSC, the Energy and Environment Cabinet's Emergency Response Team (ERT), and the Fire Marshall are notified immediately. Depending on the emergency, these agencies will coordinate and respond accordingly. If the disruption involves an interstate pipeline, PHMSA is the primary agency in control, however, the PSC may be asked to assist until PHMSA officials can arrive at the location.

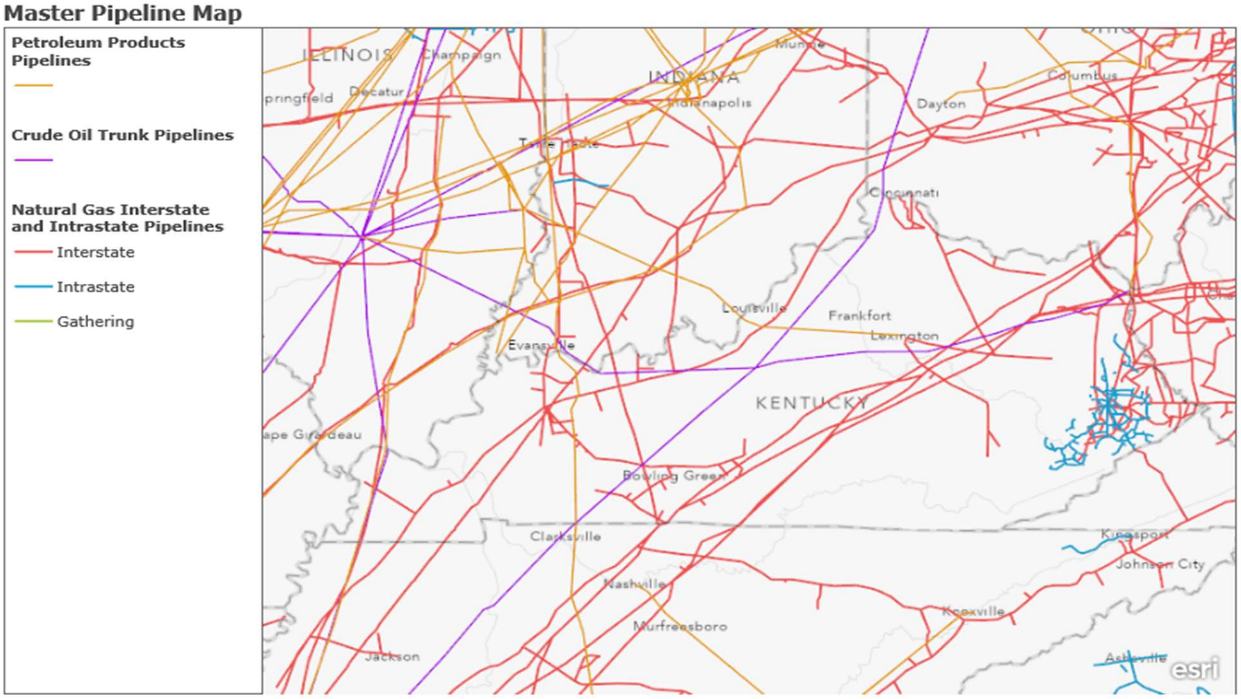


Figure 48: Kentucky Master Pipeline Map

Transportation Contacts:
State Government:
Public Service Commission - https://psc.ky.gov/
Energy and Environment Cabinet's Environmental Response Branch - https://eec.ky.gov/Environmental-Protection/Waste/Pages/EmergencyResponseBranch.aspx
Kentucky State Fire Marshal - ksfm.ky.gov
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/
Federal Government:
US Department of Transportation - https://www.transportation.gov/
Pipeline Hazardous Materials Safety Administration -www.phmsa.dot.gov
Emergency Call - (800) 424-8802
Industry:
Enterprise Products Operating LLC - https://www.enterpriseproducts.com/
MarkWest Energy Partners - http://www.markwest.com/
Marathon Petroleum Company LP - https://www.marathonpetroleum.com/

6.7.2 Motor Carrier

Process:

Motor Carrier is a common method of transport for many energy commodities. Finished petroleum products, coal, propane, and biofuels are all regularly transported by truck. Tractor-trailers will normally haul tanker loads up to 65,000 pounds (fuel and truck must not exceed 85,000 pounds). Carriers with special permits in Kentucky allow coal trucks to haul up to 120,000 pounds. These carriers often deliver the finished products to terminals where smaller trucks will in turn move products to the service facilities or the consumer.

The major energy issue related to motor carrier transportation is the safe and reliable delivery of fuels to end users. The primary agency responsible for developing standards for regulation of the trucking industry is the Federal Motor Carrier Safety Administration (FMCSA).

Federal regulations on public protection related to driver qualification and safety issues can be found at 49 CFR Parts 390 through 399.

Natural disasters and adverse weather conditions are the most common factors that cause delays in the delivery of fuels and therefore the main cause of concern for the energy industry and the population in general. Historically, adverse weather conditions have affected transport driver hours in the most dramatic way. Truck drivers, by regulation, are limited by the number of hours they can drive without a break and by the number of hours they can drive over a given period. High fuel demand and poor road conditions often magnify the effect of these restrictions during the winter months. These conditions can be especially true during winter snow or ice storms. Long waits at terminals, slow load times, and poor driving conditions can quickly deplete allowed hours.

The government has attempted to address this issue through FMCSA regulations that allow for waivers of Hours of Service (HOS) restrictions in order to provide fuel in times of need. Provisions are established for both local and regional emergencies and allow extended service hours anywhere the driver travels to support the identified emergency. In Kentucky, the process begins with a hauler or trade association requesting an extension either to the SEO-EEC, KYDOT, or directly to FMSCA. The full HOS procedure is contained in Appendix G of this document.

Motor Carrier Contacts:
State Government:

Transportation Cabinet - http://transportation.ky.gov/
Department of Vehicle Regulation - https://drive.ky.gov/
Kentucky State Police - http://kentuckystatepolice.org/
Commercial Vehicle Enforcement Division - https://kentuckystatepolice.org/commercial-vehicle-enforcement/
The Energy and Environment Cabinet State Energy Office (SEO-EEC) - http://eec.ky.gov/Energy/

Federal Government:

Federal Motor Carrier Safety Administration (FMCSA) - http://www.fmcsa.dot.gov/

Industry:

Kentucky Motor Trucking Association - https://kytrucking.net/

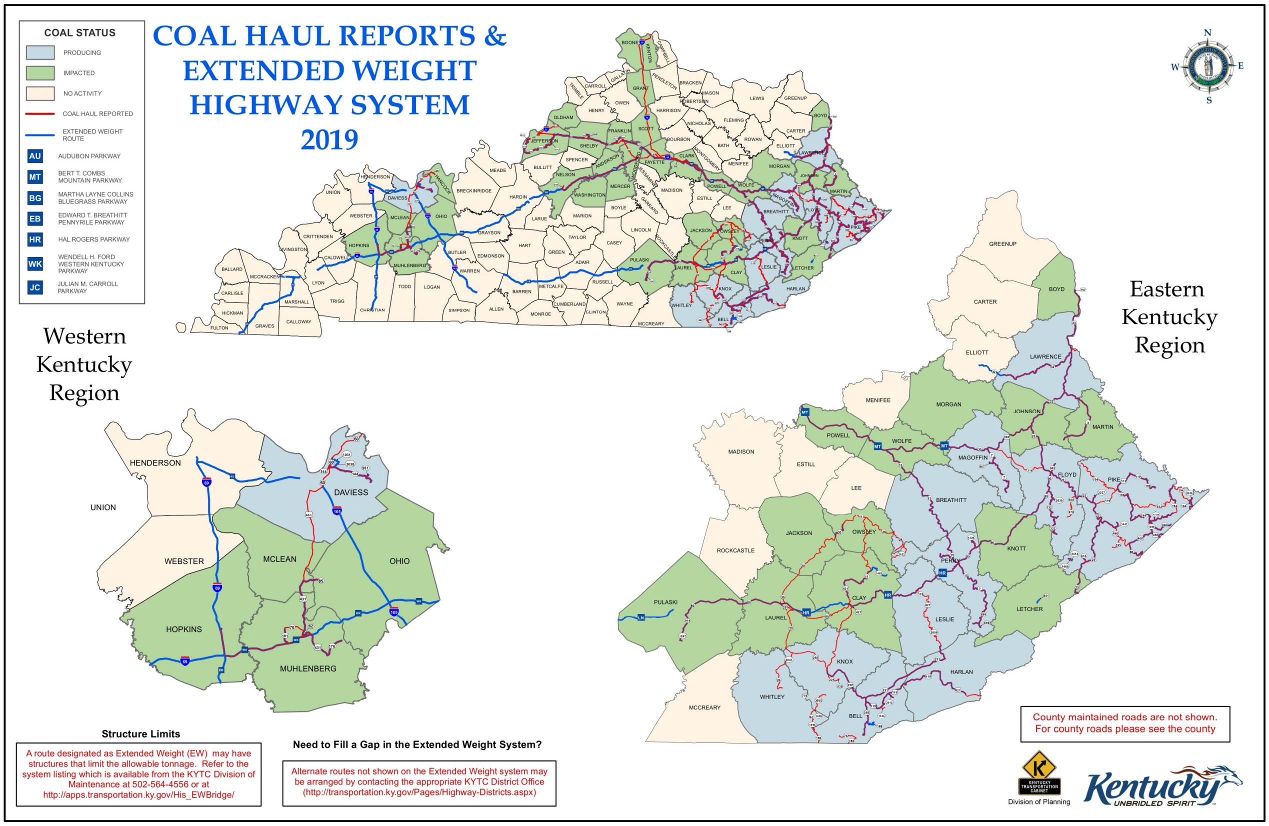


Figure 49: Kentucky Coal Haul Highway System Map, 2019

Source: **https://transportation.ky.gov/Planning/Pages/Coal-Haul-Highway-System.aspx**

6.7.3 Rail

Process:

Rail shipment is generally an energy-efficient and safe means of land transport, but it is highly capital-intensive. The efficiency of rail shipment depends on the commodity being transported. Most energy commodities are high-density materials, and therefore when moved in bulk, rail provides an ideal method of shipment when available.

Rail ships energy commodities in open-topped cars and tank cars. Coal, petroleum, and wood pellets are all ideal goods for rail shipment when possible. A typical rail car will hold around 115 tons of material with a typical train pulling at least 100 cars. Uploading, or transferring materials typically takes place at specific locations known as "tipples" for coal and at a "refinery" for petroleum products. Offloading will be at power plants and distribution terminals.

Railroad class is identified by the [Surface Transportation Board (STB)](https://prod.stb.gov/) based on annual gross revenue. For freight, railroads are listed as either Class I, II, or III.

See Appendix Q for Kentucky's Active Railroads. Contact the Kentucky Transportation Cabinet for additional information.

Rail Contacts:
State Government:
Kentucky Transportation Cabinet -
https://transportation.ky.gov/MultimodalFreight/Pages/Railroads.aspx
Division of Planning - https://transportation.ky.gov/Planning/
Multimodal Freight: Railroads -
https://transportation.ky.gov/MultimodalFreight/Pages/Railroads.aspx
Federal Government:
Surface Transportation Board - https://prod.stb.gov/
Federal Railroad Administration (Atlanta Region) - http://www.fra.dot.gov/
Industry:
Kentuckians for Better Transportation - http://www.kbtnet.org/

6.7.4 Barge

Process:

Kentucky has 1,600 miles of navigable inland waterways. Transporting materials by water is an extremely efficient method of shipment. It requires far less energy to ship by barge than other methods of shipment. A gallon of fuel can move a ton of material 514 miles by barge, whereas that one gallon of fuel would only move that ton of material 59 miles by truck and 202 miles by train.

This efficiency is related directly to the tonnage hauled by the vessel. A single barge can haul 1,500 tons of material, a jumbo hopper rail car can hold approximately 115 tons of material, and a larger semi-trailer can move 26 tons of material. Stated differently, a 15-ton barge (a normal bulk load on the Ohio River) can carry the equivalent load of 870 semi-trailers. This makes barge shipment extremely efficient for bulk materials over long distances.

Kentucky ranks among the top five states in the shipment of domestic waterborne tonnage. Coal represents the bulk of the tonnage by far at over 47 percent of the total volume shipped. Petroleum and other related energy commodities also account for another 12 percent of the goods moved.

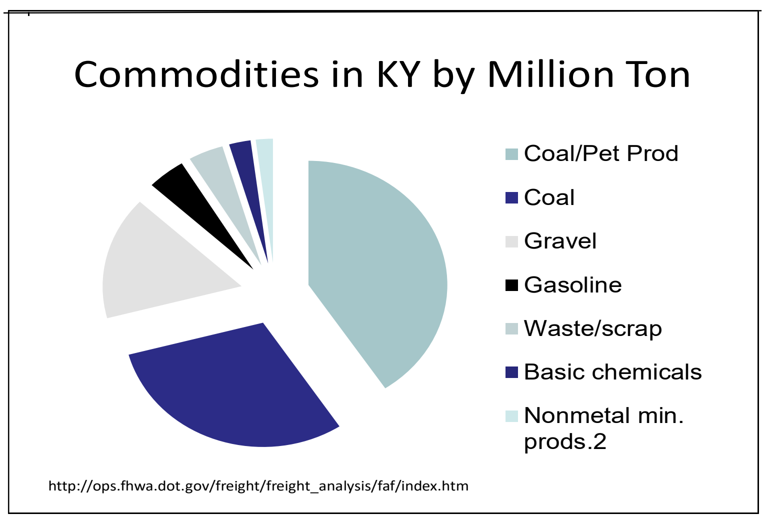


Figure 50: Commodities in Kentucky (MMTons)

Kentucky is located at the hub of the nation's inland waterway system. Its central location makes it an integral link between Canada, Mexico, and the ports in New Orleans and Mobile, AL. This proximity to United States and world markets makes the state especially attractive for the processing and distribution of energy commodities in all phases of production.

Kentucky has 10 public river ports; seven of these are operating ports with the other three under development. Each port serves the individual county where it is located, the area at large, and the entire state. Some facilities are quite mature while others are still in their infancy. In addition to the public ports, there are also several private ports in the state. Some of these serve one specific facility while others are for general commerce.

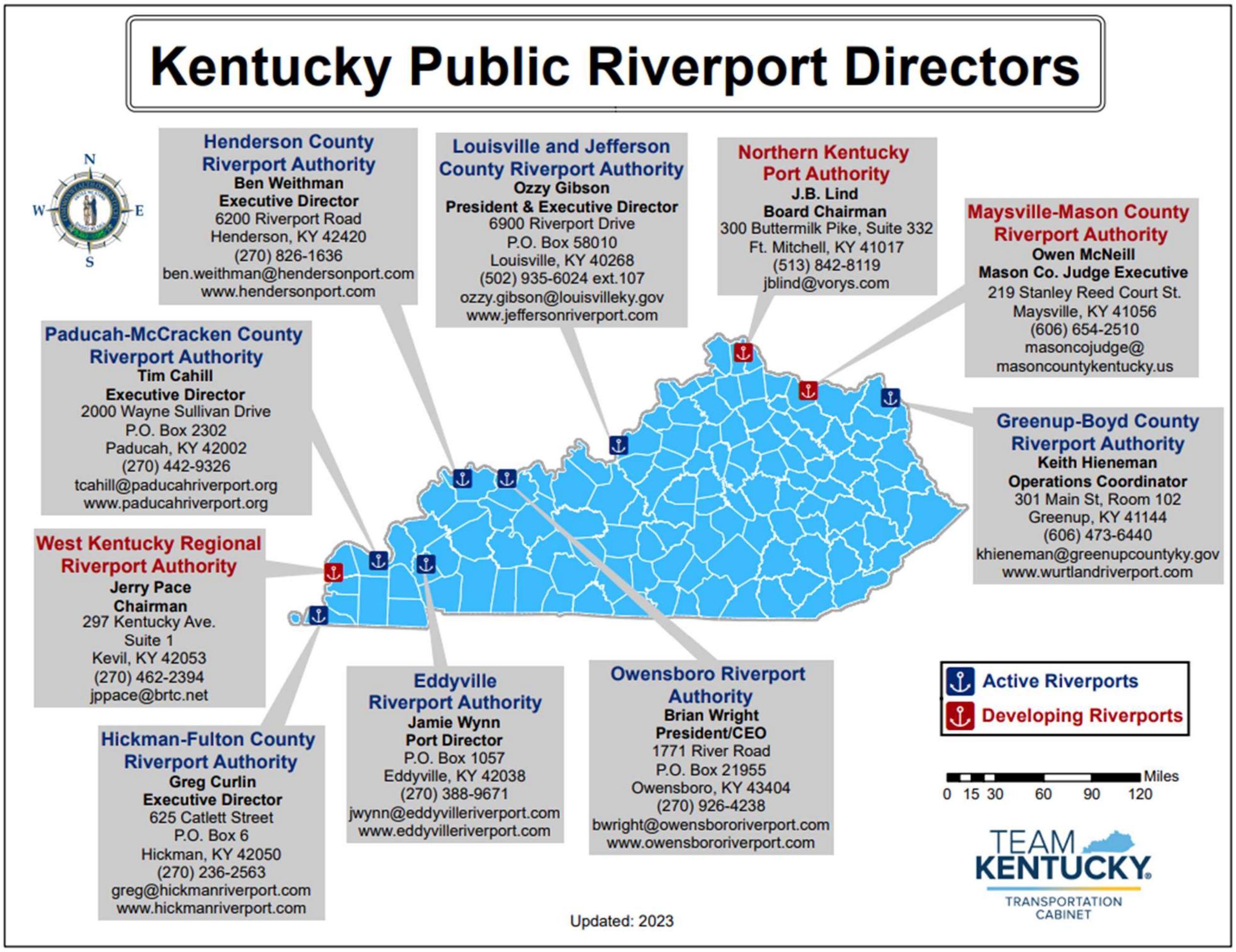


Figure 51: Kentucky Public River Port Directors 2023

Figure 52: Map of Locks & Dams on the Ohio River

Barge Contacts:
State Government:
Transportation Cabinet - http://transportation.ky.gov/
Division of Planning - https://transportation.ky.gov/Planning/
Federal Government:
U.S. Army Corp of Engineers - https://www.usace.army.mil/
Huntington District - https://www.lrh.usace.army.mil/
Louisville District - https://www.lrl.usace.army.mil/
Nashville District - https://www.lrn.usace.army.mil/
Industry:
Kentuckians for Better Transportation - http://www.kbtnet.org/

7.0 Energy Mitigation Strategies

7.1 Mitigation Strategy

Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters. It begins with state, tribal and local governments identifying natural disaster risks and vulnerabilities that are common in their area. After identifying these risks, they develop long-term strategies for protecting people and property from similar events. Mitigation plans are key to breaking the cycle of disaster damage and reconstruction.

All events start local, and it is the experience of the SEO that local jurisdictions in Kentucky are able to and have significant support for developing and implementing actions/measures mitigating the effects from natural hazard events. Kentucky's Area Development Districts (ADDs), the Division of Emergency Management (KYEM), and other state, regional, and nonprofit organizations provide significant and targeted direct support to local jurisdictions in developing natural (and human-caused) mitigation actions/measures. Consequently, a driving issue for the SEO is the additional identification and/or prioritization of mitigation measures that include energy, either as the reason to identify or a component of prioritize energy resilient investment actions in mitigation planning.

Previous sections of this document depict the procedures to be followed in monitoring the energy environment and responding to emergencies. This section identifies specific actions (risk mitigation measures) that the state intends to pursue in the short-, medium-, and long-term. These actions neither are exhaustive nor time-sensitive. These actions will enhance energy infrastructure security primarily by lessening the impact of a disruption event and mitigate the effects from long-term power outages for communities pursuing these actions.

7.1.1 KYE3

Governor Andy Beshear, on October 20, 2021, in collaboration with the Energy and Environment Cabinet, announced Kentucky's energy strategy for a transitioning energy landscape. The strategy is known as KYE3: Designs for a Resilient Economy. KYE3 is an energy strategy wrapped in economic development and focused on resilience. KYE3 stands for energy, environment, and economic development, three issues that are inextricably linked.

KYE3 represents a long term strategic vision for Kentucky's energy landscape and articulates overarching goals and objectives. The vision for KYE3 is an economy built on our past, answering the needs of today, and equipped for tomorrow's opportunities.

- KE3 Addresses our energy sector in a holistic and integrated manner and promotes the utilization of all of Kentucky's energy resources, including energy efficiency and conservation. It recognizes that economic prosperity is linked to the availability, reliability, sustainability and affordability of consumer energy supplies, and supports the commercialization of innovative energy technologies.
- KYE3 Increases the resilience of the Commonwealth though our local communities' and energy sector's ability to anticipate, prepare, mitigate, respond, and recover quickly from threats or disruptions to our energy infrastructure.
- KYE3 Ensures that Kentucky's regulatory oversight provides safe, reliable and adequate energy services at reasonable prices, yet provides for the financial stability of and supports the operational competence of energy providers.

The benefits of our approach can only be realized by listening to all voices across the Commonwealth and engaging in partnerships that build actions to create success across our energy, environment and economic development landscape. Clearly defined goals and strategies will form the framework for the rest of the plan's design and guide decisions about what actions (including policies, programs, and projects) will be proposed. Goals and strategies also help communicate the specific value of efforts to key audiences and provide a basis for tracking and measuring progress.

7.1.2 Kentucky Energy Mitigation Approach

The SEO-EEC is responsible for enhancing the energy resilience and security of the Commonwealth by identifying opportunities to increase the ability to respond effectively to an energy disruption and to recover quickly. The SEO-EEC is a non-regulatory entity that works closely with local, state and private industry stakeholders to identify areas of the state that are vulnerable to long term energy disruptions and seek funding to mitigate these threats and hazards.

The SEO-EEC, representing ESF 12, have been activated to the KY SEOC fifteen times since 2020. In this time KY has experienced five major DR declarations, all of which had an impact to our energy infrastructure and utility services across the state. Regardless of the nature of the event, ESF-12 After Action Reports have produced trends that our office has identified, and intend to pursue. The SEO-EEC has committed time and coordination with several agencies to secure grant funding to mitigate for long term energy disruptions and some of these activities are listed below.

FEMA Building Resilient Infrastructure Communities (BRIC)

The KY SEO-EEC were awarded a 2020 FEMA Building Resilient Infrastructure Communities (BRIC) project scoping grant to contract with KY's 15 Area Development Districts (ADD), legislative entities responsible for regional planning and economic development, and more specifically local hazard mitigation plans for FEMA funding.

The SEO-EEC and the ADDs will conduct project scoping activities with local governments and planners throughout the 120 counties and the 500 + cities to survey critical facilities for backup generation capabilities and identify what areas and services in the community are vulnerable to energy disruptions, map what hazards and threats enhance the likelihood of long term power outages and identifying future mitigation projects that will result in data collection and analysis intended to increase the capability of and build the capacity for local governments to propose, and to complete mitigation project applications that either wholly or partially address power and general energy needs and infrastructure needs.

New local hazard mitigation plan guidance (effective April 19, 2023) requires a vulnerability assessment, along with a capabilities assessment from each county. It further clarifies that hazard mitigation plan may no longer just list assets (critical facilities) without context (interdependencies) along with the capabilities to pursue and complete the proposed mitigation actions.

This grant will produce a vulnerability assessment that will assist communities in identifying areas in their region that are susceptible to long term power outages. The data will enhance each ADDs local hazard mitigation plans, mitigation strategy section, to include mitigation actions for energy resilient investments, i.e. "problem statements". Identifying one or more problem statements for each county and, as a best practice, for each city, will lead to and justify mitigation projects that are needed to enhance back up generation for critical facility types generally, or a "system-wide" problem which one or more or one "mega"/multi-faceted mitigation project could be directed.

The project deliverable for each county (and, potentially, city) does not have to result in strictly "backup power" mitigation actions, however, minimally, a "problem statement" will lead to justifying the purchase of additional generators and or larger capacity generators. The discussion of alternative/less well-known backup power energy mitigation actions will end up going beyond the "minimum." After all, in order to justify the purchase of a nano- or micro-grid, the deliverable will first address why simply purchasing generators is not a sufficient mitigation action.

The DOE and FEMA consider certain specific mitigation actions as applicable to both agencies' goals and initiatives.

- Asset Relocation
- Installation or enhanced flood walls/gates
- Enhances/builds/elevate storm water pumps and lift stations
- Culvert Expansion
- Equipment elevation,
- Utility line burial
- Supply chain resilience planning
- Utility Pole hardening
- Any or all of the above

At a minimum the BRIC grant allows the opportunity for local governments to identify critical facilities in their region, state-wide and secondly to assess the capabilities of these facilities to mitigate long term power outages.

FEMA Hazard Mitigation Grant Program (HMGP)

Kentucky's electric grid is unique in that the state has two wholesale marketers (PJM & MISO), four Investor Owned Utilities (Duke, LG&E, KY Utilities and American Power), 26 co-ops served by 2 G/T Cooperation (EKPC & Big Rivers), 21 Self-Regulated Municipal Electric Utilities, five co-ops and 11 municipal utilities regulated by the Tennessee valley Authority (TVA). A detailed list is located in section 6.1.

With all this infrastructure, coordinating and communicating with this robust network can prove challenging during black sky events, especially considering that only 94% of KY's electric utilities are being tracked with public accessible websites, leaving a 6% gap in ESF 12 situational awareness during an energy emergency. The 6% gap represents 17 municipal utilities that do not have an Outage Management System (OMS). An outage management system (OMS) is a utility network management software application that models network topology for safe, efficient field operations related to outage restoration. Major functions usually found in an OMS include:

- Prediction of location of transformer, fuse, recloser or breaker that opened upon failure.
- Prioritizing restoration efforts and managing resources based upon criteria such as locations of emergency facilities, size of outages, and duration of outages.
- Providing information on extent of outages and number of customers impacted to management, media and regulators.
- Calculation of estimation of restoration times.
- Management of crews assisting in restoration.
- Calculation of crews required for restoration.

The SEO is coordinating efforts with the Kentucky Municipal Utility Association (KMUA) and the municipal utilities that do not have this software, to apply for funding through the Hazard Mitigation Grant Programs, Initiative program, to purchase an OMS system. Once the utilities incorporate this system, the SEO-EEC will work with the DOE Eagle-I for outage integration for utility outage tracking.

DOE Infrastructure Investment and Jobs Act (IIJA)

The 40101(d) Formula Grant Program from the Department of Energy (DOE) aims to provide states and tribes with aid to help improve the resiliency of their electric grids. The SEO-EEC will use this grant funding to strengthen grid infrastructure within Kentucky’s state parks and at select municipal and electric cooperatives. The Kentucky State Parks system is used during emergencies as mass sheltering for displaced residents as well as for staging areas for utilities first responders, if needed. Currently, the grid infrastructure of the state parks is not reliable enough to provide power during minor weather events let alone during a severe storm; this issue serves as both a safety risk and an energy risk.

Out of the 44 state parks in Kentucky 14 of them have state owned electric distribution systems. The SEO-EEC is considering 6 of the 14 state owned parks for this grant opportunity:

- Barren River Lake State Resort Park
- Carter Caves State Resort Park
- Greenbo Lake State Resort Park

- Kenlake State Resort Park
- Kentucky Dam Village State Resort Park
- Lake Barkley State Resort Park

In recent years parks have communicated issues regarding reliability for their current electric infrastructure. Maintenance for the infrastructure becomes very difficult and inconsistent. The lack of resources for maintenance has placed the infrastructure in a poor and hazardous state which has reduced reliability in the electrical system. This poses a risk since parks are used for displaced communities during emergencies. On average, Kentucky experiences 2 presidentially declared natural disasters every year and if these disasters were to place communities in one of these state parks with poor infrastructure that can pose a safety risk to those citizens.

There are several threats to these systems. The most prevalent is the natural ecosystem and weather events. The current infrastructure is so vulnerable to these risks that minor events like a windy day could shut the whole electrical system down. Furthermore, since parks primarily serve as tourism revenue for the state the current status of the electrical system poses safety risks to the general public.

The first two years of funding will be used to bring the state park infrastructure up to modern standards and in essence “hardening the grid”. This will be carried out, but not limited to, updated infrastructure that meets utility standards by updating older equipment, replacing wires, smart grid improvements, improving distribution lines and vegetation removal.

Once the state park infrastructure has been updated to be at utility standards the long-term maintenance and oversight is expected to revert back to the serving electric utility, as the utility is more equipped than parks to service the system during times of disruption. These efforts will require coordination with local, state, federal and private partners in the commonwealth.

DOE State Energy Program (SEP) Annual

The 2021 ice storm highlighted yet again the need for energy resilience in Kentucky’s public water and wastewater systems. Drinking water outages closely follows the loss of power which quickly complicates emergency response efforts as critical customers such as health care facilities are affected. This can be easily offset by auxiliary power; however, most water pump stations are not fortified with a transfer switch that allows for a quick and safe connection to a generator. The inability to connect to auxiliary power extends the water outage, creates more bottled water demand, and increases the likelihood of evacuating critical facilities.

Data extracted from the Water Resources Information System shows that 1,700 (85%) of drinking water facilities and 3,938 (75%) of wastewater facilities do not have auxiliary power. Based on our experience of coordinating generator deliveries during disasters It is estimated the 95% of the 5,600 pumping facilities in Kentucky without auxiliary power also do not have transfer switches installed that allow for a safe and quick connection to a generator.

	Total Facilities	with AUX Power
Wastewater Treatment Plants	243	85
Wastewater Lift Station	3695	1220
Drinking Water Plants	209	82
Pump Stations	1491	211

The SEO-EEC worked with Kentucky Rural Water Association (KRWA) on a transfer switch grant funded that resulted in 41 utilities submitting applications for 93 facility retrofits. The requests totaled $640,300. Transfer switch pricing with installation ranged between $3,500 and $25,000 with $7,000 being the median. The SEO-EEC will continue to utilize DOE SEP funding to work with Kentucky's water utilities to improve robustness, redundancy and rapid detection of their critical facilities.

DOE SEP Biden Infrastructure Law (BIL)

The SEP BIL Grant Program from the Department of Energy (DOE) provides funding to implement projects that will promote energy efficiency and conservation, develop training programs for new energy technologies and continue to work with underserved communities on energy affordability issues.

The SEO-EEC will use this grant to research the development of micro-grids at colleges and universities and nano-grid technology at wastewater treatment facilities to demonstrate the availability and feasibility of the technologies, to enhance local system and community resiliency.

Using the findings of the University feasibility study, seed funding will be provided to assist in the development of two strategically selected universities or colleges to demonstrate the design, building and operations of an emergency micro-grid to serve as critical facilities areas such as physical plant process and student centers. The project will ensure that within the micro-grids are one or more kinds of distributed energy (solar panels, storage, combined heat and power, generators) that produce its power. All of the micro-grids will be local, independent, and intelligent systems operating to enhance campus and community resilience.

The Wastewater Energy Efficiency study project will provide studies on up to three (3) sites preselected by the SEO and key stakeholders. Efforts will include working with key decision makers to identify critical loads and resilience needs, assessing site availability, conducting preliminary benefit-cost analysis, and suggesting next steps for project implementation and pursuing funding sources. This grant will promote energy efficiency and conservation at local wastewater treatment facilities statewide and provide at least one nano-grid demonstration project to showcase that technology for resiliency at these facilities. The training objectives are to continue the education and outreach project to additional local facilities.

The objective of conducting these feasibility studies is to serve as a primer to pursue applications for energy and grid resilience improvement funding.

DHS Regional Resiliency Assessment Program (RRAP)

The KY SEO-EEC was selected to conduct a Regional Resiliency Assessment, (RRAP), of its petroleum product terminals, in bound. This project will study the resiliency of Kentucky's petroleum distribution and transportation fuel networks and the supply chain with focus on dependency on supporting electric power infrastructure. Specifically, characterize the petroleum infrastructure, examine the potential hazards and threats for key refined fuels facilities, identify cross sector interdependencies and capturing study data to inform planning because the ability of the Commonwealth to restore the petroleum system to normal is very dependent on the ability to restore critical sectors to normal operational level.

This RRAP will provide the state with information on specific petroleum knowledge gaps and help stakeholder's understanding of the petroleum infrastructure and product distribution systems in Kentucky.

- Kentucky petroleum supply chain is critically dependent on electric utility systems and dependent on truck, pipeline, and river systems. The Louisville terminal operations are critical and in some instances a sole pathway into the state. An assessment of mitigation measures around terminal operations, statewide infrastructure needs and transport modes are essential to our energy security programs.
- Critical petroleum infrastructure servicing Kentucky is especially vulnerable to winter storms, flooding, tornados and earthquake hazards;

- Identifying vulnerabilities to Kentucky's petroleum infrastructure and systems;
- Petroleum infrastructure is critically dependent on information technology and operating technologies such as supervisory control and data acquisition (SCADA); and,
- Fostering information-sharing relationships between petroleum sector elements and Kentucky state agencies would improve emergency fuel planning and response.

This analysis will also inform the management of risks to that system that will ultimately be used to support and assist the development of a state emergency master fuel plan.

KYEM THIRA

The KY SEO-EEC will work with KYEM to determine current capability metrics and develop a capability target for Power Restoration. This work includes a power restoration gap analysis focusing on challenges relating to planning, organization, equipment, training, and exercises as well as developing a strategic vision for improvement focusing on priorities and initiatives to address gaps and move closer to achieving target metrics. This information will be used to help the Commonwealth assess the impacts of our most catastrophic threats and develop plans to help response and mitigation efforts.

Nuclear

Kentucky takes an "all of the above approach" in regards to its energy infrastructure. However, with the increasing transition away from firm, baseload power like coal power generation, Kentucky's utility portfolios are becoming less diverse while at the same time increasing the reliability and resilience risk. A mitigation strategy to this risk is adding nuclear power generation to Kentucky's electricity generation portfolio.

The 2022 Winter Storm Elliott highlighted the vulnerability of Kentucky electric power generation portfolio and the added benefits of having nuclear power generation in the mix of technologies. The TVA along with LG&E and Kentucky Utilities, deployed for the first time in Kentucky history, rolling 15-minute outages because of generation failure to perform during the extreme cold event. The two serving Regional Transmission Organizations in Kentucky all implemented voluntary energy conservation measures.

With increasing threats to the power generation infrastructure, the 2023 General Assembly passed Senate Joint Resolution 79, which established Kentucky's Nuclear Energy Development Workgroup. The directive of the workgroup is to develop recommendations for the formation of a permanent nuclear energy development commission and identify barriers to nuclear energy deployment in the Commonwealth. Adding advanced nuclear power generation in Kentucky is a long-term mitigation measure to extended power outage event.

Hydrogen

As the world shifts to fossil-fuel alternatives in response to a growing call to reduce greenhouse gas emissions hydrogen has emerged as a strong substitute especially for hard to decarbonize industries e.g. the transportation industry. These efforts come to fruition in the U.S. National Clean Hydrogen Strategy and roadmap. The Biden Administration has set goals that include:

- A 50% to 52% reduction in U.S. GHG emissions from 2005 levels by 2030
- 100% carbon pollution-free electricity by 2035
- Net zero GHG emissions no later than 2050
- 40% of the benefits of federal climate investments delivered to disadvantaged communities

In addition there has been federal funding to support efforts to form regional hydrogen hubs in the US. These hubs serve to be localized areas for hydrogen production, storage, and demand. Currently Kentucky resides in three of those hubs: Appalachian (ARCH2), Midwest (MachH2), and Southeast.

Hydrogen serves as solution for hard to decarbonize industries like steel or cement. Since hydrogen is 100% carbon free as a fuel source and is energy dense it serves as a strong and reliable option for energy in hard decarbonize industries.

Since these systems and facilities are so novel identifying threats have become difficult. As of now there are more barriers for the implementation of hydrogen infrastructure. To name a few there are barriers in production and distribution as well as price competitiveness. Currently there is not a price competitive way to distribute hydrogen either. There is established distribution via truck for hydrogen; however, this proves to be expensive the further you go from the production site. Dedicated pipelines for hydrogen are a possible solution however there are many policy barriers that need to be addressed.

If hydrogen is introduced as a fuel source for the grid and transportation this will only diversify the Commonwealth's energy portfolio. A diverse portfolio stands to be more resilient against threats like extreme weather.

Electric Vehicles

Fleet fuel diversification is also a core mitigation strategy for the Commonwealth. The SEO works with two main types of funding as it relates to increasing electric vehicles and charging stations across the state. The Kentucky Transportation Cabinet (KYTC) in coordination with the Energy and Environment Cabinet (EEC), the Public Service Commission (PSC), the Federal Highway Administration (FHWA), and several other State Cabinets developed Kentucky's Electric Vehicle (EV) Infrastructure Deployment Plan (Plan). This plan is a requirement to obtain EV infrastructure funding through the National Electric Vehicle Infrastructure (NEVI) Formula Program from the 2021 Infrastructure Investment and Jobs Act (IIJA).

In addition, the SEO is the agency designated for implementation of the Environmental Mitigation Plan for the Volkswagen Settlement. On October 18, 2016, a Partial Consent Decree was finalized between the U.S. Justice Department, and the Volkswagen (VW) Corporation. An Environmental Mitigation Trust has been established as part of the Consent Decree (CD) that provides funds to the states to mitigate the air quality impacts from higher vehicle emissions. Kentucky’s initial allocation from the Trust is $20,378,649.58. A portion of this funding has been set aside for electric vehicle infrastructure to complement the NEVI funding.

7.1.3 Energy Mitigation Response Action

Energy emergencies can occur for many different reasons. They can be the result of natural disasters, accidents, political disputes, or terrorist activities. Disruptions may be large in scope affecting nations and all industries, or they may be much smaller affecting only a small geographic region or a specific industry.

This variability makes it difficult to construct a precisely designed set of actions that can be predetermined to address all potential emergencies. This does not mean, however, that the development of specific response plans is without merit. Since the promptness of response can often be the most critical factor in mitigating an emergency, it is vital to have response plans and procedures that have been developed and tested before an actual emergency.

Previous sections of this document depict the procedures to be followed in monitoring the energy environment and responding to emergencies. This section identifies specific short and long-term actions that may be taken to alleviate or lessen the impact of a disruption events for mitigating energy burden and long term power outages in the Commonwealth.

These actions/risk mitigation measures listed below, are organized according to energy interdependencies and illustrates the state's approach/strategy to increase energy reliability and end-use resilience.

Electric Power

Conservation:	**Regulatory :**	**Ratepayer Protection:**
Develop and implement a public education and information program regarding electric power conservation. Curtail use by and/or impose electric power conservation goals on state government facilities and operations. Develop and impose an electric power-rationing scheme (voluntary or mandatory) for the impacted area based on time of day, type of use, or similar criteria. Require implementation of a time of day/day of the week pricing scheme to reduce peak demand for the duration of the event where the necessary technology is available.	Aid in securing variances to air pollution regulations so facilities that are equipped to burn coal may do so. Temporarily suspend or waive enforcement of state-mandated rules and regulations to allow use of alternative fuels and/or alternative operating conditions. Request or require modification to scheduled electric generating unit maintenance outages pending resolution of electric energy shortages. Promote substitution of other fuels where feasible.	Impose temporary price controls on the state regulated retail costs of electricity. Impose criteria and/or guidelines for prohibitions on curtailment of electricity supply to local critical uses and/or other high priority electricity users. Temporarily halt electricity service disconnections for non-payment.

Subsidies:

- Provide, arrange, or subsidize financial incentives for electric power conservation for homes and businesses.
- Subsidize purchase of additional electric power on the wholesale market by the state's utilities.
- Subsidize purchase and installation costs of, or temporary provision of, standby generators for public and private sector critical facilities.

- Temporarily provide electric generators to key employers and important community facilities to sustain operations and to mitigate losses in revenue generated or employment.
- Provide low-interest or interest-free loans on an emergency basis to support businesses and industries in the impacted areas.
- Provide cost subsidies for purchase of fuels for electric power generation.
- Provide subsidies, loans, grants, or similar financial support to financially disadvantaged families for payment of higher electric costs.

Electric Mitigation Measures

Backup Generators (fixed/portable)
Utility Line Burial
Demand Response Programs
System Segmentation
Battery Storage
Microgrid Deployment
Advanced Distribution Management Systems
AI Analysis
Distribution Automation

Drone Asset Inspection
LiDAR Analysis for Vegetation Management
Advanced Metering Infrastructure
Supply Chain Resilience Planning
Thermal Enclosures
Advanced water-cooling Technologies
Dry Colling
Storm Water Pumps
Vented Manhole Covers
Fire Resistant Poles

Natural Gas

Conservation:	**Regulatory :**	**Ratepayer Protection:**
Develop and implement a public education and information program regarding natural gas conservation.	Aid in securing variances to air pollution regulations so facilities that are equipped to burn coal may do so. Temporarily suspend or waive enforcement of state-mandated rules and regulations to allow use	Provide subsidies, loans, grants, or similar financial support to financially disadvantaged families for payment o higher natural gas costs. Impose temporary price controls on the state regulated retail costs of natural gas.

Promote substitution of other fuels where feasible. Curtail use by and/or impose gas conservation goals on state government facilities and operations. Provide for allocation or non-essential use prohibitions in the impacted areas.	of alternative fuels and/or alternative operating conditions. Recommend that interruptible service plans be initiated. Assess customers on interruptible tariffs to determine immediately available for curtailment.	Impose criteria and/or guidelines for prohibitions on curtailment of natural gas supply to local critical uses and/or other high priority natural gas users. Temporarily halt natural gas service is connections for non-payment.

Subsidies:

- Provide, arrange, or subsidize financial incentives for natural gas conservation for homes and businesses.
- Fund increased domestic natural gas production.
- Purchase and/or subsidize purchase on the wholesale market of natural gas redistribution to the impacted areas.
- Provide subsidies, loans, grants, or similar financial support to financially disadvantaged families for payment of higher natural gas costs.
- Purchase gas for delivery to critical facilities in the impacted areas.

Natural Gas Mitigation Measures

Demand Response Programs
System Segmentation
Backup Generators
Ties Between Gas Pipelines
AI Analysis
Drones for Asset Management
Remote Operated Valves
Supply Chain Resilience Planning
Pipeline Insulation and Trace Heating

Water Line Management
Thermal Enclosures
Elevate Equipment
Flood Walls/Gates
Relocate Assets
Storm Water Pumps
Submersible Equipment
Vent Line Protectors
Culverts and Flexible Joints

Propane

Conservation:	Regulatory :	Consumer Protection:
Develop and implement a public education and information program regarding propane conservation. Promote substitution of other fuels where feasible. Curtail use by and/or impose propane conservation goals on state government facilities and operations. Provide for allocation or non-essential use prohibitions in the impacted areas.	Temporarily suspend or waive enforcement of state-mandated rules and regulations to allow use of alternative fuels and/or alternative operating conditions. Recommend that interruptible service plans be initiated. Coordinate transportation regulation waivers (e.g. hours of service) with the Transportation Cabinet.	Provide subsidies, loans, grants, or similar financial support to financially disadvantaged families for payment of higher propane costs. Impose temporary price controls on the retail and/or wholesale costs of propane.

Supplies:
Locate available supplies of fuel for emergency response and critical facilities.

Subsidies:
- Provide, arrange or subsidize financial incentives for home heating conservation for homes and businesses.
- Purchase and/or subsidize purchase on the wholesale market of propane for redistribution to the impacted areas.
- Provide subsidies, loans, grants, or similar financial support to financially disadvantaged families for payment of higher propane costs.
- Purchase gas for delivery to critical facilities in the impacted areas.

Petroleum Fuels

Conservation:	**Regulatory :**
Develop and implement a public education and information program regarding liquid fuels conservation. Curtail use by and/or impose liquid fuels conservation goals on state government facilities and operations. Promote employer-based car-pool programs that provide car-pool information and matching services to employees. These programs could be supplemented by an outside agency assisting employers in setting up these services, or expanded solely by employer initiative. Increase rural car-pool parking lots that can be built on major commuter routes along state trunk lines outside urban areas. Existing lots that are being used at near capacity could also be enlarged to provide convenient, free parking to commuters. Establish area-wide car-pool programs that provide car-pool matching by local ride-sharing offices to area residents on request. Promote public vanpool programs. Provide vanpool information and matching services to interested participants and make the necessary arrangements to provide vans to qualified vanpool groups. Vanpooling could be encouraged as part of the Public Information Program.	Coordinate transportation regulation waivers (e.g. hours of service, weight restrictions) with the Transportation Cabinet. Promote substitution of other fuels where feasible. Aid in securing variances to air pollution regulations. Provide for mandatory reallocation of liquid fuel supplies from various regions within the state to the areas impacted by the shortage. Request lower speed limits on highways and roads in the Commonwealth with the Transportation Cabinet. Establish purchase plans by restricting gasoline purchases to every fourth day, based on the vehicle owner's license plate number. Operators of vehicles with license plate numbers ending in 00 to 24 could purchase gasoline on the first day of the plan, 25 to 49 on the second day, 50 to 74 on the third day, and 75 to 99 and personalized plates on the fourth day. Beginning on the fifth day, the rotation would repeat. This procedure for purchasing gasoline every four days could be extended to a longer interval if the emergency became more severe. Vehicles with commercial license plates would be exempt. Exemption tickets that would allow a one-time purchase per ticket on a non-purchase day would also be sold by the state.

Establish preferred parking for employee car pools. Reserved parking in state government and business complexes could be offered to employees as a ride-sharing incentive. Recommend the Governor direct State department directors to reduce expenditures for vehicle travel. Encourage employers to offer telecommuting and/or flextime scheduling options to their employees to facilitate ride sharing and the use of public transit. Use school buses for public transportation to augment bus fleets. School buses could be used in tandem with transit buses along transit routes that are redesigned to respond to an increase in demand for public transit.	Impose "alternate (even-odd) days" motor vehicle refueling restrictions. Temporarily suspend or waive enforcement of state-mandated rules and regulations to allow use of alternative fuels and/or alternative operating conditions. Provide for liquid fuels rationing or non-essential use prohibitions in the impacted areas. Purchase liquid fuels for delivery to critical facilities in the impacted areas. Participate in appropriate state role if the federal government imposes price or allocation controls on energy sources. Implement federally mandated fuel allocation or rationing programs.

<u>Supplies:</u>

Locate available supplies of fuel for emergency response and critical facilities.

<u>Subsidies:</u>

- Provide subsidies, loans, grants, or similar financial support to financially disadvantaged families for payment of higher heating fuel costs.
- Provide, arrange or subsidize financial incentives for liquid fuels conservation for residents and businesses.
- Purchase and/or subsidize purchase of liquid fuels for redistribution to the impacted areas.

Liquid Fuel Mitigation Actions

- System Segmentation
- Backup Generators
- AI Analysis
- Drone Asset Inspection
- Remote-Operated Valves
- Supply Chain Resiliency Planning
- Pipeline Insulation and Trace Heating
- Water Line Management
- Flood Walls/Gates
- Relocate Assets
- Storm Water Pumps
- Submersible Equipment
- Culverts
- Flexible Joints
- Thermal Enclosures
- Elevate Equipment

Coal

<u>Conservation:</u>	**<u>Regulatory :</u>**	**<u>Transportation:</u>**
Develop and implement a public education and information program regarding electric power conservation. Curtail use by and/or impose electric power conservation goals on state government facilities and operations. Develop and impose an electric power-rationing scheme (voluntary or mandatory) for the impacted area based on time of day, type of use or similar criteria.	Coordinate transportation regulation waivers (e.g. hours of service) with the Transportation Cabinet. Facilitate the scheduling of alternative methods of transportation for coal delivery. Provide additional staff resources to process coal mine permits.	Request the assistance of local and state agencies in road clearing activities during periods of snow and ice. (This may include the clearing of private driveways if necessary for delivery of fuel supplies for protection of life and property.) Request, through transportation companies or appropriate federal agencies, the priority movement of petroleum products, coal, or other fuels on rail, waterways, pipelines or other means. Work with appropriate state and federal agencies to remove

Require implementation of a time of day/day of week pricing scheme to reduce peak demand for the duration of the event where the necessary technology is available.		restrictions on highway transportation (e.g., weight limits, hours of service, route restrictions, etc.) without causing safety or other problems. Assist suppliers and consumers in locating transportation for petroleum products, coal or other fuels.

7.1.4 All Hazards Mitigation Strategy Summaries

The measures summarized on the subsequent pages are categorized into two main groups: "All Hazards" measures that can apply to a range of threats and "Hazard-Specific" measures that are designed to mitigate a specific threat or risk, such as cold weather or wildfires. All Hazard measures are divided into categories that align with three of the "infrastructural qualities" outlined in the Department of Homeland Security's Resilience Framework:

1) Robustness – measures that strengthen a system to withstand external hazards without degradation or loss of functionality.

2) Redundancy – measures that allow for alternate options, choices, and substitutions when a system is under stress.

3) Rapid Detection/Recovery – measures that shorten the time it takes to overcome a disruption and restore energy services.

The last two sections provide general resources on ways to increase the resilience of energy systems and resources related to specific risk mitigation measures.

All Hazards Risk Mitigation Measures:

- Robustness
- Redundancy
- Rapid Detection/Recovery

Hazard-Specific Risk Mitigation Measures:

- Cold Weather
- Extreme Heat and Drought Resistance
- Flooding
- Seismic
- Wildfire
- Wind

Electricity	Liquid Fuel	Natural Gas

All-Hazards Risk Mitigation Measures

Robustness

Measure	Description	Sector
Demand response programs	Demand response programs relieve pressure on electric or natural gas delivery systems by reducing or time-shifting customer energy usage. Demand reduction during peak periods reduces the chance of system overload and service failure. In addition to enhancing reliability, demand response can also help reduce generator or supplier market power and lessen price volatility.	
System segmentation	Energy systems (power grids, gas pipeline networks, and liquid fuels pipeline networks) can be sub-divided to more efficiently isolate damaged areas, allowing undamaged segments to continue serving customers. By segmenting networks, service isolations can be more targeted and affect fewer customers.	
Undergrounding power lines	Placing transmission lines underground protects them against external threats, including high winds and falling branches, wildfires, extreme heat or cold, icing, dirt/dust/salt accumulation, and animals. Buried lines may be more vulnerable to flooding if located in low-lying areas and may be more difficult and expensive to maintain and repair.	

Redundancy

Measure	Description	Sector
Backup generators	Fixed or portable backup generators can provide backup power to critical facilities when grid-supplied power is interrupted. Backup generators may be designed to power emergency functions, such as emergency lighting, fire suppression, or stormwater removal, or may be designed to power some or all of a facility's operational functions. Mobile generators can power utility or emergency responder base camps (sites where response personnel and equipment are staged). Backup generators require adequate fuel supply to operate.	

Measure	Description	Sector
[Battery storage]	Battery energy storage can be used to provide backup power during electric grid outages. Batteries can be deployed at utility-scale as front-of-the-meter systems, providing services like utility load peak shaving or behind-the-meter by customers. Batteries are often paired with solar photovoltaic systems and included in microgrid designs.	
[Microgrids]	A microgrid is a group of interconnected loads and distributed energy resources that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to operate in grid-connected or island mode. Microgrids can improve customer reliability and resilience to grid disturbances.	
Ties between gas pipelines	Natural gas system operators can add ties between gas distribution lines or "mains" to diversify the transmission system and allow additional pathways to route natural gas in the event some sections of transmission mains are damaged.	

Rapid Detection/Recovery

Measure	Description	Sector
[Advanced distribution management systems]	Advanced distribution management systems integrate numerous utility systems and provide automated outage restoration and optimization of distribution grid performance. These functions improve the resilience of the distribution system and decrease the length of customer outages.	
Artificial intelligence analysis	Artificial intelligence analysis can augment the abilities of subject matter experts to prioritize transmission line operations, identify defects, and update asset management systems.	
Distribution automation	Distribution automation uses digital sensors and switches with advanced control and communication technologies to automate feeder switching; voltage and equipment health monitoring; and outage, voltage, and reactive power management.	
[Drones for asset inspection]	The use of drones to inspect pipelines, transmission lines, or other assets allows for safer and more frequent inspections, enhanced asset information, reduced operational costs and failure rates, and extended asset lifetimes.	

Measure	Description	Sector
LiDAR for vegetation management	Vegetation is the primary cause of overhead power line outages. "Light Detection and Ranging" (LiDAR), is remote-sensing technology that can measure how close vegetation is to power lines. LiDAR units can be deployed on the ground, drones or aircraft, to enable more effective vegetation management reducing the impact of storms on electric infrastructure.	
Remote-operated valves	Remote-operated valves more efficiently isolate systems during disruptions or peak event load management (e.g., temporarily disconnecting gas customers).	
Advanced Metering - Infrastructure	Advanced metering infrastructure (AMI) is an integrated system of smart meters, communications networks, and data management systems that enables bi-directional communication between utilities and customers. Smart meters can provide near-real-time visibility into customer outages and help utilities allocate resources and restoration activities more efficiently.	
Supply chain resilience planning	Assessing current supply chains and working with relevant stakeholders to strategically plan for the continuity and rapid restoration of those supply chains after major disruptions improves supply chain resilience.	

Hazard-Specific Risk Mitigation Measures

Cold Weather Protection Measures

Measure	Description	Sector
Pipeline insulation & trace heating	Fiberglass insulation used to enclose piping can protect against freezing. Additionally, an electrical heating element installed along the length of a pipe and covered by thermal insulation can be used to maintain or raise the temperature of the pipe during cold weather.	
Water line management	Draining water lines prevents rupturing that would otherwise be caused by the freezing water caught inside. Water lines that cannot be drained can be set to drip. The small amount of flow caused by the steady drip can help prevent the water inside the lines from freezing and rupturing the lines.	

Measure	Description	Sector
Heating & pitch adjustment for wind turbines	Wind turbine blades and lubricant housings can be fitted with heating elements that prevent ice accumulation that would otherwise impair operations. Wind turbines can also be configured to operate in winter ice operation mode, which changes the pitch of the blades to allow continued operation as they accumulate ice.	
Thermal enclosures	Instrumentation can be enclosed and heated to ensure functionality and operational continuity during extreme cold conditions.	

Extreme Heat & Drought Resistance Measures

Measure	Description	Sector
Advanced water-cooling technologies	Power plants require significant volumes of water for thermoelectric cooling. Asset owners can employ approaches to reduce their water use to make them more resilient to drought conditions. Alternative approaches include recirculating cooling, dry cooling (highlighted below), and wet-dry hybrid cooling technologies. Cooling equipment capable of using alternative water sources (e.g., brackish water, wastewater) can reduce the impact of droughts.	
Dry cooling	Nearly all thermal generation, including nuclear and coal-fired power plants, requires large quantities of water for cooling. Extreme heat can lead to water shortages or make the water used for cooling too warm, forcing power plant operators to curtail electricity output. Dry cooling technologies use air-cooled heat exchangers and other technologies to significantly reduce water use.	
Hydropower reservoir capacity	Increasing reservoir storage capacity at hydroelectric power plants can offset the effects of precipitation variability.	
Turbine efficiency	Higher-efficiency hydroelectric turbines require less water per unit of electricity generated and are more resilient to drought.	

Flood Protection Measures

Measure	Description	Sector
Elevate equipment	Elevating equipment located in low-lying areas can protect it from flooding that would otherwise damage or destroy it.	

Measure	Description	Sector
Environmental management	Preserving certain kinds of natural habitats (e.g., coastal wetlands) provides a natural barrier to lessen the impact of storm surge.	
Flood walls/gates	Installing flood walls, gates, and/or barriers can protect essential equipment in flood prone areas from water intrusion and avoid restoration delays after major storms and floods.	
Relocate assets	Relocating energy assets away from flood-prone areas can reduce or eliminate their exposure to flooding and inundation threats.	
Stormwater pumps	Stormwater pumps can remove flood water and help prevent equipment from being submerged.	
Submersible equipment	Equipment located in flood-prone areas, such as underground power distribution systems in low-lying areas, can be modified or replaced with equipment that is designed to continue functioning when subjected to flooding from water containing typical levels of contaminants such as salt, fertilizer, motor oil, and cleaning solvents.	
Vent line protectors	A vent line protector (VLP) protects gas regulator vent lines from encroaching water. The VLP is usually open, but if water enters the vent line via the VLP, a float will seal the vent line shut. The float will drop when the water recedes, re-opening the vent to its normal position.	
Vented manhole covers	In flooding scenarios, manhole covers can dislodge, and the exposed manhole creates a hazard for pedestrians and vehicles. Proper vent design can allow for the flow of excess water without dislodging the cover.	

Seismic Protection Measures

Measure	Description	Sector
Base isolation transformer platform	Substation transformers can be placed on platforms designed to absorb the shaking from earthquakes that would otherwise damage the equipment.	

Measure	Description	Sector
Culverts	Placing fuel pipelines within buried concrete trenches, called culverts, significantly reduces the fracturing, buckling, and other damage caused to buried pipelines during an earthquake.	
Flexible joints	Flexible joints between steel pipe segments absorb the deformations caused during an earthquake and lessen the damage caused to pipeline infrastructure.	

Wildfire Protection Measures

Measure	Description	Sector
Covered conductors	To mitigate wildfire risk, utilities can replace bare wire overhead conductors on high-voltage transmission lines with conductors that have a plastic covering (also called tree wire). Covered conductors greatly reduce the number of faults, and the risk of ignition. Similar products include spacer cables and aerial cables.	
Fire-resistant poles	Wood poles can be replaced with ones made from fireproof materials, or wrapped in fireproof sheaths (e.g., wool-ceramic fiber).	
Line-break-protection systems	Automated monitoring equipment, called phasor measurement units, installed on transmission lines can detect a voltage change associated with the breakage of a power line. The system can respond in near real-time by de-energizing that segment of the transmission line so that the broken power line does not spark a fire as it falls to the ground.	
Pre-treat assets in path of fire	Pre-treating infrastructure (e.g., by applying flame retardant coatings or wrapping assets such as utility poles in flame retardant sheaths) decreases wildfire damage and expedites restoration of service.	
Reconductoring	Reconductoring is the process of installing new conductor wires on existing towers to increase transmission capacity, thus reducing propensity for high loads and line sag, which can cause ignition. Reconductoring typically involves replacing traditional steel-reinforced lines with composite core lines.	

Wind Protection Measures

Measure	Description	Sector
Breakaway service connectors	A breakaway service connector is designed to disconnect when the power line it is attached to is pulled by a falling limb or other debris. This avoids damage caused when a service wire is pulled down in a way that damages the meter receptable. Meter receptables are not owned by the utility, and a private electrician is needed to first make repairs, delaying service restoration.	
Dead-end towers	Dead-end towers (also called anchor towers or anchor pylons) are self-supporting structures made with heavier material than suspension towers. Dead-end towers are used at the end of a transmission line; where the transmission line turns at a large angle; on each side of a major crossing such as a large river or highway, or large valley; and at intervals along straight segments to provide additional support. Suspension towers are typically used when the transmission line continues along a straight path. When weaker suspension towers are compromised or topple, the stronger dead-end structures can stop a domino effect that takes down multiple towers. Reducing the spacing between dead-end structures can limit the impacts of domino effect failures.	
Stronger utility poles	This can involve reinforcing wood poles, replacing wood poles with concrete ones, or replacing wood cross-arms with fiberglass ones.	
Vegetation management	Clearing vegetation away from transmission and distribution lines helps prevent damage (e.g., falling tree branches) to power lines that cause outages.	

Figure 53: ALL Hazards Risk Mitigation Measures

General Resources

Mitigating impacts from hazards to the energy system is a topic that is constantly being reevaluated, and the guidance for best practices is ever-changing. The following reports focus on ways to increase the resilience of energy systems. Note: this is not a comprehensive list of resources.

Institute of Electrical and Electronics Engineers (IEEE). 2020. *Resilience Framework, Methods, and Metrics for the Electricity Sector*.

> This report provides an overview of resilience definitions (including its relationship with reliability), the existing frameworks for holistically defining resilience planning and implementation processes, and the metrics to evaluate and benchmark resilience. It also evaluates technologies, tools, and methods to improve electrical system resilience.

National Renewable Energy Laboratory. 2019. *Energy Resilience Assessment Methodology*.

This report presents a replicable energy resilience assessment methodology for sites, military bases, and campuses to assess energy risks and develop prioritized solutions to increase site resilience.

National Renewable Energy Laboratory. 2019. *Power Sector Resilience Planning Guidebook: A Self-Guided Reference for Practitioners*.

This guidebook introduces policymakers, power sector investors, planners, system operators, and other energy sector stakeholders to the key concepts and steps involved in power sector resilience planning.

U.S. Climate Resilience Toolkit. 2019. *Building Resilience in the Energy Sector*

This toolkit examines climate change challenges for the energy sector, possible actions to mitigate risk and links to resources.

U.S. Department of Homeland Security. 2019. *National Mitigation Investment Strategy.*

The National Mitigation Investment Strategy ("NMIS"), developed by the Mitigation Framework Leadership Group, is a single national strategy for advancing mitigation investment to reduce risks posed by natural hazards and increasing the nation's resilience to natural hazards. This report outlines the investment strategy and how federal and non-federal partners can coordinate community mitigation investments.

National Academies of Sciences, Engineering, and Medicine. 2017. *Enhancing the Resilience of the Nation's Electricity System*.

This report focuses on identifying, developing, and implementing strategies to increase the electric system's resilience in the face of events that can cause large-area, long-duration outages: blackouts that extend over multiple service areas and last several days or longer.

U.S. Dept. of Energy. 2016. *Climate Change and the Electricity Sector: Guide for Climate Change Resilience Planning*.

This report provides basic assistance to electric utilities and other stakeholders in assessing vulnerabilities to climate change and extreme weather, and in identifying an appropriate portfolio of resilience solutions.

Electric Power Research Institute (EPRI). 2016. *Electric Power System Resiliency*.

This report describes innovative technologies, strategies, tools, and systems that the electricity sector is developing and applying to address resiliency. The report explores three elements of resiliency: damage prevention, system recovery, and survivability.

Argonne National Laboratory. 2016. *Front-Line Resilience Perspectives: The Electric Grid*.

This report summarizes how states and local utilities approach all-hazards resilience in planning, construction, operations, and maintenance of the electric system as well as challenges faced when addressing all-hazards resilience.

U.S. Dept. of Energy. 2014. *United States Fuels Resiliency Volume III: U.S. Fuels Supply Infrastructure Vulnerabilities and Resilience*.

This study evaluates the ability of the nation's oil and natural gas transportation, storage, and distribution infrastructure to respond to and recover from natural disasters and intentional acts, system chokepoints and interdependencies, and other supply interruptions.

U.S. Dept. of Energy. 2010. *Hardening and Resiliency: U.S. Energy Industry Response to Recent Hurricane Seasons*.

This report examines the storm hardening and resilience measures that refiners, petroleum product pipeline operators, and electric utilities in the Gulf Coast area took in response to the 2005 and 2008 hurricane seasons. It focuses on the segments of the energy industry that contribute most to the delivery of gasoline and diesel to the Southeast U.S.

7.2 Environmental Justice and Emergency Response Planning

Under-resourced or under-served communities are often the most exposed to disasters and the least able to recover after disasters strike. As severe weather becomes more frequent, the role of state agencies significantly increases to help communities prepare, respond, and recover from natural and mad made disasters. Proactively understanding community demographics and characteristics is a primary role of emergency management agencies in terms of addressing environmental and energy justice issues.

On February 11, 1994, through Executive Order 12898, the federal government took action and directed all federal agencies to identify and address environmental justice in their programs and focus on reducing and addressing disproportionate impacts. Environmental Justice can be defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

The fundamental principle of environmental justice is that all stakeholders should have meaningful and informed participation in all aspects of environmental decision-making that could affect their community; this includes disaster response and recovery efforts. Affected communities must have the ability to effectively collect data and other information in order to be informed and active participants in decision-making processes. A community that is environmentally and energy aware and is an active participant in decision-making serves as the best source for environmental protection and energy awareness and preparedness.

Building off the tenets of environmental justice, energy justice refers to the concepts of equity, affordability, accessibility, and participation in the energy system and energy transition regardless of race, nationality, income, or geographic location.

On January 21, 2021, through Executive Order 14008, the President directed the Director of the Office of Management and Budget (OMB), the Chair of the Council on Environmental Quality (CEQ), and the National Climate Advisor, in consultation with the White House Environmental Justice Advisory Council (WHEJAC), to jointly publish guidance on how certain Federal investments might be made toward the goal that 40 percent of the overall benefits of such investments flow to disadvantaged communities – the Justice40 Initiative. This includes federal resources directed for emergency preparedness, response, and recovery efforts.

Kentucky’s statutes and regulations do not expressly refer to environmental or energy justice, but public outreach and engagement is an integral part of Kentucky’s energy and environmental programs. The EEC is committed to the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. The SEO role is to analyze energy consumption data, pricing, and revenue data to identify trends or issues by sectors and at the geospatial level to provide policy support to management and the PSC. This is especially relevant to identifying vulnerable and disadvantaged communities and the energy trends or events affecting those populations.

The SEO-EEC functions as one of three ESFs during an emergency within the EEC: ESF-3, 10, and 12 dealing with hazardous materials, water and wastewater infrastructure, and energy issues, respectively. When looking at response and recovery after a man-made or natural disaster or environmental incident, communities affected by these releases, disasters, or incidents often include those with high environmental justice indicators. Awareness, training, and modification of existing plans is needed to ensure that marginalized and vulnerable communities in Kentucky are able to provide participation and have necessary access and the ability to recover from such incidents requiring emergency response or Energy Security planning.

In addition to ESF-12 responsibilities, the SEO serves as a non-regulatory agency inside the EEC assisting all citizens, businesses, and organizations throughout the Commonwealth on all energy-related issues. Central to this assistance is the provision of energy education across the Commonwealth. The Office strives to design programs and collaborate with partners to reach those areas of Kentucky identified as having significant environmental justice indicators. The SEO is facilitating an Energy Affordability Workgroup comprised of private, public and nonprofit entities across the state to tackle the complex issues that encompass energy affordability and energy burden for our most vulnerable Kentuckians.

The SEO-EEC has been spotlighted as a DOE case study on the use of the Low-Income Energy Affordability Data Tool (LEAD). The LEAD Tool has enabled the SEO-EEC to both identify geographical areas of the state with above average energy burden (percentage of income spent on energy) and direct grant funding to partner organizations in those areas to help address the issue. In addition, the SEO-EEC has a robust geospatial and data capacity to identify under-resourced and underserved areas that may be adversely impacted by natural or man-made events. Using the FEMA Hazard Risk Indices, the SEO-EEC can identify those areas that rank high for social vulnerability and low for community resilience. Working across all ESFs, ESF-12 helps coordinate appropriate resource support to these areas.

In order to better meet government responsibilities related to the protection of public health and the environment, the federal EPA has developed a new environmental justice (EJ) mapping and screening tool called EJSCREEN. It is based on nationally consistent data and an approach that combines environmental and demographic indicators in maps and reports. In the future, EJSCREEN will be utilized during disruption events to identify those vulnerable populations across the Commonwealth, thereby aiding in enhanced communication, outreach, and engagement.

In January of 2021, President Biden issued Executive Order 14008. The order directed the Council on Environmental Quality (CEQ) to develop a new tool. This tool is called the Climate and Economic Justice Screening Tool. The tool has an interactive map and uses datasets that are indicators of burdens in eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The tool uses this information to identify communities that are experiencing these burdens. These are the communities that are disadvantaged because they are overburdened and underserved.

8.0 Citizen Service Programs

8.1 Energy Pricing Concerns and Complaints

Process:

The Attorney General's Office of Rate Intervention serves as a watchdog for consumers detecting and protecting against unreasonable, gas, water, sewer, electric, and telephone rates. Since its creation in 1974, the Office has helped to make the rate application process open and understandable to the consumers of the Commonwealth.

Contacts:
State Government:
Office of the Attorney General - https://www.ag.ky.gov/Pages/default.aspx
Office of Rate Intervention -https://ag.ky.gov/about/Office-Divisions/ORI/Pages/default.aspx
Consumer Protection Division - https://www.ag.ky.gov/about/Office-Divisions/OCP/Pages/default.aspx

Process:

The Public Service Commission (PSC), Division of Consumer Services provides informal complaint resolution for the state's regulated utility customers. Customers may contact the PSC by telephone, fax, e-mail, letter, or in person. Use of the toll-free number or e-mail allows the complaint to be handled with the greatest speed and efficiency.

The staff assist in resolving a wide range of utility problems including improper termination of service, unauthorized or incorrect charges on utility bills, problems reading meters, customer deposits for utility services, poor quality of service, and problems with delayed connection of services.

Although the PSC cannot resolve every complaint to the customer's satisfaction, investigators take prompt action on all complaints and resolve them appropriately, as determined by the statutes and regulations that apply to the utilities under the PSC jurisdiction.

Contacts:
State government:
Public Service Commission - http://psc.ppr.ky.gov
Division of Consumer Services - http://psc.ky.gov/agencies/psc/consumer/info_idx.htm

psc.consumer.inquiries@ky.gov

8.2 Low Income Home Energy Assistance Program (LIHEAP)

Process:

LIHEAP is a federally funded heating assistance program administered by the Kentucky Cabinet for Health and Family Services and contracted to Community Action Kentucky for service delivery in each of the state's 120 counties. The program provides heating assistance to eligible low-income households. Community Action Kentucky provides these services through the association's network of 23 community action agencies blanketing the Commonwealth.

Contacts:
State government:
Kentucky Cabinet for Health and Family Services - https://chfs.ky.gov/
Department for Community Based Services - https://chfs.ky.gov/agencies/dcbs/Pages/default.aspx
Community Action Kentucky - https://www.capky.org/

8.3 Weatherization Assistance Program (WAP)

Process

The Federal Government funds the Weatherization Assistance Program (WAP), which provides money to assist qualifying low-income households improve the energy efficiency of their homes by measures such as sealing leaks, adding insulation, and upgrading heating and cooling equipment. The program is administered by Kentucky Housing Corporation (KHC) on behalf of the Finance and Administration Cabinet (FAC), the state recipient of these funds. Kentucky Housing Corporation contracts with the Community Action Kentucky, which subcontracts with 23 Community Action Agencies and one local government to operate the program throughout Kentucky's 120 counties.

Contacts:
State Government:
Kentucky Finance and Administration Cabinet - https://finance.ky.gov/
Kentucky Housing Corporation - https://www.kyhousing.org/
Community Action Kentucky - https://www.capky.org/

8.4 Energy Legal Assistance

Process:

The Office of the Attorney General (OAG) Consumer Protection Division as well as non-governmental agencies can provide assistance with unfair, false, misleading, or deceptive acts or practices in the conduct of any trade or commerce.

Contacts:
State Government:
Consumer Protection Division -
http://ag.ky.gov/family/consumerprotection/Pages/default.aspx
Local Government:
Louisville Metropolitan Area (Jefferson and Bullitt Counties) -
Consumer Protection Division, Frankfort Office - https://ag.ky.gov/about/Office-Divisions/OCP/Pages/default.aspx
Non-governmental agencies:
Access to Justice Foundation

The Better Business Bureau may be able to provide information about the history of a company or whether a particular charity meets certain voluntary guidelines. They have offices in Louisville and Lexington.

8.5 Local Government Assistance

Process:

There are approximately 40 municipalities throughout the Commonwealth that are not serviced by a major local distribution company for their natural gas and/or electrical service. Municipalities experiencing difficulties financing energy supply may qualify for assistance from the Department for Local Government (DLG). DLG, under the Office of the Governor, provides financial help through grants and loan assistance to local governments. Federal grant funds are awarded on a competitive basis for construction and improvement of infrastructure and public facilities through the Community Development Block Grant Program (CDBG). Additionally, state grant funds for construction and improvement of infrastructure may be available through the Local Government Economic Development Fund (Coal Severance) Program.

Contacts:

State Government:
Department for Local Government - http://kydlgweb.ky.gov/
Community Development Block Grant Infrastructure Branch - https://kydlgweb.ky.gov/FederalGrants/16_CDBG.cfm
Kentucky Association of Counties (KACO) - https://www.kaco.org/
Kentucky League or Cities (KLC) - https://www.klc.org/
Kentucky Municipal Utility Association - https://www.kymua.com/

8.6 Emergency Shelter/ Warming Center Support

Process:

Extreme winter conditions may force Commonwealth citizens from their homes or lodging. If such extreme weather conditions prevail, state agencies can coordinate temporary shelters or warming centers. Support for these centers can be provided by both governmental and non-governmental agencies.

Contacts:
State Government:
Kentucky Division of Emergency Management - http://kyem.ky.gov/Pages/default.aspx
(OPS) Hotline - 1-800-255-2587
American Red Cross - https://www.redcross.org/
Non-Governmental agencies:
Community Action Kentucky - http://www.kaca.org/
Homeless & Housing Coalition of Kentucky - http://www.hhck.org

8.7 Disaster Food Benefits

Process:

Authority to operate a Disaster Supplemental Nutrition Assistance Program, (D-SNAP) is found in the Robert T Stafford Disaster Relief and Emergency Assistance Act. The Act provides the Secretary of Agriculture with the authority to operate D-SNAP when affected areas have received a presidential disaster declaration and when commercial channels of food distribution are available. The Food Stamp Act of 1977, as amended, provides the Secretary of Agriculture with the authority to establish temporary emergency standards of eligibility for households who are victims of a disaster that disrupts commercial channels of food distribution after those channels have been restored.

The Food and Nutrition Service (FNS) oversees the D-SNAP and approves the operation under the Stafford Act when affected areas have received a presidential declaration of major disaster and a declaration for individual assistance (IA). FNS provides food assistance in three ways:

- Providing food for shelters and mass feeding sites.
- Providing food for distribution directly to households.
- Providing disaster food benefits.

The Department for Community Based Services (DCBS) has the primary responsibility for providing emergency food assistance in Kentucky. DCBS is responsible for the design of a food benefit disaster plan, evaluation of the need for disaster food benefits or other feeding programs during a disaster, making a request to FNS to operate and implementing the D-SNAP, conducting post-disaster reviews, and reporting the findings to FNS.

D-SNAP is separate than regular SNAP, so when we issue D-SNAP benefits, that's only to non-SNAP recipients. Services we can provide to ongoing SNAP recipients include:

- Replacement benefits for food lost when the disaster hit, and
- Supplemental benefits for the disaster month so they get the same benefit amount as households receiving D-SNAP

Replacement benefits can happen anytime there is an adverse event for a household, like a fire, flood, or power outage lasting 4 hours or more. Most of those power outages don't rise to the level of federally-declared disasters with individual assistance, but sometimes many, many households are impacted.

FNS Declared Disaster with individual assistance DSNAP since 2020

- Flooding in Eastern KY during February-March 2021
- Tornado in December 2021
- Flooding in Eastern KY July 26, 2022

In "normal times", households have 10 days to request a replacement. For larger events, the State may request a waiver of that 10-day limit (typically extended to 30 days), which does not require a disaster declaration for approval.

This is where data from the power companies along with the DOE Eagle-I is vital to emergency response. DCBS can use power outage data to verify their food loss, saving time and effort for the recipient and DCBS workers.

Contacts:
State Government:
Department for Community Based Services - https://chfs.ky.gov/
Cabinet for Health and Family Services - https://chfs.ky.gov/

9.0 APPENDICES

10.0 FIGURES

11. ACRONYM

ADD – Area Development Districts
AMI- Advanced Metering Infrastructure
API- American Petroleum Institute
APPA- American Public Power Association
ARCH2- Appalachian Regional Clean Hydrogen Hub
bbl- Barrel
BCF- Billion Cubic Feet
BIL- Bipartisan Infrastructure Law
BOEMRE- Bureau of Ocean Energy Management, Regulation, and Enforcement
BPA- Bonneville Power Administration
BPCD- Barrels per Calendar Day
BRIC- Building Resilient Infrastructure and Communities
BSEE- Bureau of Safety and Environmental Enforcement
C2M2- Cybersecurity Capability Maturity Model
CBP- U.S. Customs & Border Protection
CDBG- Community Development Block Grant
CED- Cabinet for Economic Development
CESER- Cybersecurity, Energy Security, and Emergency Response
CEQ- Council on Environmental Quality
CHFS- Cabinet for Health and Family Services
CHP- Combined Heat and Power
CISA- Cybersecurity and Infrastructure Security Agency
CISO- Chief Information Security Officer
CJIC-Commonwealth Joint Information Center
CMV- Commercial Motor Vehicles
COOP- Continuity of Operations
DAIL- Department of Aging and Independent Living
DCBS- Department for Community Based Services
DCS- Distributed Control Systems
DEP- Department for Environmental Protection
DER- Distributed Energy Resources
DHS- Department of Homeland Security
DLG- Department for Local Government
DNG- Downstream Natural Gas
DNR- Department of Natural Resources
DOC- Department of Commerce
DOD- Department of Defense
DOE- Department of Energy
DOI- Department of the Interior
DOJ- Department of Justice
DPH- Department for Public Health
D-SNAP- Disaster Supplemental Nutrition Assistance Program
EAGLE-I- Environment for Analysis of Geo-Located Energy Information
EEAC- Energy Emergency Assurance Coordinator
EEAG- Energy Efficiency Advisory Group
EEC- Energy and Environment Cabinet
EIA- Energy Information Administration
EJ- Environmental Justice

EKPC- East Kentucky Power Cooperative
EPRI- Electric Power Research Institute
ERT- Emergency Response Team
ESF- Emergency Support Function
ESP- Energy Security Plan
EPA- Environmental Protection Agency
EV- Electric Vehicle
EVIDP- Electric Vehicle Infrastructure Deployment Plan
FAC- Finance and Administration Cabinet
FBI- Federal Bureau of Investigation
FCO- Federal Coordinating Officer
FEMA- Federal Emergency Management Agency
FERC- Federal Energy Regulation Commission
FHWA- Federal Highway Administration
FMCSA- Federal Motor Carrier Safety Administration
FNS- Food Nutrition Service
FOUO- For Official Use Only
GDP- Gross Domestic Product
GHG- Green House Gas
GII- Geospatial Information Infrastructure
GIS- Geographic Information System
HIFLD- Homeland Infrastructure Foundation-Level Data
HMGP- Hazard Mitigation Grant Program
HOS- Hours of Service
HQ- Headquarters
ICS- Incident Command Structure
IEEE- Institute of Electrical and Electronics Engineers
IIJA- Infrastructure Investment and Jobs Act
IMAT- Incident Management Assistance Team
IMT- Incident Management Team
IOU- Investor Owned Utilities
IRS- Internal Revenue Service
ISAC- Information Sharing and Analysis Centers
ISERnet- Infrastructure Security and Energy Restoration
IT- Information Technology
JFO- Joint Field Office
JIC- Joint Information Center
KACO- Kentucky Association of Counties
KAR- Kentucky Administration Regulation
KDA- Kentucky Department of Agriculture
KHC- Kentucky Housing Corporation
KIFC- Kentucky Intelligence Fusion Center
KLC- Kentucky League of Cities
KOAG- Kentucky Office of the Attorney General
KOHS- Kentucky Office of Homeland Security
KRS- Kentucky Revised Statutes
KV- Kilovolts
KYNG- Kentucky National Guard
KYNG JOC- Kentucky National Guard Joint Operating Center
KYTC- Kentucky Transportation Cabinet
KYEM- Kentucky Emergency Management
KMUA- Kentucky Municipal Utilities Association
LGEKU- Louisville Gas and Electric Company and Kentucky Utilities
LIHEAP- Low-Income Home Energy Assistance Program
LEAD- Low-Income Energy Affordability Data
LiDAR- Light Detection and Ranging
LLET- Limited Liability Entity Tax
LPG- Liquefied Petroleum Gas
MACHH2- Mid-Atlantic Clean Hydrogen Hub
MISO- Midcontinent Independent System Operator
MOC- Manager on Call
MS ISAC- Multi State Information Sharing and Analysis Centers
MW- Megawatts
MWPSR- Midwest Petroleum Shortage Response Collaborative
NASEO- National Association of State Energy Officials

NARUC- National Association of Regulatory Utility Commissioners
NEMA- National Electrical Manufactures Association
NERC- North American Electric Reliability Corp
NEVI- National Electric Vehicle Infrastructure
NGA- National Governors Association
NGL- Natural Gas Liquids
NIMS- National Incident Management System
NIPP- National Infrastructure Protection Plan
NMSZ- New Madrid Seismic Zone
NOAA- National Oceanic & Atmospheric Administration
NRC- Nuclear Regulatory Commission
NRCC- National Response Coordination Center
NRECA- National Rural Electric Cooperative Association
NRF- National Response Framework
OAG- Office of the Attorney General
OCP- Office of Consumer Protection
OMB- Office of Management and Budget
OMS- Outage Management System
ONG- Oil and Natural Gas
OOC- Office of Communications
OPS- Office of Pipeline Safety
OSC- Operating Section Chief
PA- Public Assistance
PADD- Petroleum Administration for Defense Districts
PCI- Pipeline Cybersecurity Initiative
PHMSA- Pipeline and Hazardous Material Safety Administration
PII- Personal Identifiable Information
PIO- Public Information Officer
PJM- Pennsylvania, New Jersey, and Maryland
PMA- Power Marketing Administrations
PSC- Public Service Commission
PUC- Public Utility Commission
PV- Photovoltaics
RC3- Rural Cooperative Cybersecurity Capabilities
RDUP- Rural Development Utilities Program
RECC- Rural Electric Cooperative Companies
RRAP- Regional Resiliency Assessment Program
RSF- Recovery Support Functions
RVP- Reed Vapor Pressure
SCADA- Systems and Supervisory Control and Data Acquisition
SEDS- State Energy Data System
SEOC- State Emergency Operations Center
SEO-EEC- Kentucky Energy and Environment Cabinet’s State Energy Office
SEOP- State Emergency Operations Plan
SEP- State Energy Program
SEPA- Smart Electric Power Alliance
SIT REP- Situation Report
SLOPE- State and Local Planning for Energy
SLTT- State, Local, Tribal, and Territorial
SOP- Standard Operating Procedure
SPR- Strategic Petroleum Reserve
SPR- Stakeholder Preparedness Review
SPSRC- Southeast Petroleum Shortage Response Collaborative
STB- Surface Transportation Board
SWPA- Southwestern Power Administration
THIRA- Threat and Hazard Identification and Risk Assessment
TVA- Tennessee Valley Authority
TSA- Transportation Security Administration
USACE- United States Army Corps of Engineers
USDA- United States Department of Agriculture
USDOC- United States Department of Commerce
USDOT- United States Department of Transportation
USEPA- United States Environmental Protection Agency
VLP- Vent Line Protectors
WAP- Weatherization Assistance Program **WAPA-** Western Area Power Administration
WHEJAC- White House Environmental Justice Advisory Council

APPENDIX A:

Emergency Support Functions

(ESF)

Appendix A: EMERGENCY SUPPORT FUNCTION (ESF)

ESF 1 - Transportation, Provides overall supervision of the Commonwealth transportation infrastructure to include identifying road closures on all state and local roads as well as conducting usability inspections of bridges and other transportation support structures throughout the Commonwealth for use as emergency supply and evacuation routes. Provides for coordination, control, and allocation of transportation assets in support of the movement of emergency resources including the evacuation of people, and the redistribution of food and fuel supplies. They also contract for repair and/or reconstruction of transportation infrastructure. ESF 1 also provides for coordination, control and allocation of assets for emergency ice, snow, and debris removal.

ESF 2 – Communications, Coordinates the delivery of emergency communications systems and equipment to first responders and emergency managers. ESF 2, in coordination with the Commonwealth Office of Technology and commercial providers, assists in the restoration of commercial communications to government agencies.

ESF 3 - Public Works and Engineering, Identifies and procures engineering and construction services necessary to provide or restore critical public facilities such as water and sewer systems damaged during disasters. Procured services include provisions of emergency power supplies for critical facilities, potable water and sewer infrastructure, coordination of emergency repairs to public facilities, appropriate construction services (e.g. electrical, plumbing, soils), and emergency demolition or stabilization of damaged structures and facilities designated as hazards to public health.

ESF 4 – Firefighting, Provides for mobilization and deployment, and assists in coordinating structural firefighting resources to combat forest and wild land or urban incidents. ESF 4 provides incident management assistance for on-scene incident command and control operations.

ESF 5 - Emergency Management, Provides for the overall coordination of the Commonwealth's emergency operations in support of state and local governments. For decision-making purposes, ESF 5 collects, analyzes, and disseminates critical information on emergency operation.

ESF 6 - Mass Care, Emergency Assistance, Temporary Housing, and Human Services

Coordinates sheltering, feeding, and first aid for disaster victims and pets. ESF 6 also provides for temporary housing, food, clothing, and special human needs in situations that do not warrant mass-care systems.

ESF 7 – Logistics, Coordinates the acquisition of response resources through mutual aid agreements and procurement procedures for all functional areas or groups, as needed. Provides for coordination and documentation of personnel, equipment, supplies, facilities, and services used during disaster response and initial relief operations.

ESF 8 - Public Health and Medical Services, Coordinates care and treatment for the ill and injured and mobilizes trained health and medical personnel and other emergency medical supplies, materials and facilities. ESF 8 provides public health and environmental sanitation services, disease and vector control, and the collection, identification, and protection of human remains.

ESF 9 - Search and Rescue, Coordinates resources for ground, water, and airborne activities to locate, identify, and remove from a stricken area, persons lost or trapped in buildings and other structures from stricken area. SAR also provides for specialized emergency response and rescue operations. Performs health and wellness assessments.

ESF 10 – Oil and Hazardous Materials Response, Coordinates effective local, state, federal, and private sector efforts in reducing or removing the danger to public health, safety, and the environment from threatened or actual incidents involving oil or hazardous material releases

ESF 11 – Agriculture and Natural Resources, Coordinates response to any incident, real or perceived, relating to the appearance of a communicable disease or condition within the Commonwealth of Kentucky's animal or plant population that could have a direct impact on productivity, exporting animal and plant products, and public health.

ESF 12 – Energy, Coordinates all energy resources within the Commonwealth for use during an emergency. Coordinates with the private sector for the emergency repair and restoration of critical public energy utilities, (i.e. gas, electricity, etc.). Coordinates the rationing and distribution of emergency power and fuel, as necessary.

ESF 13 - Public Safety and Security, Coordinates for the protection of life and property by enforcing laws, orders, and regulations, including the movement of persons from threatened or hazardous areas. Provides for area security, traffic, and access control in impacted areas.

ESF 14 - Cross-Sector Business and Infrastructure, Supports the coordination of cross-sector operations, including stabilization of key supply chains and community lifelines, among infrastructure owners and operators, businesses, and their government partners.

ESF 15 - External Affairs, Coordinates the Joint Information Center (JIC) and provides emergency public information through the Joint Information System (JIS). ESF 15 coordinates all public affairs messages and public information requirements and constructs the executive messages in support of incident or emergency requirements.

Attachment 1:

Energy Emergency Response Playbook for States and Territories

U.S. DEPARTMENT OF ENERGY | Office of Cybersecurity, Energy Security, and Emergency Response

NASEO National Association of State Energy Officials

Energy Emergency Response Playbook for States and Territories

May 2022

This resource was produced by the U.S. Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) to aid states in energy emergency planning. States may choose to incorporate parts or all of the provided material (optional) in their State Energy Security Plans (SESPs). States are encouraged to adapt or supplement the provided material to align with existing state roles, authorities, and plans; and to better address state-specific needs and situations.

Acknowledgement

The *Energy Emergency Response Playbook for States and Territories* was developed through the partnership with U.S. Department of Energy's (DOE) Office of Cybersecurity, Energy, Security, and Emergency Response (CESER) and the National Association of State Energy Officials (NASEO). Brandi Martin (DOE CESER) led the development of the Playbook with support from Campbell Delahoyde (NASEO), and Kirsten Verclas (NASEO).

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Disclaimer

Introduction

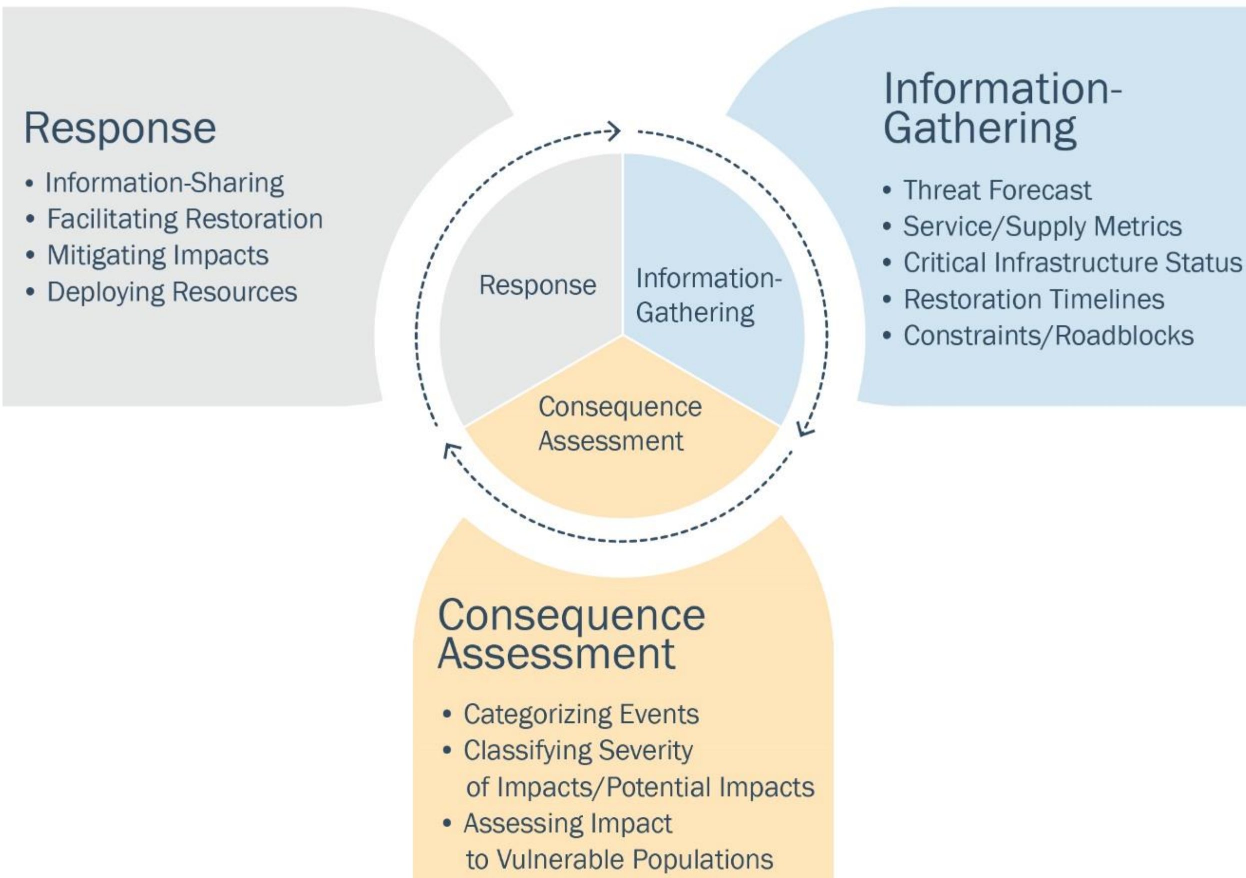
The *Energy Emergency Response Playbook for States and Territories* provides State Energy Offices with preparing for, responding to, and recovering from energy emergencies. The Playbook is intended to complement (but not replace) State Energy Security Plans (SESPs) by providing guidance on how and when to utilize authorities and response actions detailed in SESPs. This Playbook presumes that SESPs are in place and that state emergency response roles and responsibilities are defined and understood.

This Playbook provides a starting point for energy emergency response planning, including a framework for evaluating energy emergencies, guidance and templates for emergency response actions, and other supplemental planning, monitoring, and response resources. This Playbook is not intended to be prescriptive or suggest non-statutory expansion of State Energy Office responsibilities or purview during energy emergencies. Responsibilities may vary significantly from state to state.

Playbook users (state and territorial energy officials) are encouraged to add to, edit, and expand this Playbook to include additional state-specific actions, resources, and responsibilities. Users are encouraged to make structural edits that best meet their unique needs or to best integrate with existing plans, policies, and procedures. After customizing this Playbook to fit state-specific structures and authorities, states may incorporate the Playbook as part of their SESPs.

Playbook Structure

Emergency management is a continuous cycle of Preparedness → Response → Recovery → Mitigation. This Playbook focuses on the Response part of the cycle. Responding to energy emergencies involves an iterative process of gathering information, assessing the actual or potential consequences of the incident, and taking action to share critical information, facilitate system restoration, and mitigate impacts to dependent lifeline sectors and consumers. This process is repeated over the course of an emergency with response actions adapting to changing conditions as the situation evolves.



This Playbook is arranged into three sections that align with the three stages of the Response Cycle. Each section provides guidance and resources that are tailored to emergencies involving power, liquid fuel, and natural gas systems. Supplemental information is provided in the appendices.

The Playbook includes:

The Playbook includes appendices with supplemental information for emergency response planning:

APPENDIX B:

Chapter 39A Kentucky Revised Statutes

Appendix B: Chapter 39A Kentucky Revised Statues

39A.100 Emergency powers of Governor and local chief executive officers.

(1) In the event of the occurrence or threatened or impending occurrence of any of the situations or events contemplated by KRS 39A.010, 39A.020, or 39A.030, the Governor may declare, in writing, that a state of emergency exists. The Governor shall have and may exercise the following emergency powers during the period in which the state of emergency exists:

(a) To enforce all laws, and administrative regulations relating to disaster and emergency response and to assume direct operational control of all disaster and emergency response forces and activities in the Commonwealth;

(b) To require state agencies and to request local governments, local agencies, and special districts to respond to the emergency or disaster in the manner directed;

(c) To seize, take, or condemn property, excluding firearms and ammunition, components of firearms and ammunition, or a combination thereof, for the protection of the public or at the request of the President, the Armed Forces, or the Federal Emergency Management Agency of the United States, including:

1. All means of transportation and communication;

2. All stocks of fuel of whatever nature;

3. Food, clothing, equipment, materials, medicines, and all supplies; and

4. Facilities, including buildings and plants;

(d) To sell, lend, give, or distribute any of the property under paragraph (c) of this subsection among the inhabitants of the Commonwealth and to account to the State Treasurer for any funds received for the property;

(e) To make compensation for the property seized, taken, or condemned under paragraph (c) of this subsection;

(f) To exclude all nonessential, unauthorized, disruptive, or otherwise uncooperative personnel from the scene of the emergency, and to command those persons or groups assembled at the scene to disperse. A person who refuses to leave an area in which a written order of evacuation has been issued in accordance with a written declaration of emergency or a disaster may be forcibly removed to a place of safety or shelter, or may, if this is resisted, be arrested by a peace officer. Forcible removal or arrest shall not be exercised as options until all reasonable efforts for voluntary compliance have been exhausted;

(g) To declare curfews and establish their limits;

(h) To prohibit or limit the sale or consumption of goods, excluding firearms and ammunition, components of firearms and ammunition, or a combination thereof, or commodities for the duration of the emergency;

(i) To grant emergency authority to pharmacists pursuant to KRS 315.500, for the duration of the emergency;

(j) Except as prohibited by this section or other law, to perform and exercise other functions, powers, and duties deemed necessary to promote and secure the safety and protection of the civilian population;

(k) To request any assistance from agencies of the United States as necessary and appropriate to meet the needs of the people of the Commonwealth; and

(l) Upon the recommendation of the Secretary of State, to declare by executive order a different time, place, or manner for holding elections in an election area for which a state of emergency has been declared for part or all of the election area. The election shall be held within thirty-five (35) days from the date of the suspended or delayed election. The State Board of Elections shall establish procedures for election officials to follow. Any procedures established under this paragraph shall be subject to the approval of the Secretary of State and the Governor by respective executive orders.

(2) In the event of the occurrence or threatened or impending occurrence of any of the situations or events contemplated by KRS 39A.010, 39A.020, or 39A.030, which in the judgment of a local chief executive officer is of such severity or complexity as to require the exercise of extraordinary emergency measures, the county judge/executive of a county other than an urban-county government, or mayor of a city or urban-county government, or chief executive of other local governments or their designees as provided by ordinance of the affected county, city, or urban county may declare in writing that a state of emergency exists, and thereafter, subject to any orders of the Governor, shall have and may exercise for the period as the state of emergency exists or continues, the following emergency powers:

(a) To enforce all laws and administrative regulations relating to disaster and emergency response and to direct all local disaster and emergency response forces and operations in the affected county, city, urban-county, or charter county;

(b) To exclude all nonessential, unauthorized, disruptive, or uncooperative personnel from the scene of the emergency, and to command persons or groups of persons at the scene to disperse. A person who refuses to leave an area in which a written order of evacuation has been issued in accordance with a written declaration of emergency or a disaster may be forcibly removed to a place of safety or shelter, or may, if this is resisted, be arrested by a peace officer. Forcible removal or arrest shall not be exercised as options until all reasonable efforts for voluntary compliance have been exhausted;

(c) To declare curfews and establish their limits;

(d) To order immediate purchase or rental of, contract for, or otherwise procure, without regard to procurement codes or budget requirements, the goods and services essential for protection of public health and safety or to maintain or to restore essential public services; and

(e) To request emergency assistance from any local government or special district and, through the Governor, to request emergency assistance from any state agency and to initiate requests for federal assistance as are necessary for protection of public health and safety or for continuation of essential public services.

(3) Nothing in this section shall be construed to allow any governmental entity to impose additional restrictions on the lawful possession, transfer, sale, transport, carrying, storage, display, or use of firearms and ammunition or components of firearms and ammunition.

Effective: April 15, 2020
History: Amended 2020 Ky. Acts ch. 91, sec. 74, effective April 15, 2020. -- Amended 2010 Ky. Acts ch. 22, sec. 3, effective July 15, 2010. -- Amended 2006 Ky. Acts ch. 7, sec. 1, effective March 8, 2006; and ch. 240, sec. 10, effective July 12, 2006. -- Amended 2005 Ky. Acts ch. 91, sec. 1, effective June 20, 2005. -- Created 1998 Ky. Acts ch. 226, sec. 9, effective July 15, 1998

https://apps.legislature.ky.gov/law/statutes/chapter.aspx?id=37202

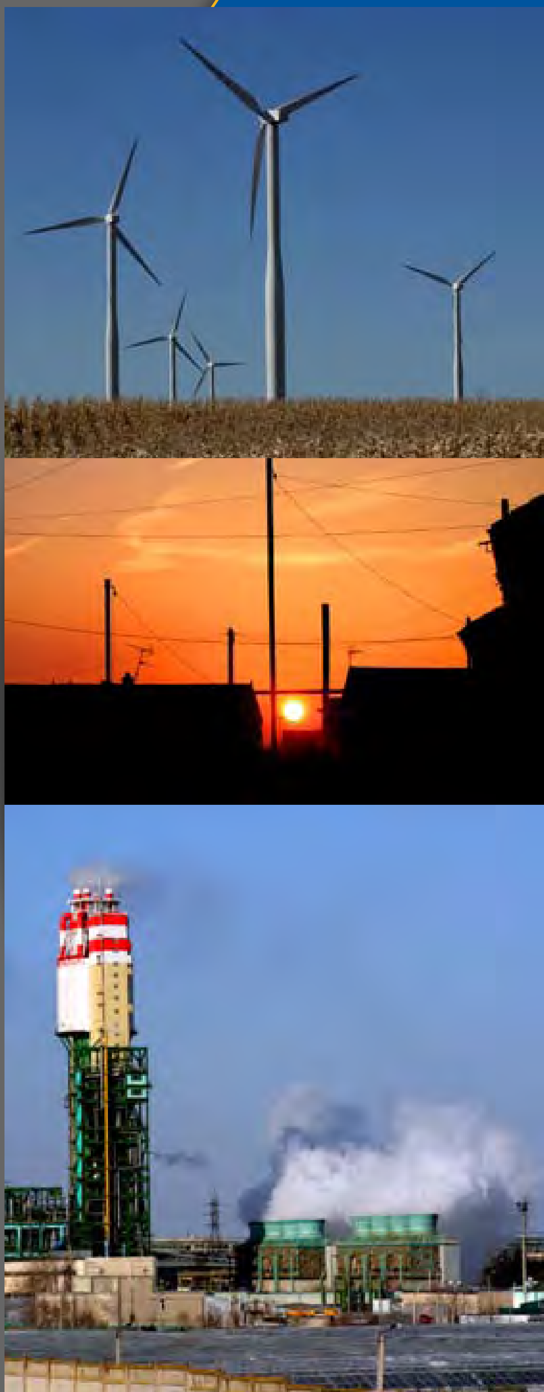
APPENDIX C:

Kentucky Energy Sector Emergency Response Contact List

APPENDIX D:

NASEO Energy Security Plan Guidance

State Energy Assurance Guidelines



NASEO National Association of State Energy Officials

Transforming America's Energy Future

National Association of Regulatory Utility Commissioners
Dedicated to Public Service
1889

Version 3.1
December 2009

Attachment 1:

DOE Energy Security Plan Guidance

STATE ENERGY SECURITY PLAN GUIDANCE

The energy sector is uniquely critical as all other critical infrastructure sectors depend on power and/or fuel to operate. An impact on critical energy infrastructure can directly affect the security and resilience within and across other critical infrastructure sectors – threatening public safety, the economy, and national security.

Energy Security Planning ensures a **reliable** and **resilient** supply of energy through efforts to **identify, assess, and mitigate risks** to energy infrastructure and to **plan for, respond to and recover** from events that disrupt energy supply. Our nation's energy infrastructure and delivery systems are vulnerable to a variety of threats and hazards, including severe weather (exacerbated by climate change), cyberattacks, system failures, pandemics, and deliberate physical attacks. Because most of the nation's critical infrastructure is owned and operated by private companies, both the government and private sector have a mutual incentive to reduce the risk of disruptions to critical infrastructure. It is the responsibility of state and local officials to work with energy providers, across government agencies and with relevant stakeholders to reduce the risk, vulnerabilities, and consequences of an energy disruption or emergency and provide for rapid recovery.

State energy security plans (SESP) are an essential part of energy security planning. SESPs describe the state's energy landscape, people, processes, and the state's strategy to build energy resilience. More specifically, the plans detail how a state, working with energy partners, can secure their energy infrastructure against all physical and cybersecurity threats; mitigate the risk of energy supply disruptions to the State; enhance the response to, and recovery from, energy disruptions; and ensure that the state has secure, reliable, and resilient energy infrastructure.

The purpose of this guidance is to provide clarity and detail on the six elements outlined in Section 40108 of the bipartisan *Infrastructure Investment and Jobs Act* (IIJA) hereafter referred to as the "BIL." The U.S. Department of Energy's (DOE) goal is to support states and provide additional clarification beyond the text of the BIL.

The guidance below is the DOE's interpretation of how the six elements could be met – it is not exhaustive. Other methods for meeting the six elements are also acceptable. The example plan layout below provides a logical flow of information, organizing the six elements into practical sections that reduce redundancies. DOE understands that states are working from existing energy security plans and that each of those plans is different. DOE anticipates that states will use different approaches to address the six elements described in the BIL. States do not have to follow this exact format or flow listed below. This is intended to provide examples and to serve as a reference only.

The guidance also references drop-in resources from the Office of Cybersecurity, Energy Security and Emergency Response (CESER) that will be available in early May 2022. Use of these resources is optional. States can use part or the full "drop-in" and customize for their state needs. These resources are intended to assist states in satisfying the elements outlined in the BIL.

BIL 40108 Provision Excerpt:

FINANCIAL ASSISTANCE FOR STATE ENERGY SECURITY PLANS. —Federal financial assistance made available to a State under this part may be used for the development, implementation, review, and revision of a State energy security plan that—

1) assesses the existing circumstances in the State; and
2) proposes methods to strengthen the ability of the State, in consultation with owners and operators of energy infrastructure in the State
    a. to **secure** the energy infrastructure of the State against all physical and cybersecurity threats;
    b. to **mitigate** the **risk** of energy supply disruptions to the State; and to **enhance the response** to, and **recovery** from, energy disruptions; and
    c. to ensure that the State has **reliable**, secure, and resilient energy infrastructure.

Contents of Plan. --A State energy security plan shall--

(1) address all energy sources and regulated and unregulated energy providers;

(2) provide a State energy profile, including an assessment of energy production, transmission, distribution, and end-use;

(3) address potential hazards to each energy sector or system, including--
    - physical threats and vulnerabilities; and ``
    - cybersecurity threats and vulnerabilities; ``

(4) provide a risk assessment of energy infrastructure and cross-sector interdependencies;

(5) provide a risk mitigation approach to enhance reliability and end-use resilience; and

(6) address
    - multi-State and regional coordination, planning, and response; and
    - coordination with Indian Tribes with respect to planning and response; and
    - to the extent practicable, encourage mutual assistance in cyber and physical response plans.

STATE ENERGY SECURITY PLAN FRAMEWORK

SECTION	DESCRIPTION	Relative BIL Section (Elements 1-6)
1. Intro / Navigation	• Describes purpose of each section	
2. Energy Landscape and Risk Profiles	**State Energy Profile:** Provide baseline data, maps, and other information on state markets and infrastructure for all energy sources (electricity, liquid fuels, and natural gas), including: • **Production** – in-state energy production, including electricity generation by fuel and oil and gas upstream production and refining/processing • **Transmission** - interstate energy transfers and imports, including information on major pipelines, transmission lines, and marine and rail infrastructure • **Distribution** – overview of energy providers in the state, including electric utilities, natural gas local distribution companies, and liquid fuels terminal operators and fuel distributors • **End-Use**- energy demands, including information on seasonal and intraday variability, demands by sector, and any state-specific fuel specifications As appropriate, the profile should include discussion of wider interstate and regional energy markets.	1 address all energy sources and regulated and unregulated energy providers; 2 provide a State energy profile, including an assessment of energy production, transmission, distribution, and end-use;
	Threats/Vulnerabilities: Provide information on threats and vulnerabilities to state or regional energy sectors or systems. • Threat information includes anything that can expose a vulnerability and damage, destroy, or disrupt energy systems, including natural, technological, manmade/physical, and cybersecurity hazards. • Vulnerabilities are weaknesses within infrastructure, processes, and systems, or the degree of susceptibility to various threats. Vulnerabilities may be specific to the threat, energy type, and infrastructure component. Information for this section can be drawn from several sources, including DOE state risk profiles, state hazard mitigation plans, state integrated resource plans, utility emergency plans, and after-action reports for previous incidents, and discussions with energy system operators and other stakeholders.	3 address potential hazards to each energy sector or system, including— a. physical threats and vulnerabilities; and b. cybersecurity threats and vulnerabilities;
	Assessing risk to energy infrastructure is a complex, ever evolving, and continuous process with many different stakeholders and systems. Knowing how susceptible an energy asset is to a disruption (natural or man-made) allows decision makers to focus resources on better protecting the most vulnerable assets. **Assessment:** Conduct risk assessments and analyze cross-sector interdependencies for energy infrastructure assets within the state.	4 provide a risk assessment of energy infrastructure and cross-sector interdependencies;

	• <u>Risk Assessment of Energy Infrastructure:</u> Risk is defined as the potential for loss, damage, or destruction of key resources or energy system assets resulting from exposure to a threat. Risk assessments consider the consequence of an asset's loss, the vulnerability of an asset to specific threats, and the likelihood that an asset will be exposed to a specific threat. Certain energy infrastructure assets may be especially important to ensuring energy infrastructure continuity. Being able to identify the assets that are most critical to the infrastructure or that provide significant support to other critical infrastructure systems helps to determine overall risk and prioritize mitigation strategies more effectively. *(Risk assessments may help inform prioritization of 40101 funds)* <u>Cross-Sector Interdependencies</u>: consider interdependencies between the energy sector and other sectors and between different energy sub-sectors (electricity, liquid fuels, and natural gas). Understanding the interconnected nature of energy infrastructure and the interdependencies can identify the possible cascading impacts of a disruption.	
3. Energy Security and Emergency Response Authorities	a) Provide relevant authorities, doctrines, and guiding statutes for energy security and emergency response activities, including federal, state, and local government authorities and emergency response structures.	**1** assesses the existing circumstances in the State
4. Energy Security Planning & Preparedness	a) Document State Energy Office roles and responsibilities, which may include monitoring energy markets, mutual assistance work, holding/ participating in staff training & exercises, engaging with stakeholders, updating the energy security plan, completing after-action reports, and undergoing continuous improvement b) Roles of Other State Entities c) Describe Tribal Coordination d) Describe coordination, planning and response activities with neighboring states and the region. Include city and county coordination as appropriate.	**6** a) address i. multi-State and regional coordination, planning, and response; and ii. coordination with Indian Tribes with respect to planning and response; iii. encourage mutual assistance in cyber and physical response plans.
5. Energy Emergency Response	Describe response actions /authorities for energy emergencies, including power outages/electricity shortages, liquid fuels shortages, and natural gas shortages. Components may include: a) Response Cycle Overview b) Information Gathering/Situational Awareness c) Event Consequence Assessment d) Response Actions	**6, 2b** … mitigate the risk of energy supply disruptions to the State; and to enhance the response to, and recovery from, energy disruptions;
6. Energy Resiliency & Hazard Mitigation	a) Mitigation approach: provide a strategy for reducing the potential consequences of energy disruptions. The mitigation strategy should describe how energy sector stakeholders will accomplish the goals of strengthening energy sector reliability, enhancing energy supply resilience for end-users, and securing critical energy infrastructure. The approach to prioritize funding and implementation should leverage a risk assessment if feasible. Specific projects and activities can be mentioned. *b) Link to 40101 (optional)*	**5** provide a risk mitigation approach to enhance reliability and end-use resilience; and other entities responsible for— a. maintaining fuel or electric reliability; and b. securing energy infrastructure.
7. Appendix		

STATE ENERGY SECURITY PLAN (SESP) DETAILED FRAMEWORK

1) INTRO/NAVIGATION

2) ENERGY & RISK PROFILES (1, 2, 3, 4)

a) **State Energy Profile:** Overview of energy supply, demand, import/export, and infrastructure. Includes EIA data, maps, and lists of key infrastructure and service providers. For all energy types: Electricity (includes: coal, nuclear, and renewable energy), Natural Gas, and Liquid Fuels (includes: biofuels and propane)
   - *i) CESER instructions: How to develop a profile using EIA Data*
   - *ii) Limited example based on EIA data with appropriate analysis*

b) **Threats/Vulnerabilities:**
   - i) Threats
     - (1) Data on historic emergency events and energy disruptions
       - *(a)* CESER State and Regional Risk Profiles
     - (2) Cybersecurity Threats
       - *(a) Drop-in: Cyber IT / OT overview and 2 graphics*
       - *(b) Drop-In: Conversation guidance to gather state specific information*
   - ii) Vulnerabilities
     - (1) Descriptions of vulnerabilities
       - *(a) Drop-In: CESER developed supply chain graphics for each energy type*

c) **Risk Assessment:**
   - (1) Cross-Sector Interdependencies:
     - (a) Description of interdependencies
     - *(b) Drop-In: CESER developed 3 diagrams*
   - (2) Risk Assessment of Critical Infrastructure:
     - (a) State Critical Infrastructure Analysis

3) ENERGY SECURITY AND EMERGENCY RESPONSE AUTHORITIES (1)

a) **Relevant Authorities, Doctrines, and Guiding Statutes**
   - i) Requirements to have SESP and plan to maintain and strengthen
   - ii) Authorities
     - (1) Relevant Federal Authorities & Organization Structure
       - *(a) Drop-In: Federal Authorities*
     - (2) Relevant State Authorities
       - (a) emergency response laws and authorities' relevant to energy resources
       - (b) Other state departments or agencies which deal with interdependent sectors (Air Quality, Transportation, Water/Wastewater, Health, etc.
     - (3) Relevant local and tribal authorities (e.g., home rule)

4) ENERGY SECURITY PLANNING & PREPAREDENESS (6)

a) **State Energy Office Roles and Responsibilities**
   i) State Energy Office Responsibilities
      (1) **Monitoring Energy Markets**
         (a) Monitor market and supply data
         (b) Review DOE CESER communications on threats/events
      (2) **Assess Mitigation, Impact and Response Actions** (e.g., conservation, regulatory, consumer protection, waivers, supply acquisition, subsidies)
      (3) **State Energy Emergency Assurance Coordinators (EEAC) Program**
         (a) Drop-In: EEAC overview
      (4) **Stakeholder Engagement**
         (a) Sustain relationships with public and private energy suppliers and other key stakeholders
         (b) Maintain stakeholder contact lists
            (i) Drop-In: Contact list template (part of emergency playbook)
      (5) **Staff Training and Exercises**
      (6) **After Action Reporting, Evaluation, and Continuous Improvement**
      (7) **State emergency response responsibilities**
         (a) Coordination and Roles
         (b) Public Information Program
         (c) With non-government and private sector entities (NASEO included)
         (d) With other states (Multi-State Coordination)
         (e) With federal government
         (f) Contacts (refer to annex)

b) **Roles of Other State Entities Relating to Energy Security**
   i) Governor's Office
   ii) Governor's Energy Advisor
   iii) Public Utility Commissions (PUC)
   iv) Emergency Management Agencies (EMA)
   v) Homeland Security Agency (HSA)
   vi) Fusion Center

c) **Tribal Coordination**
   i) Coordination with Indian Tribes with respect to planning and response;

d) **Regional Structures and Coordination**
   i) Applicable elements from other states' plans in region
   ii) Regional implementation plans and any agreements/MOUs/plans related to mutual assistance to cyber and physical responses.

5) ENERGY EMERGENCY RESPONSE (6, 2B)

(Drop-In: CESER/NASEO customizable state Energy Emergency Response Playbook)

a) **Response Cycle Overview**
   i) Information Gathering a Consequence Assessment a Response

b) **Information Gathering/Situational Awareness** (for each energy type)
   i) Situational Awareness Tools (e.g., DOE tools, EIA tools)
   ii) Weather Threat Monitoring Tools (e.g., NOAA hurricane tracks, blizzard forecasts)
   iii) Industry, Peer, and Regional Outreach

c) **Consequence Assessment Guidelines** (for each energy type)
   i) Guidance on Event Classification/Ratings: Tiers of event consequences

- ii) Event Assessment Factors:
  - (1) Threat Information (identify threats to energy infrastructure)
  - (2) Impacts to energy consumers
  - (3) Impacts to critical energy delivery systems (e.g., critical power plants)
  - (4) Impacts to bulk/ wholesale energy markets (e.g., bulk fuel stocks)

d) **Response Actions**
- i) Response Action Matrices
  - (1) Event Type (Power Outage, Natural Gas Shortage, Liquid Fuels Shortage, Multi-System Failure)
    - (a) Event consequence tiers and event stage (pre-event, response/restoration)

6) ENERGY RESILIENCY & HAZARD MITIGATION (5)

a) **State approach** (prioritization, grants, public-private partnerships)
- *i) Drop-In: CESER developed a simple list of general mitigation measures (e.g., system segmentation, smart grids, backup generation at gas stations) as well as measures by hazard type. (e.g., raising substations in flood prone areas)*

7) APPENDICIES

a) **Appendix: SESP Connection to Relevant State Plans**
- i) Long term State Energy Plans
- ii) Hazard Mitigation Plans
- iii) Climate Adaptation Plans
- iv) Resilience Plans
- v) Critical Infrastructure Protection Plans
- vi) State COOP plans
- vii) Utility Integrated Resource Plans
- viii) Citizen Service Programs (LIHEAP, WAP, assistance programs, etc.)
- ix) Others

b) **Other Relevant Energy Sector Risk Assessments/Resources**
- i) NIPP, THIRA – energy integration, Cybersecurity Risk Assessments

c) **Appendix: Data/Situational Tools** *(Drop-in: included in emergency playbook)*
- i) EAGLE-I
- ii) ISO System Condition Pages
- iii) EIA: Grid Monitor, Weekly Petroleum Status Report, Heating Fuels and Energy Atlas
- iv) Natural Gas Pipeline Online Bulletin Boards

APPENDIX E:

KENTUCKY ENERGY PROFILE 2023

Kentucky Energy Profile

8th Edition • 2023

TEAM KENTUCKY

ENERGY AND ENVIRONMENT CABINET

Executive Summary

The Kentucky Energy and Environment Cabinet (EEC) offers the Kentucky Energy Profile 2023 to serve as an impartial point of reference for the general public and as a foundation for discussing Kentucky's energy future.

In 2020, after more than two centuries of commercial mining operations, Kentucky's domestic supply of coal remained a primary source of energy. Kentucky is the seventh-largest coal producing state in the United States with 95% of the coal staying in the US and 46% being used in-state (pg. 52-53). Coal accounts for 69% of Kentucky's electricity portfolio (pg.16) and 32% of its total energy consumption (pg. 37-38). Although coal is Kentucky's primary energy source (76%), the state also produces small amounts of oil (pg. 55) and natural gas (pg. 59). Kentucky also has growing renewable energy resources and opportunities (pg. 60-64).

Kentucky's low energy costs stimulate economic growth by lowering the costs of doing business. Kentucky was tied for the fourth lowest industrial electricity price in the United States in 2020 and tied for the second-lowest east of the Mississippi River (pg. 8-10). In 2020, 39% of the energy and electricity consumed in Kentucky went to manufacturing (pg. 16), which remains Kentucky's largest source of revenue and one of the leading sources of employment (pg. 5). In addition to large flagship manufacturers, Kentucky is also home to other energy-intensive manufacturing processes and a growing commercial sector. Kentucky is also a transportation and logistics hub, which consume large amounts of transportation fuels to ship manufactured goods around the United States and the world.

While Kentucky maintains one of the lowest electricity prices in the United States (pg. 8-12), electricity prices do vary across the Commonwealth and between utilities. Electricity in Kentucky is supplied by 173 individual electricity generating units at 52 power plants across the state (pg. 20-21). In 2020, our utility power plants average 31 years of age, with our oldest hydroelectric station being built in 1925 and the newest solar facilities coming online in 2019. Electricity is sold by six major electric utilities and dozens of smaller municipalities, as shown on the maps (pg. 14-15). Each major electric utility is profiled (pg. 24-35), as well as each coal-fired power plant (pg. 70-105). Kentucky's power plants have reduced emissions of pollutants such as sulfur dioxide and nitrogen oxides by more than 85% since 1995 (pg. 23), as shown on the profile for each utility and power plant.

Direct all inquiries or feedback to Evan Moser (Evan.Moser@ky.gov). All of the data in this report are public information aggregated from a variety of state and federal government agencies, and are available at: https://eec.ky.gov/Energy/News-Publications/Pages/Kentucky-Energy-Profile.aspx

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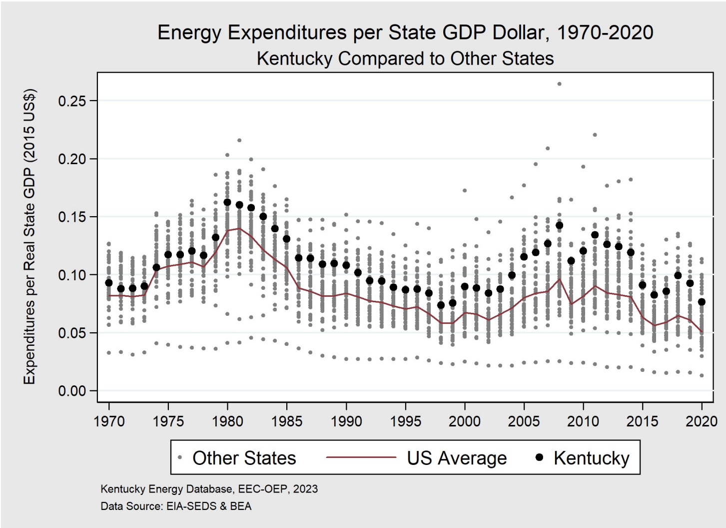
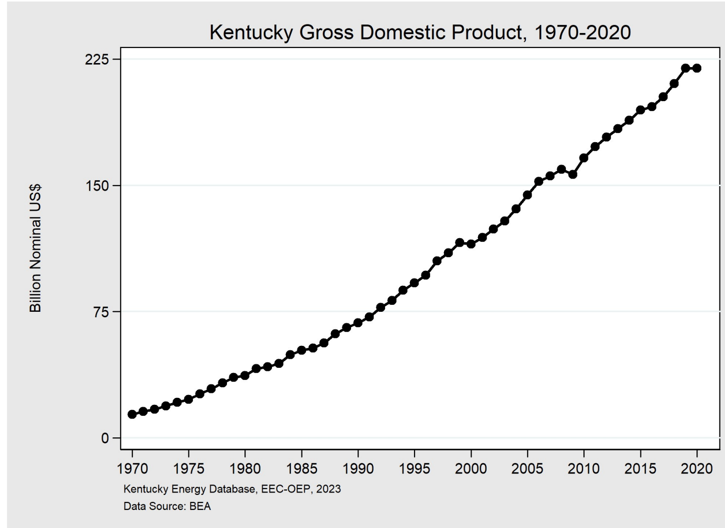
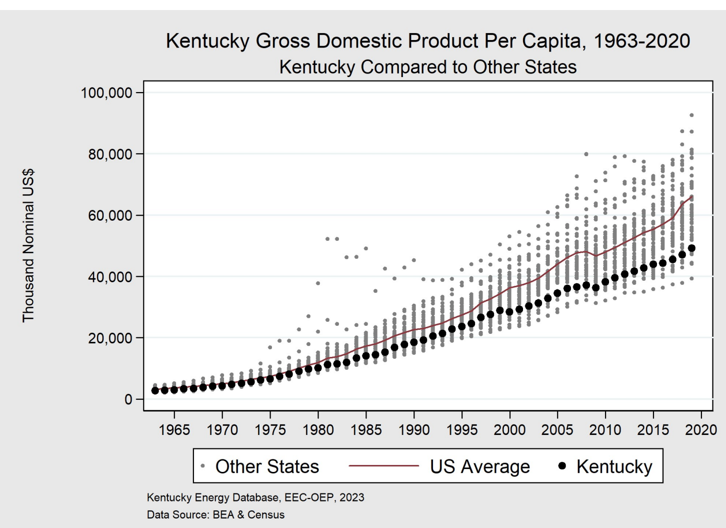
General Statistics

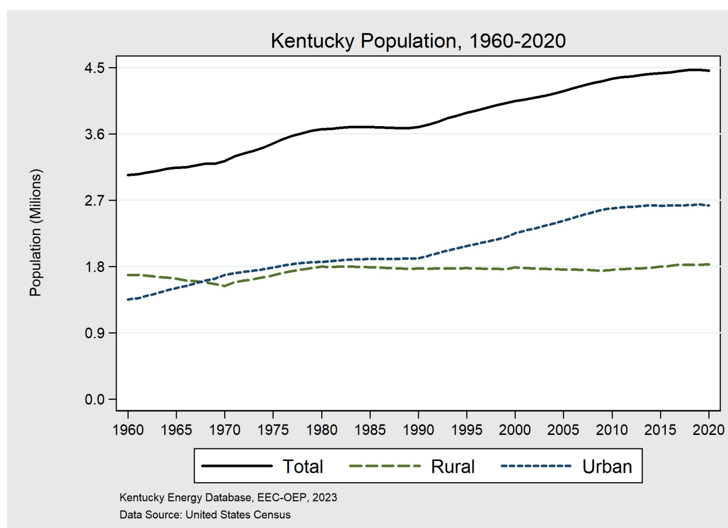




In 2020, on average $0.07 was spent in Kentucky on energy to produce one dollar of state Gross Domestic Product (GDP). Kentucky ranked 10th in energy intensity of GDP in 2020, and decreased its intensity by 2% from 2019. Kentucky is home to large, energy-intensive, manufacturing operations which cause Kentucky's electricity intensity to be higher than other states.

In 2020, the gross domestic product of Kentucky was $215 billion, a decrease of 0.2% from 2019. Kentucky has experienced steady growth in nominal GDP over the course of recorded history.

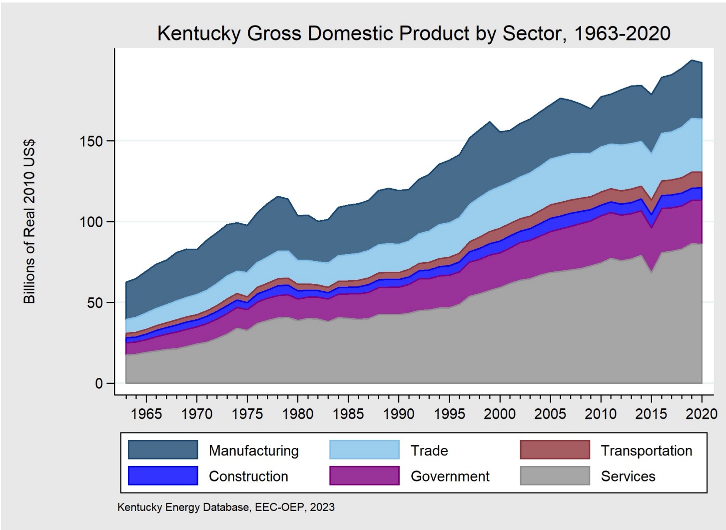


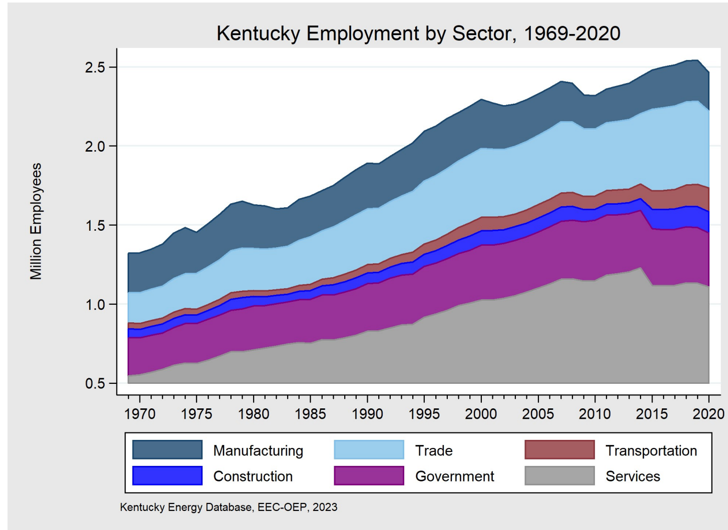


In 2020, Kentucky's GDP per capita was $49,201, an increase of 0.1% from 2019. Kentucky ranked 45th in the nation in terms of GDP per capita and below the national average of $64,787 in 2020.

In 2020, Kentucky's population was approximately 4.5 million people, a decrease of 5,721 or 0.1% since 2019. From 1960 to 2020, Kentucky's urban population has doubled while the rural population has stayed consistent.

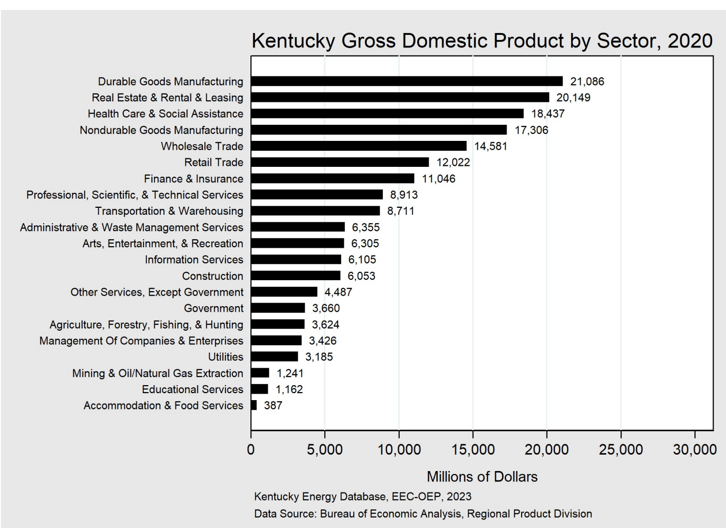
Kentucky's Economy

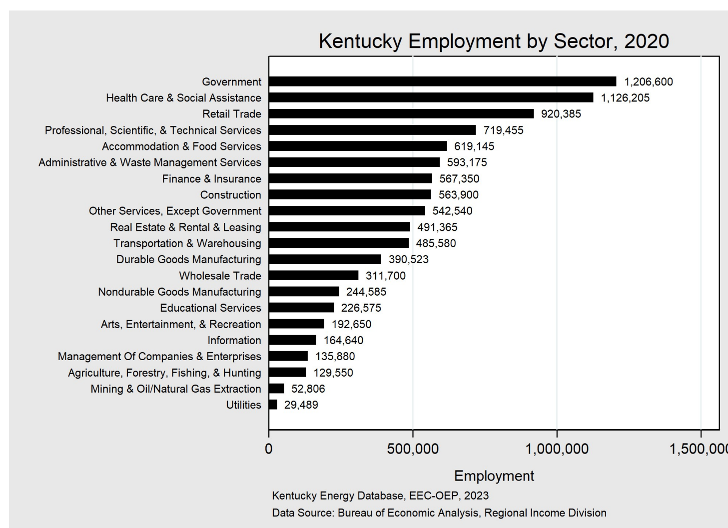




GDP from most sectors has risen gradually in the last 50 years, with output from the service sector rising the most. Manufacturing GDP has been relatively more volatile than that from other sectors, with peaks of output in 1999 and 2006 followed by significant decreases thereafter.

With the exception of manufacturing, employment in all sectors of the Kentucky economy remained stable until 2008, when most sectors experienced decreases in employment. In 2020, total employment across all sectors decreased by 3% compared to 2019.

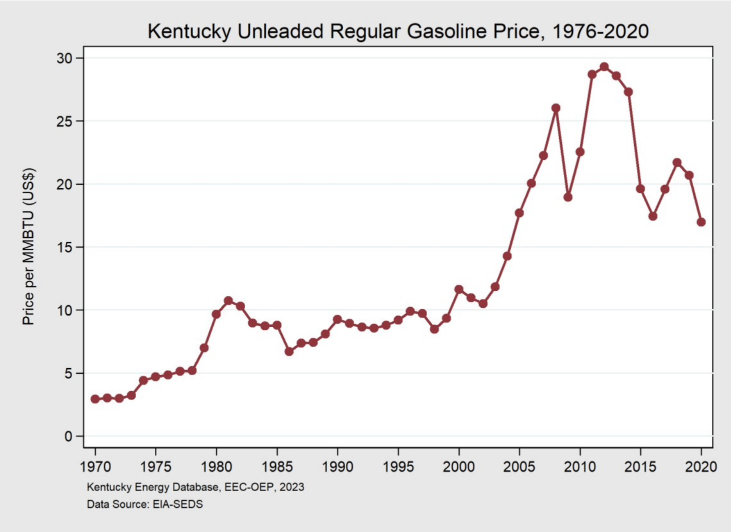




The durable goods manufacturing sector had the largest portion of state GDP with 10.7%, followed by real estate and rental leasing with approximately 10.2% of the total GDP in 2020. Nondurable goods manufacturing contributes 8.7%.

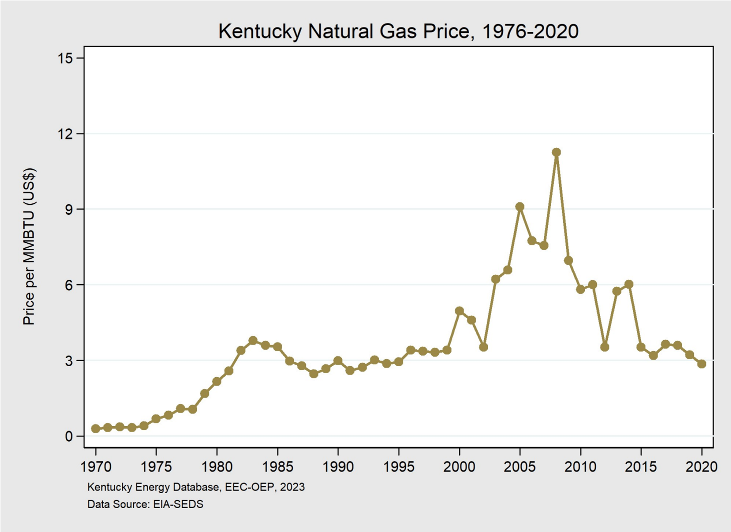
In 2020, the government sector was the single largest employer in Kentucky. Government employment was approximately 13.5% of total employment, healthcare was 11.2%, and retail trade 10.1%. Employment is defined as the average number of full-time and part-time jobs where wages or salaries are paid.

Kentucky Commodity Prices



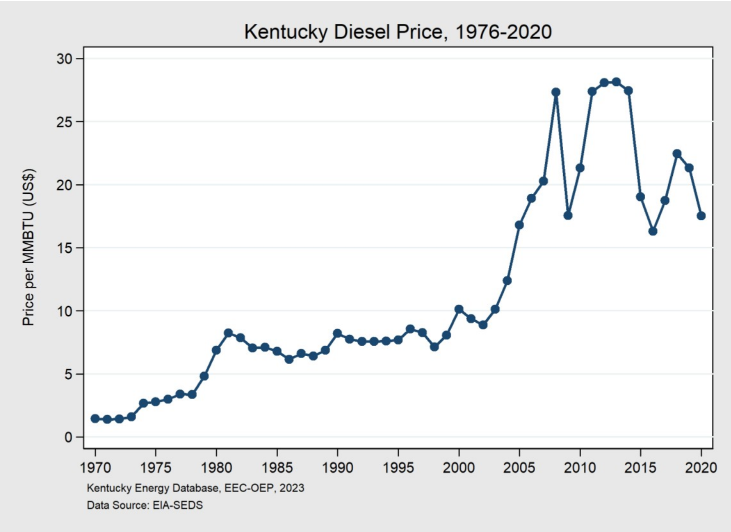
Fuel Type	U.S.$/MMBtu	% Change
Gasoline	16.97	-17.9%

Unleaded gasoline in Kentucky cost $16.97 per MMBtu in 2020, a 18% decrease from the previous year.



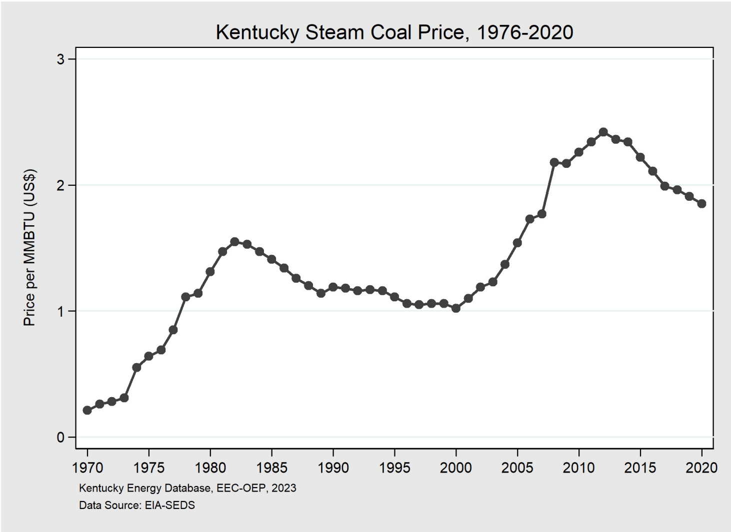
Fuel Type	U.S.$/MMBtu	% Change
Natural Gas	2.86	-11.8%

The average citygate price of natural gas in Kentucky in 2020 was $2.86 per million Btus, an 11.8% decrease in the price of natural gas compared with 2019.



Fuel Type	U.S.$/MMBtu	% Change
Diesel	17.51	-17.9%

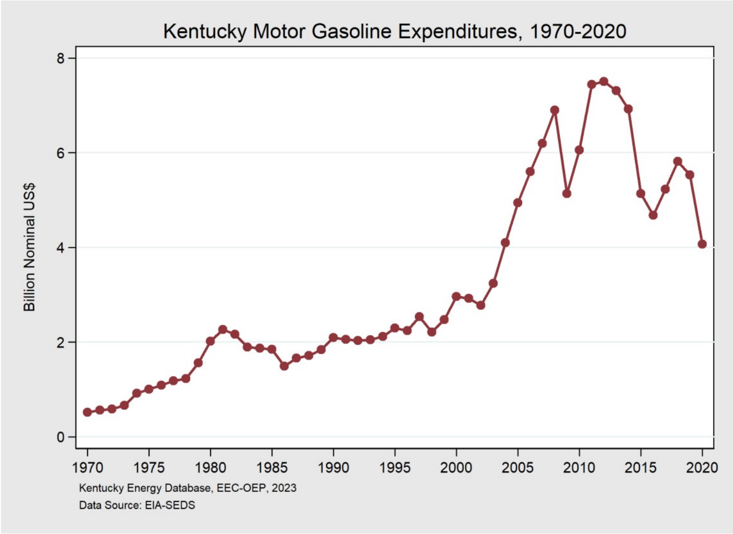
The average retail price of diesel in Kentucky in 2020 was $17.51 per million Btus, a 17.9% decrease in the price of diesel compared with 2019.



Fuel Type	U.S.$/MMBtu	% Change
Coal	1.85	-3.1%

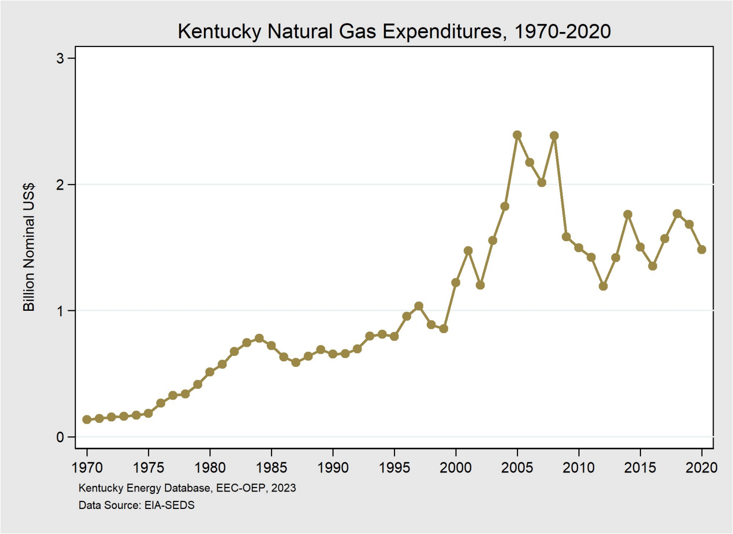
The average price of steam coal in Kentucky in 2020 was $1.85 per million Btus, a 3.1% decrease in the price of steam coal compared with 2019.

Kentucky Commodity Expenditures



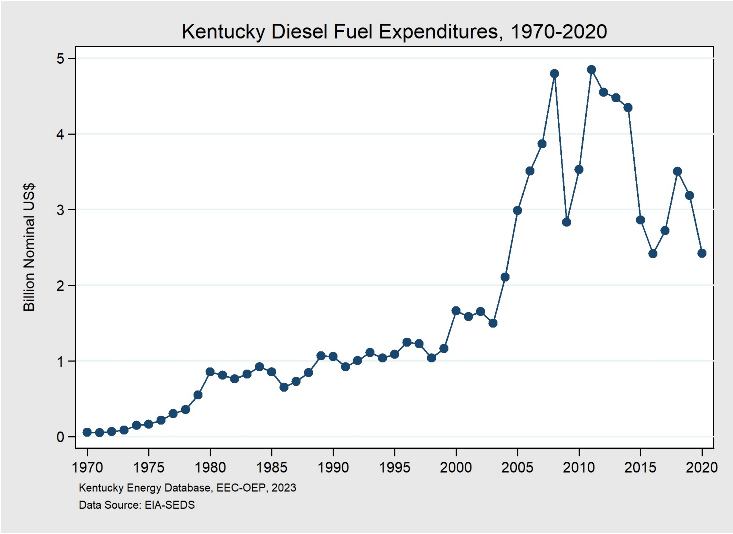
Fuel Type	Million U.S.$	% of Total
Gasoline	4,071	26.3%

Gasoline expenditures in Kentucky were approximately $4.1 billion in 2020; a 26.4% decrease in gasoline expenditures compared with 2019, and accounted for 26.3% of energy expenditures in the state.



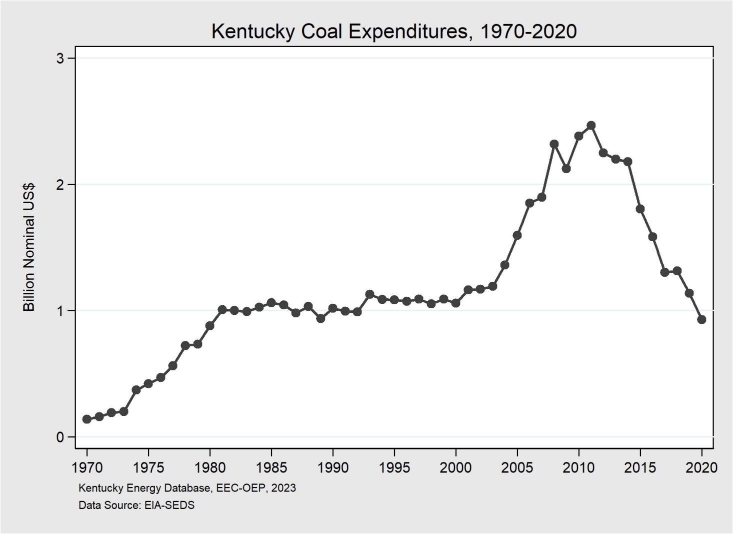
Fuel Type	Million U.S.$	% of Total
Natural Gas	1,482	9.6%

Total natural gas expenditures in Kentucky were approximately $1.5 billion in 2020; an 11.9% decrease in natural gas expenditures compared with 2019, and accounted for 9.6% of energy expenditures in the state.



Fuel Type	Million U.S.$	% of Total
Diesel	2,421	15.6%

Approximately $2.4 billion was spent on diesel in Kentucky in 2020, a 24.1% decrease in diesel expenditures compared with 2019, and accounted for 15.6% of energy expenditures in the state.



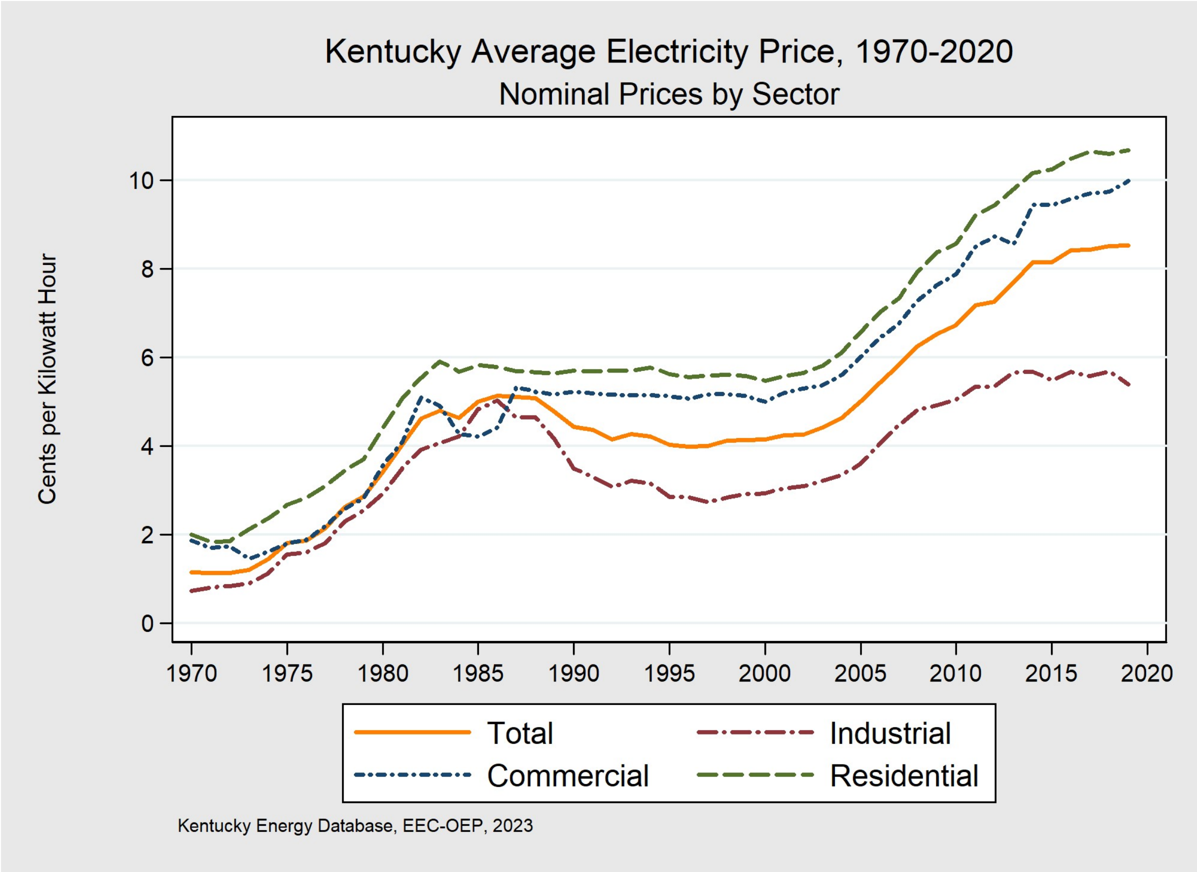
Fuel Type	Million U.S.$	% of Total
Coal	929	6%

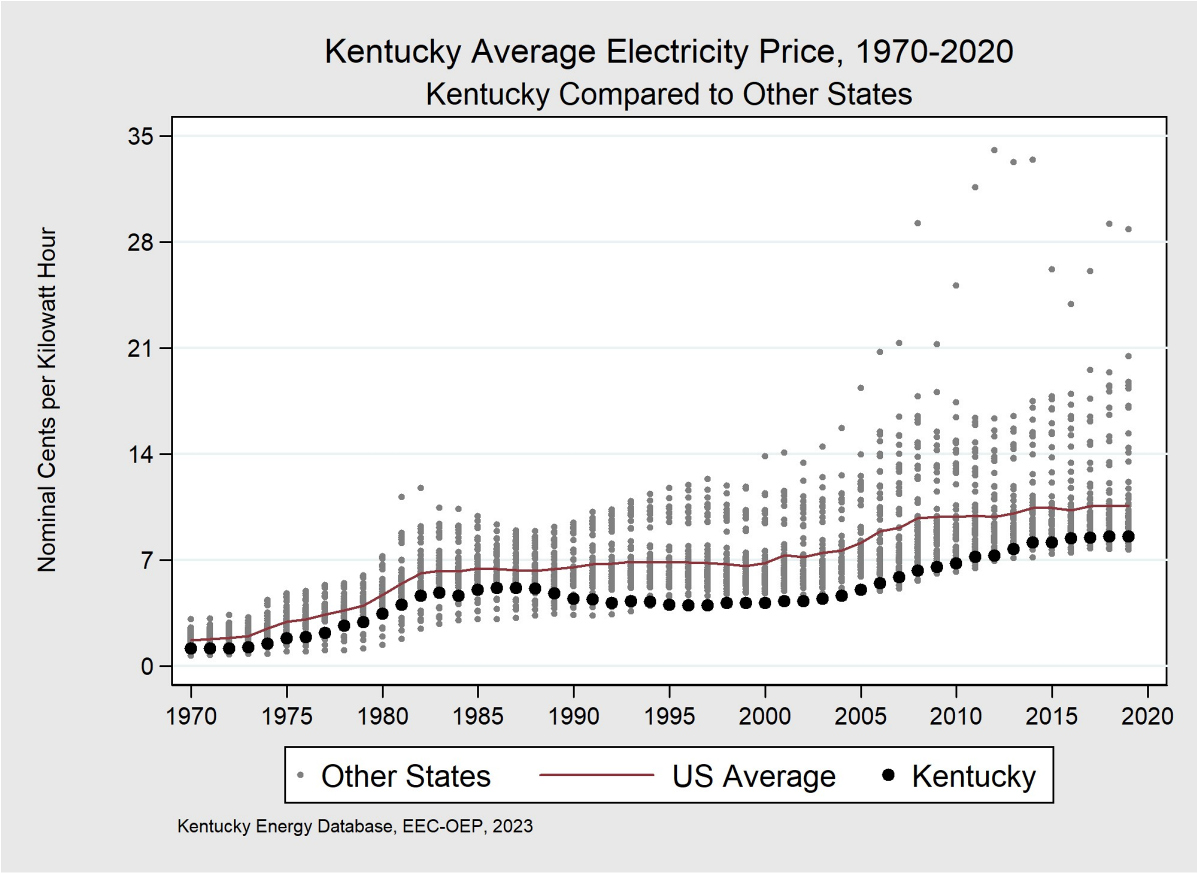
Coal expenditures in Kentucky were approximately $929 million in 2020. Spending on coal decreased by 18.2% from 2019 and accounted for 6% of energy expenditures in the state.

Average Price of Electricity by State

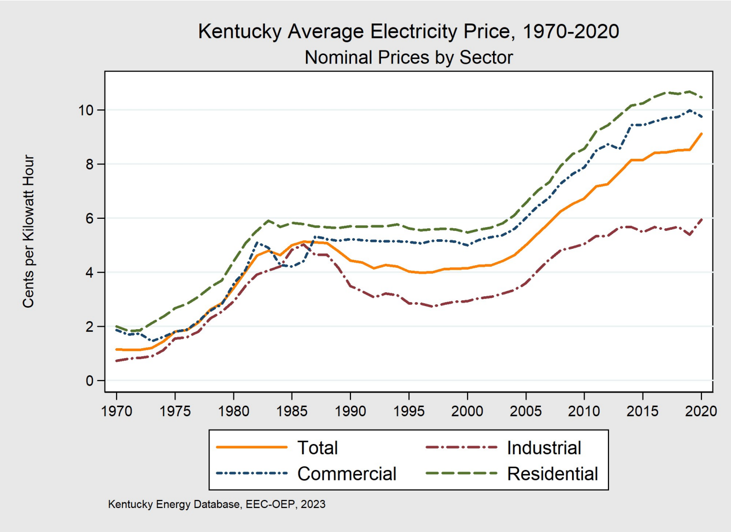
Rank	State	Primary Generation Source	2020 Industrial Price (Cents/kWh)	2020 Total Price (Cents/kWh)	Inflation Adjusted 1 Year Change	Inflation Adjusted 5 Year Change
1	Idaho	Hydroelectric	6.39	8.17	+2.2%	-1.1%
2	Wyoming	Coal	6.83	8.25	+0.2%	-0.4%
3	Utah	Coal	6.19	8.34	+0.8%	-3.1%
4	Oklahoma	Natural Gas	5.5	8.52	+11.0%	+3.8%
5	Nevada	Natural Gas	6.02	8.58	+3.0%	-2.1%
6	North Dakota	Coal	7.37	8.65	+1.4%	-1.5%
7	Washington	Hydroelectric	5.81	8.75	+4.9%	+9.7%
8	Louisiana	Natural Gas	6.21	8.82	+16.0%	+12.4%
9	Nebraska	Coal	7.26	8.84	+1.5%	-2.7%
10	West Virginia	Coal	6.07	8.87	+1.4%	-1.5%
11	Oregon	Hydroelectric	5.97	8.95	+1.5%	+1.6%
12	Arkansas	Natural Gas	6.57	9.1	+9.0%	+9.7%
13	Kentucky	Coal	5.95	9.12	+6.1%	+6.2%
14	Iowa	Coal	6.63	9.13	+1.8%	+4.5%
15	Texas	Natural Gas	6.12	9.14	+8.9%	+8.7%
16	Virginia	Natural Gas	6.49	9.14	-0.2%	-0.4%
17	North Carolina	Natural Gas	6.14	9.29	-1.5%	+2.7%
18	Mississippi	Natural Gas	5.95	9.5	+4.0%	+4.4%
19	Montana	Coal	6.24	9.5	+4.0%	+6.3%
20	Ohio	Natural Gas	6.55	9.76	+3.3%	-0.8%
21	Tennessee	Nuclear	5.51	9.78	+2.7%	+3.4%
22	New Mexico	Coal	6.16	9.79	+4.8%	+2.1%
23	Missouri	Coal	7.11	9.85	+13.1%	-1.8%
24	South Carolina	Nuclear	6.07	9.96	+0.6%	-0.1%
25	Pennsylvania	Natural Gas	6.54	9.97	+2.8%	-1.6%
26	Illinois	Nuclear	7.3	10.14	+3.9%	+6.6%
27	Alabama	Natural Gas	6.33	10.18	+3.4%	+3.5%
28	Indiana	Natural Gas	7.39	10.36	+4.3%	+5.9%
29	Georgia	Natural Gas	6.49	10.43	+4.9%	+5.9%
30	South Dakota	Hydroelectric	8.02	10.43	+3.6%	+3.7%
31	Kansas	Coal	7.38	10.47	+3.1%	+1.2%
32	Delaware	Natural Gas	7.6	10.5	+2.5%	-3.7%
33	Florida	Natural Gas	7.65	10.67	+5.9%	+2.4%
34	Arizona	Natural Gas	6.79	10.73	+2.7%	+0.8%
35	Colorado	Coal	8.01	10.9	+6.0%	+8.7%
36	Wisconsin	Natural Gas	7.63	11.01	+1.7%	+2.3%
37	Minnesota	Coal	8.29	11.08	+4.7%	+7.6%
	United States	Natural Gas	7.18	11.1	+4.7%	+5.7%
38	Maryland	Natural Gas	8.46	11.48	+2.9%	+4.3%
	District of Columbia	Natural Gas	7.87	12.81	+7.4%	+8.2%
39	Michigan	Natural Gas	7.69	12.93	+5.7%	+13.6%
40	Maine	Natural Gas	9.55	13.96	+3.1%	+7.0%
41	New Jersey	Natural Gas	10.7	14.01	+2.7%	+5.0%
42	New York	Natural Gas	6.34	16.11	+8.0%	+8.9%
43	Vermont	Hydroelectric	11.38	16.34	+0.1%	+17.3%
44	New Hampshire	Nuclear	13.81	17.37	+4.4%	+7.2%
45	Connecticut	Natural Gas	9.63	18.32	-4.3%	+4.3%
46	Rhode Island	Natural Gas	16.06	18.44	-0.5%	+11.6%
47	Massachusetts	Natural Gas	15.18	19.06	+4.7%	+10.7%
48	California	Natural Gas	14.82	19.65	+8.8%	+20.1%
49	Alaska	Natural Gas	16.85	20.02	+1.0%	+4.7%
50	Hawaii	Petroleum	27.12	30.31	+9.5%	+15.1%

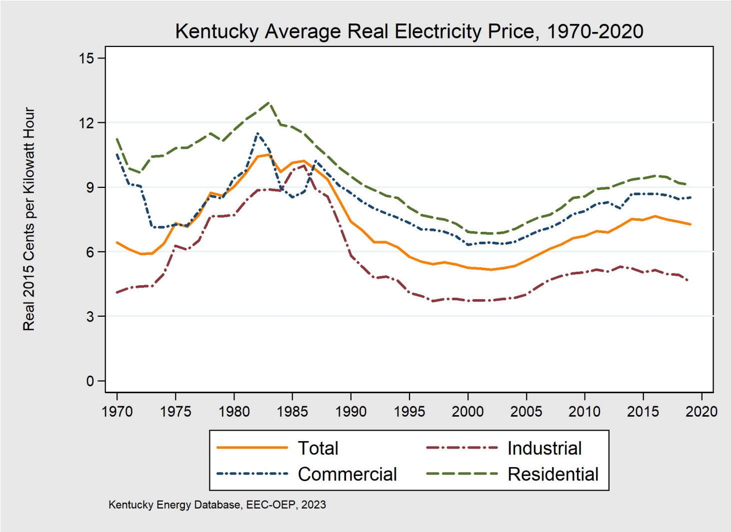
Average Price of Electricity by State





Kentucky Electricity Prices





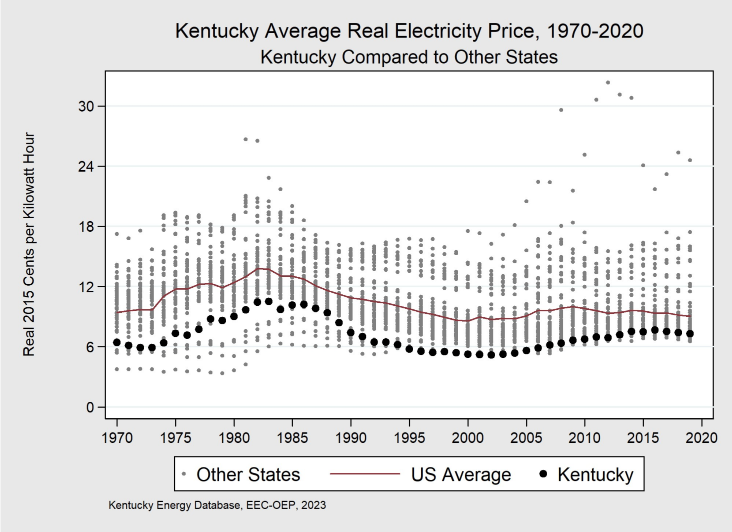
Sector	Nominal Cents/kWh	Since 2010
Average	9.12	+35.5%
Residential	10.47	+22.2%
Commercial	9.76	+23.9%
Industrial	5.95	+17.8%

Sector	Real* Cents/kWh	Since 2010
Average	9.15	+9.9%
Residential	10.05	+7.4%
Commercial	9.28	+7.3%
Industrial	5.49	-2.3%

*Real 2015 $US

Retail electricity rates are set by either the PSC, the owner or board governing a municipal utility, or TVA. Rates are generally established to cover the operating expenses and the capital costs of the utilities to maintain generation infrastructure and supply electricity. Operating expenses typically include personnel costs, fuel costs, generation costs, and maintenance costs. Capital costs typically include the costs to construct facilities, environmental equipment, and transmission & distribution lines, service the outstanding interest on debt, and earn a scheduled return on equity.

In 2020, the average price of electricity across economic sectors in Kentucky was 9.12¢ per kilowatt-hour. This average price ranked Kentucky electricity prices the thirteenth-lowest in the country. The residential sector paid the highest price for electricity at 10.67¢ per kilowatt-hour, followed by the commercial sector at 9.76¢ per-kilowatt hour, and the industrial sector at 5.95¢ per kilowatt-hour, the seventh lowest in the country. Since 1970, the average price of electricity in Kentucky has been among the lowest in the United States and well below the national average.



In inflation-adjusted dollars, the price of electricity in Kentucky actually decreased from 1980 through 2002. However, the real price of electricity in Kentucky in inflation-adjusted dollars has been increasing since 2002. The rising price of steam coal used by electric utilities drove real electricity prices in Kentucky upwards from 2002 – 2015, however, since 2016, real electricity prices have trended downward.

Kentucky Utility Prices

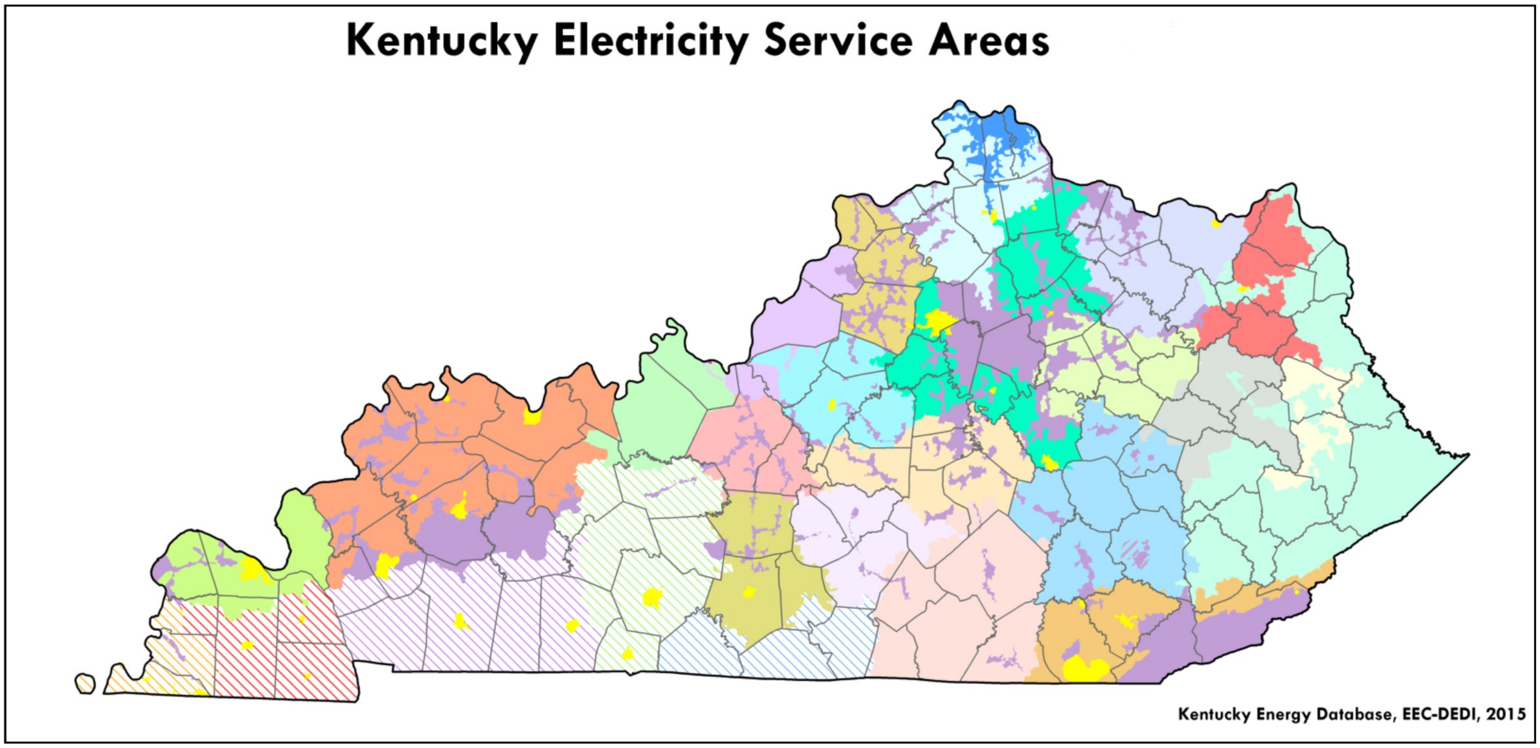
Utility	Average (cents/kWh)	Commercial (cents/kWh)	Industrial (cents/kWh)	Residential (cents/kWh)	Average Residential Bill
Big Sandy Rural Elec Co-op	11.42	10.82	8.11	11.88	$126.92
Blue Grass Energy Co-op	10.02	10.92	6.56	10.99	$123.02
City of Bardstown	8.51	8.90	7.89	9.25	$100.61
City of Benton	11.40	11.83	8.14	12.51	$141.65
City of Berea Municipal Utility	8.30	8.68	7.13	8.93	$95.31
City of Bowling Green	9.69	9.91	6.54	10.67	$115.95
City of Frankfort	9.56	10.20	8.67	10.52	$108.69
City of Franklin	9.88	11.92	6.31	12.11	$136.22
City of Fulton	10.47	11.27	7.68	12.01	$131.73
City of Glasgow	11.37	11.00	7.92	12.92	$114.67
City of Hickman	14.08	15.10	-	13.33	$139.06
City of Hopkinsville	10.15	11.67	5.64	11.09	$135.17
City of Jellico	11.35	12.85	-	11.00	$116.47
City of Mayfield Plant Board	11.54	11.34	9.38	12.30	$110.52
City of Murray	10.10	10.11	6.06	12.35	$118.14
City of Owensboro	13.42	14.46	12.05	15.95	$124.33
City of Paducah	14.17	14.11	10.08	14.65	$128.34
City of Russellville	9.85	11.33	7.37	10.74	$116.12
Clark Energy Coop, Inc.	11.26	11.02	8.70	11.39	$115.36
Cumberland Valley Electric, Inc.	10.43	11.55	7.84	11.04	$113.73
Duke Energy Kentucky	9.44	9.10	7.89	10.58	$116.56
Farmers Rural Electric Co-op	10.52	10.64	7.81	11.32	$110.20
Fleming-Mason Energy Co-op, Inc.	7.24	8.81	5.26	10.74	$123.80
Gibson Electric Members Corp	10.85	11.82	5.69	12.03	$161.78
Grayson Rural Electric Co-op	13.23	12.15	6.78	14.72	$135.90
Henderson City	6.23	7.48	5.22	7.83	$96.09
Inter County Energy Co-op	10.57	10.44	6.83	11.33	$128.45
Jackson Energy Co-op	11.54	10.70	7.10	12.21	$131.97
Jackson Purchase Energy Corporation	11.30	10.38	9.22	12.06	$135.00
Kenergy Corp	5.67	11.65	4.78	12.47	$170.21

Kentucky Utility Prices

Utility	Average	Commercial	Industrial	Residential	Average
Kentucky Power	11.50	14.03	7.26	14.24	$187.56
Kentucky Utilities	9.42	10.98	6.46	11.07	$137.16
Licking Valley RECC	11.87	11.16	7.97	12.25	$108.57
Louisville Gas & Electric	9.99	10.29	6.95	11.43	$113.06
Madisonville Municipal	10.14	9.24	-	12.69	$94.65
Meade County RECC	12.10	11.79	-	12.20	$118.56
Nolin RECC	10.14	9.65	5.71	11.23	$126.04
Owen Electric Co-op	7.63	9.44	4.97	11.32	$117.57
Pennyrile Rural Electric Co-op	10.58	12.33	6.58	11.93	$157.10
Salt River Electric Co-op	9.01	9.81	6.45	9.57	$107.43
Shelby Energy Co-op	9.82	9.00	7.23	11.48	$129.82
South Kentucky RECC	10.26	13.03	8.30	10.88	$117.23
Taylor County RECC	8.34	8.97	4.51	9.66	$96.80
Tennessee Valley Authority	4.36	6.92	4.17	-	-
Tri-County Elec Member	9.96	9.63	6.06	11.36	$131.04
Warren Rural Elec Coop Corp	9.30	11.85	6.42	10.81	$149.86
West Kentucky Rural E C C	11.95	13.87	6.22	12.20	$137.19

Source : EIA Form 861Monthly (Formerly EIA Form 826). Utility Sales and Revenue Tables.

Kentucky Electric Service Areas

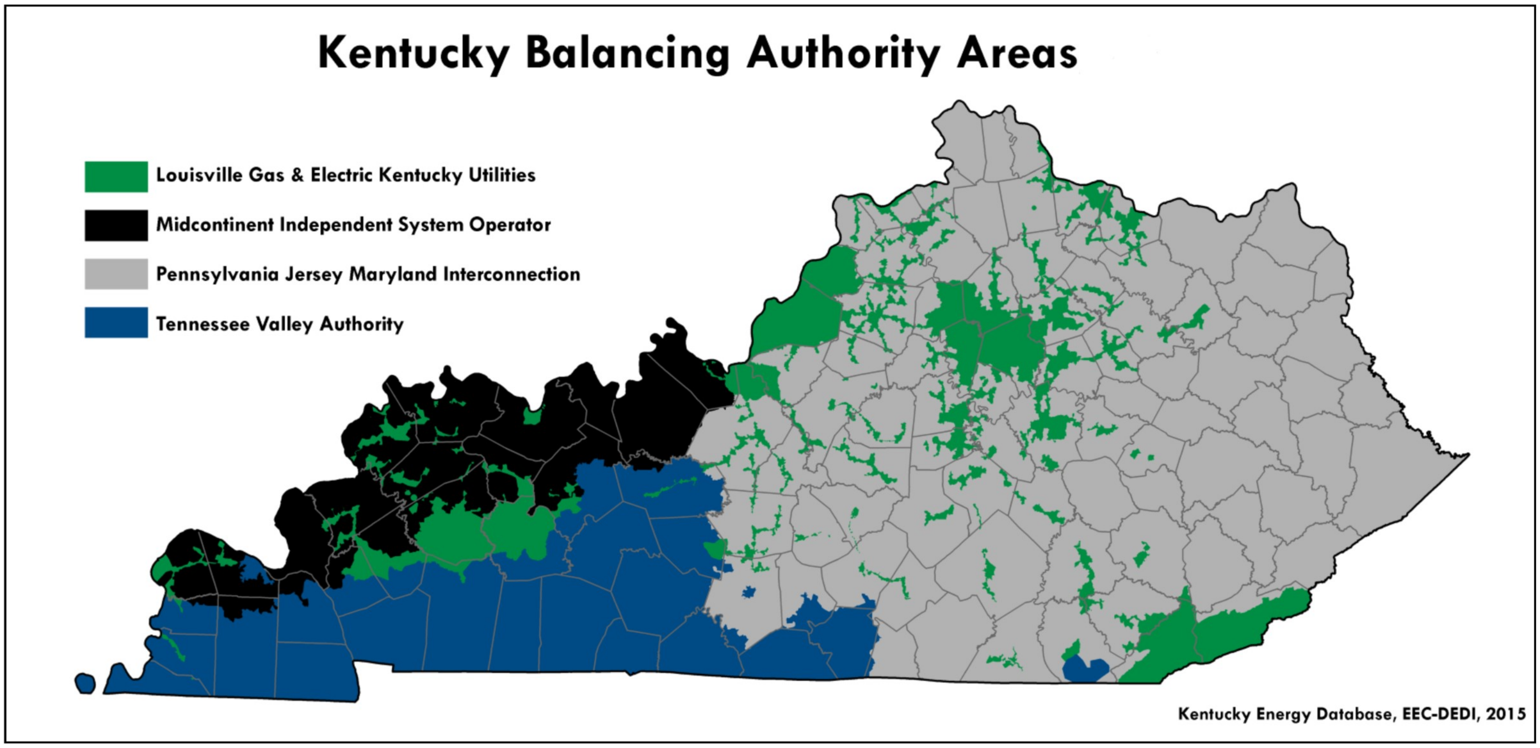


All Municipal Utilities		Kentucky Utilities*	
Big Sandy RECC†		Licking Valley RECC†	
Blue Grass ECC†		Louisville Gas & Electric*	
Clark ECC†		Meade County RECC‡	
Cumberland Valley RECC†		Nolin RECC†	
Duke Energy Kentucky*		Owen ECC†	
Farmers RECC†		Pennyrile RECC§	
Fleming-Mason ECC†		Salt River ECC†	
Grayson RECC†		Shelby ECC†	
Gibson Electric Members Corp RECC§		South Kentucky RECC†	
Inter-County ECC†		Taylor County RECC†	
Jackson ECC†		Tri-County Electric Member Corporation§	
Jackson Purchase Energy Corporation ‡		Warren RECC§	
Kenergy Corporation‡		West Kentucky RECC§	
Kentucky Power*			

The Commonwealth of Kentucky is divided into certified electric service territories as determined by the Kentucky Public Service Commission (KRS 278.016). Within these certified electric service areas, electricity service and delivery is restricted to one electricity provider per service area. Providers of electricity in Kentucky are either Investor-Owned Utilities (IOU), Municipal Utilities, Electric Cooperative Corporations (ECC), or Rural Electric Cooperative Corporations (RECC). Municipal Utilities and TVA Distributors are not subject to Kentucky Public Service Commission regulation.

*Investor-Owned Utilities
†EKPC Owner-Member Cooperative
‡BREC Member Cooperative
§TVA Distributor

Kentucky Balancing Authority Areas



Local electricity grids are interconnected to form larger networks for reliability and commercial purposes. The actual operation of the electric system is managed by entities called balancing authorities. A balancing authority ensures, in real time, that power system demand and supply are finely balanced. Balancing authorities are responsible for maintaining operating conditions under mandatory reliability standards issued by the North American Electric Reliability Corporation and approved by the U.S. Federal Energy Regulatory Commission.

Retail Service:

Electricity in Kentucky is provided to customers by one of the following types of entities that have the exclusive right to serve the customers within its territory:

- Retail electric suppliers that are regulated by the Kentucky Public Service Commission (PSC) include: Investor-Owned Utilities (IOUs) and Rural Electric Cooperative Companies (RECCs)
- Municipal Utilities
- The Tennessee Valley Authority (TVA) and its associated distributors within the state

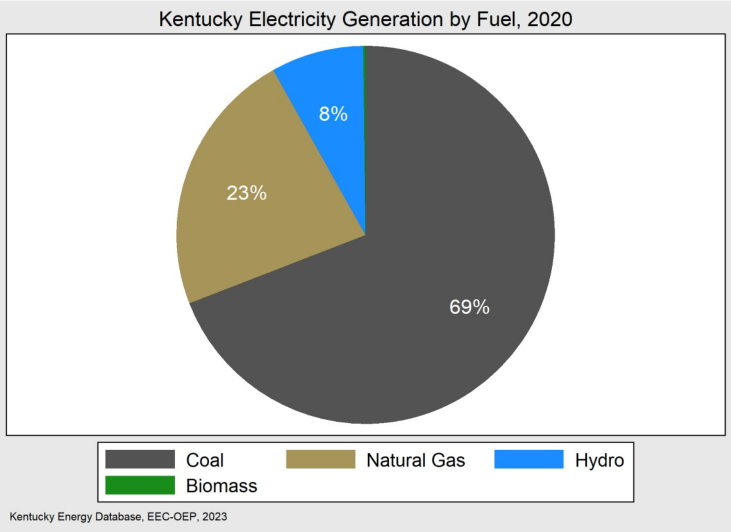
Electric suppliers fall into two categories: IOUs and RECCs. There are four investor-owned companies in Kentucky: Duke Energy Kentucky, Kentucky Power Company (aka. American Electric Power), Kentucky Utilities (KU), and Louisville Gas and Electric (LG&E). Each of these companies generates or purchases the power required to meet its respective customers' electricity demands. RECCs are owned by their individual ratepayers and are non-profit entities that reinvest profits into energy infrastructure or return profits to ratepayers.

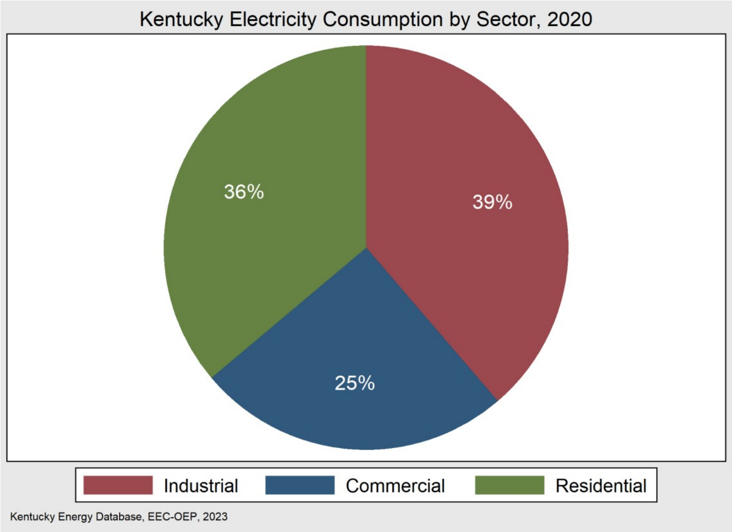
There are 24 RECCs in the state, 19 RECCs that are regulated by the PSC. A distribution cooperative typically receives power from its respective generation and transmission cooperative at a substation in the distributor's service territory. Five RECCs and ten municipal utilities purchase electricity from TVA. These RECCs and municipalities then resell and distribute electricity to customers within their service territories. TVA also directly serves several large industrial customers within Kentucky.

Eighteen municipal electric suppliers purchase power from various sources or self-generate electricity by owning and/or operating generating facilities.

*The Tennessee Valley Authority sets the wholesale rate for electricity supplied to its distributors, and approves the distributors' retail rate.

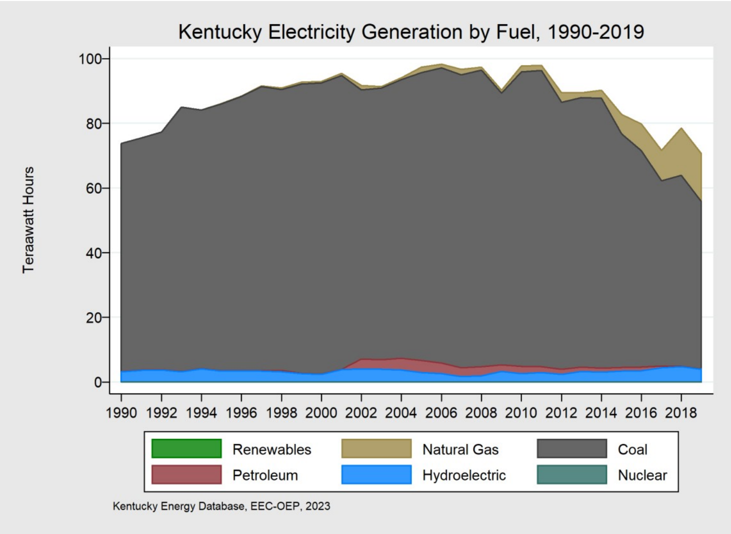
Kentucky Electricity

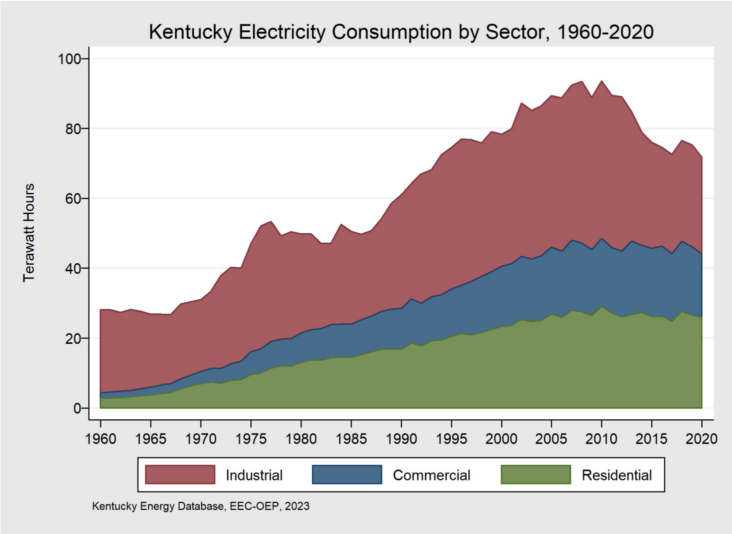




Fuel Type	Gigawatt Hours	1 Year Change
Total	63,539	-11.5%
Coal	43,638	-15.6%
Hydro	5,006	+18.3%
Natural Gas	14,384	-6.2%

Sector	Gigawatt Hours	1 Year Change
Total*	71,800	-4.7%
Industrial	27,804	-4.7%
Residential	25,935	-2.4%
Commercial	18,061	-7.9%



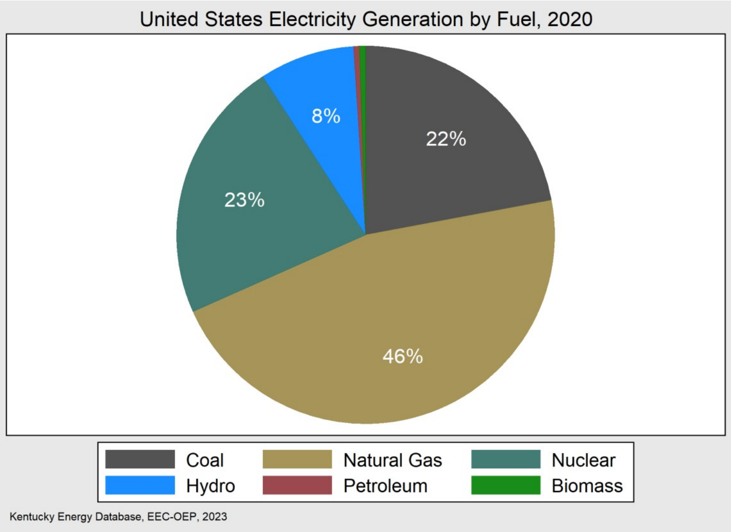


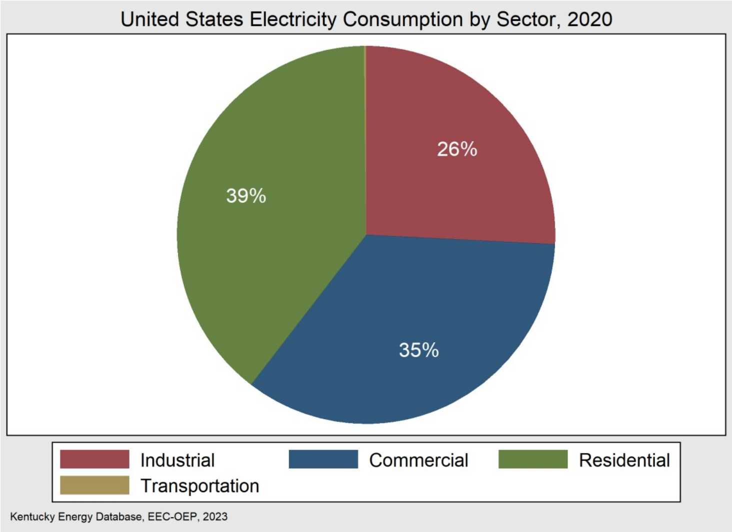
Of the electricity generated in Kentucky in 2020, 69% was derived through the combustion of coal. Coal-fired electricity generation decreased substantially. Natural gas facilities were the second-largest source of electricity. Hydroelectric power increased 18.3% and produced the third most of all fuels.

**The difference between generation and consumption are exports and transmission losses.*

Electricity consumption in Kentucky during 2020 totaled 71.8 terawatt-hours, a decrease of 4.7% compared with 2019. The industrial sector became the largest consumer of electricity in Kentucky, representing 39% of total electricity consumption while the national average was 26% in 2020. The residential sector was the second largest consumer of electricity with 36% of consumption, followed by the commercial sector with 25%.

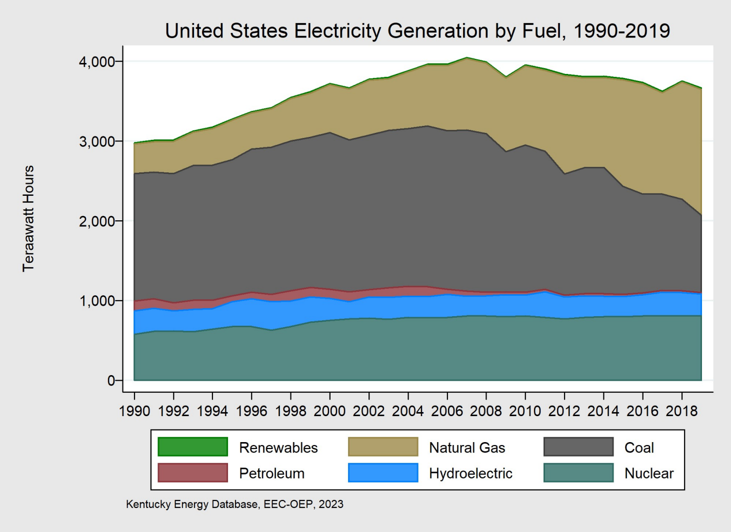
United States Electricity

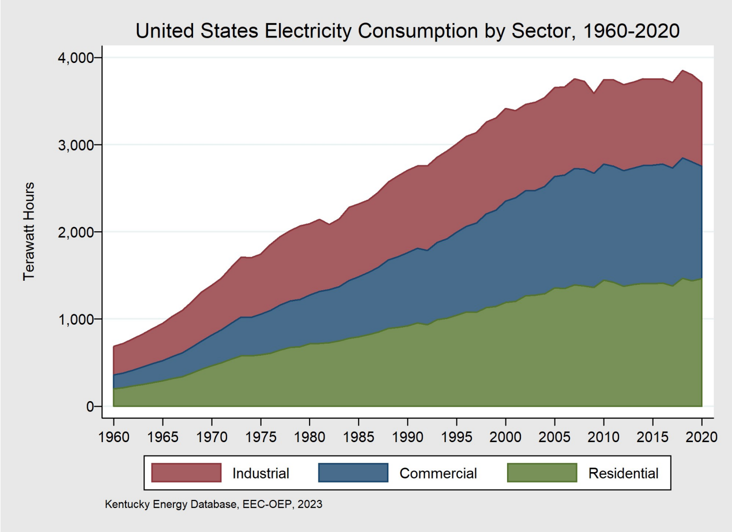




Fuel Type	Gigawatt Hours	1 Year Change
Total	4,007,019	-2.9%
Natural Gas	1,624,050	+2.4%
Coal	773,393	-19.9%
Nuclear	789,879	+0.3%
Hydro	285,274	-0.9%

Sector	Gigawatt Hours	1 Year Change
Total	3,717,674	-2.5%
Residential	1,464,605	+1.7%
Commercial	1,287,440	-5.4%
Industrial	959,082	-4.3%

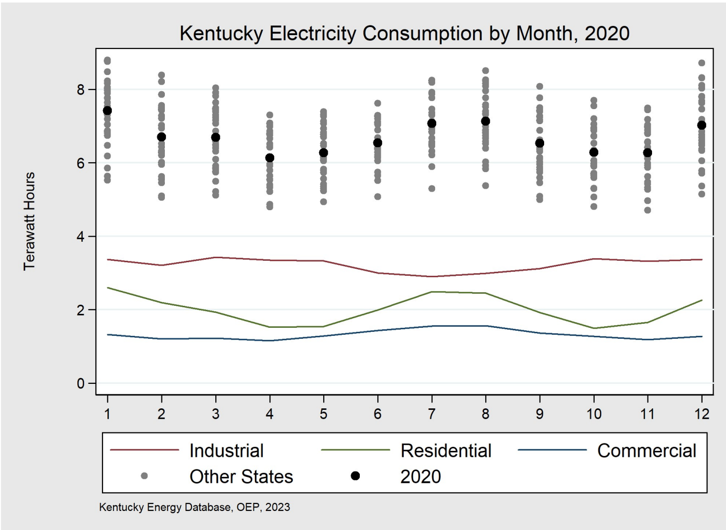




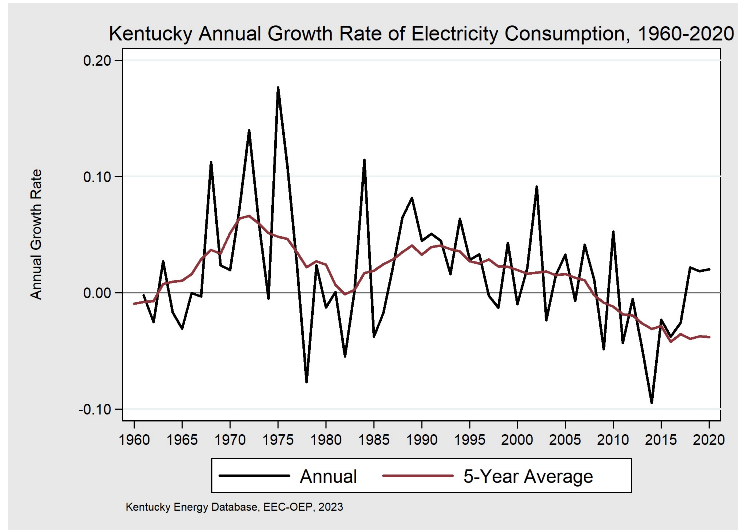
The United States generated more than four petawatt-hours in 2020, a decrease of 2.9% compared to 2019. Electricity generation from natural gas continued to be the largest source of electricity at 46% of total, and increased by 2.4% compared to 2019. Hydro electricity generated 8% of total electricity requirements. Nuclear has remained relatively constant for decades, supplying 23% in 2020.

Total electricity consumption decreased by 2.5% in 2020 to 3.7 petawatt-hours. Nationally, residential consumers are the largest share of electricity demand, 39% in 2020. Residential, which is highly responsive to changes in weather, increased by 1.7% in 2020. Industrial demand decreased by 4.3% to just under 1 terawatt-hour.

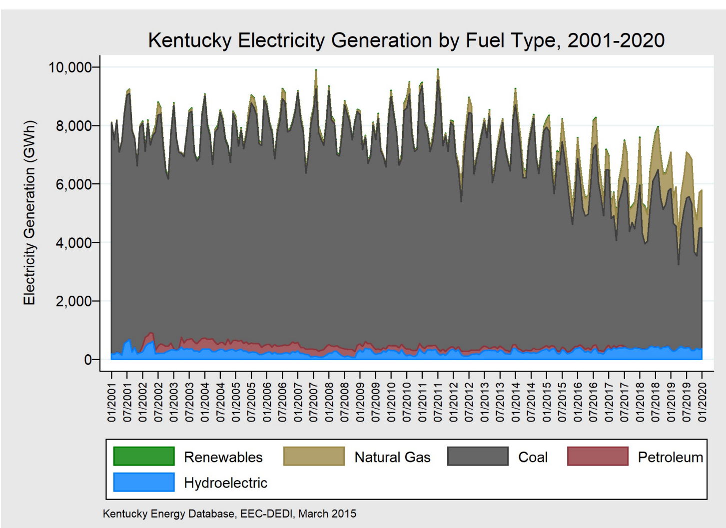
Kentucky Monthly Electricity



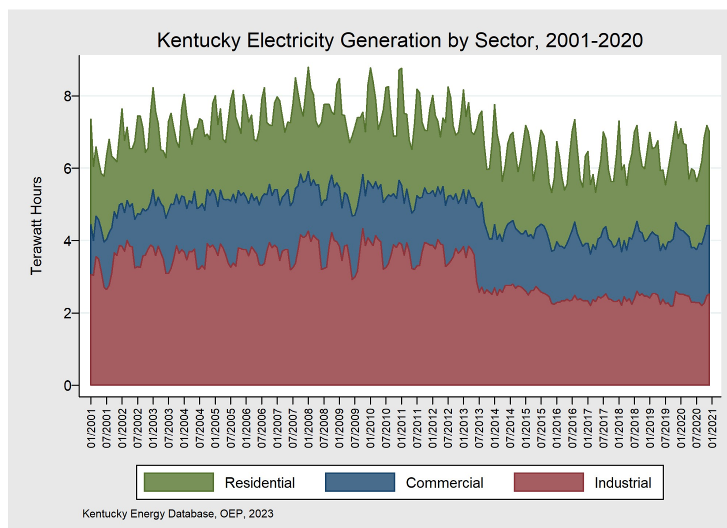
Seasonal fluctuations in Kentucky's electricity consumption are largely the result of the residential sector, which utilizes electricity for air conditioning in the summer and heating in the winter. On average, the highest demand for electricity in Kentucky occurs in summer and winter.



Kentucky electricity demand grew rapidly in the late 1960s to the early 1970s and again from the late 1980s to the early 1990s, but has decreased overall since 2008.

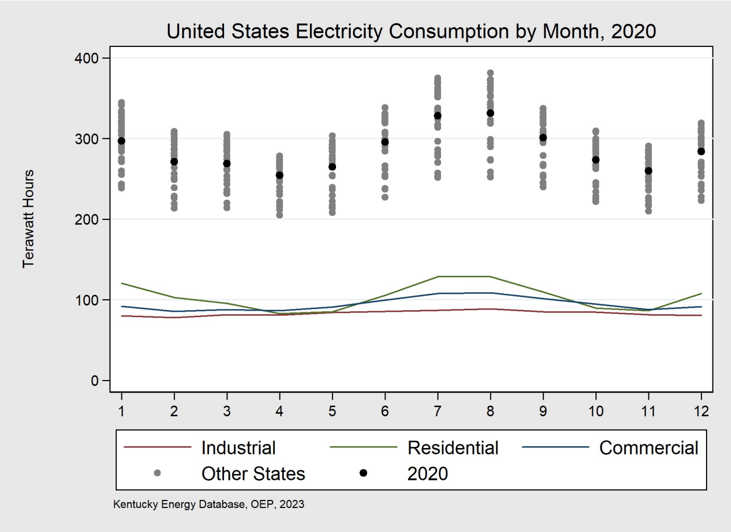


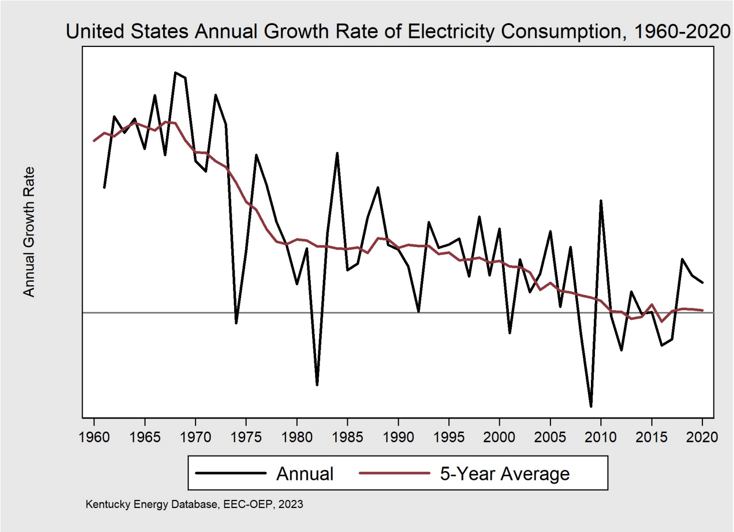
Coal-fired generation supplies the vast majority of electricity in Kentucky. During the spring and fall, electricity demand is lower and some coal plants go offline for maintenance. In the past five years, natural gas has become a bigger contributor to Kentucky's electricity generation as well as an increase in renewable energy sources.



Industrial electricity demand in Kentucky tends to vary little relative to the residential sector. Industrial electricity demand had decreased between June and August, when the United States Enrichment Corporation in Paducah—approximately 15% of Kentucky's total electricity demand—would shut down for annual maintenance. However, since the facility's closure in May, 2013 industrial sales have remained steady.

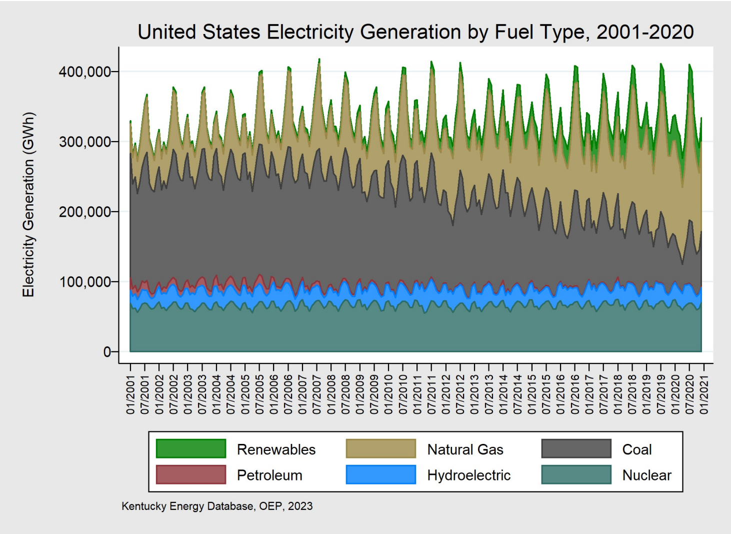
United States Monthly Electricity

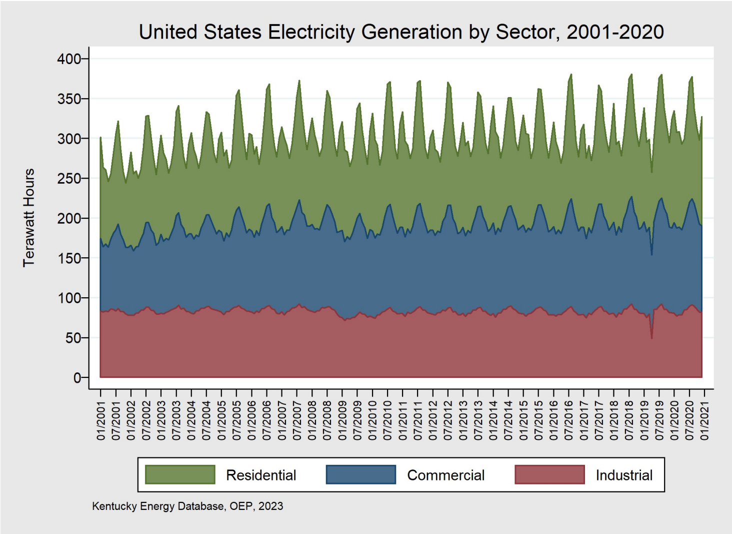




Electricity demand in the United States is approximately the same across all sectors during spring and fall, but demand for heating and air conditioning increases residential and commercial electricity demand in the summer and winter. In contrast, industrial demand is fairly constant throughout the year.

Although, electricity demand has grown in the United States for decades, the rate at which electricity demand has grown has decreased over time—from an average of 7% in the 1960s to less than one percent over the last 10 years. Since 2005, many states have experienced no growth or even decreases in electricity consumption.





Nuclear generation is relatively constant with the exception of regular shutdowns for maintenance, but renewable generation facilities depend on the presence of their respective resources. Coal and natural gas tend to make up the difference between electricity demand and electricity generated by renewables, nuclear, and hydroelectric generation. The United States has natural gas simple cycle turbines as well as combined cycle units, which are flexible and can be quickly ramped up during periods of peak electricity demand.

United States electricity demand is highest during the hotter summer, though there is a smaller increase in demand during colder winter months. Whereas summer heat can only be met with air conditioning, winter heating requirements can be remedied with a variety of non-electric fuels such as natural gas, wood, propane, and diesel fuel. Industrial demand varies somewhat, with increases in the summer months.

Kentucky Generation Infrastructure

Electricity Generating Capacity

Capacity is the maximum amount of electricity that can be produced at any one moment in time and is measured in watts, or joules per second. In 2020, Kentucky had 52 operating power plants that operated 173 individual electricity generating units. There were approximately 63.5 gigawatts of electric generation capacity in Kentucky. Of the current operating units in Kentucky, 68.9% of capacity is coal-fired, 22.5% is natural gas, 7.8% is hydroelectric. Petroleum, solar and biomass resources make up the remaining capacity (< 1%).

Generation

Of the electricity generated in Kentucky in 2020, 69% was derived through the combustion of coal. The amount of coal-based electricity generation decreased in 2020. Natural gas facilities were the second-largest source of electricity. Due to the presence of coal resources, and the low price of coal, Kentucky has consistently used coal to meet the vast majority of electricity demand within the Commonwealth; however, with the continued retirements of coal units, many have been converted into natural gas units.

Capacity Factor

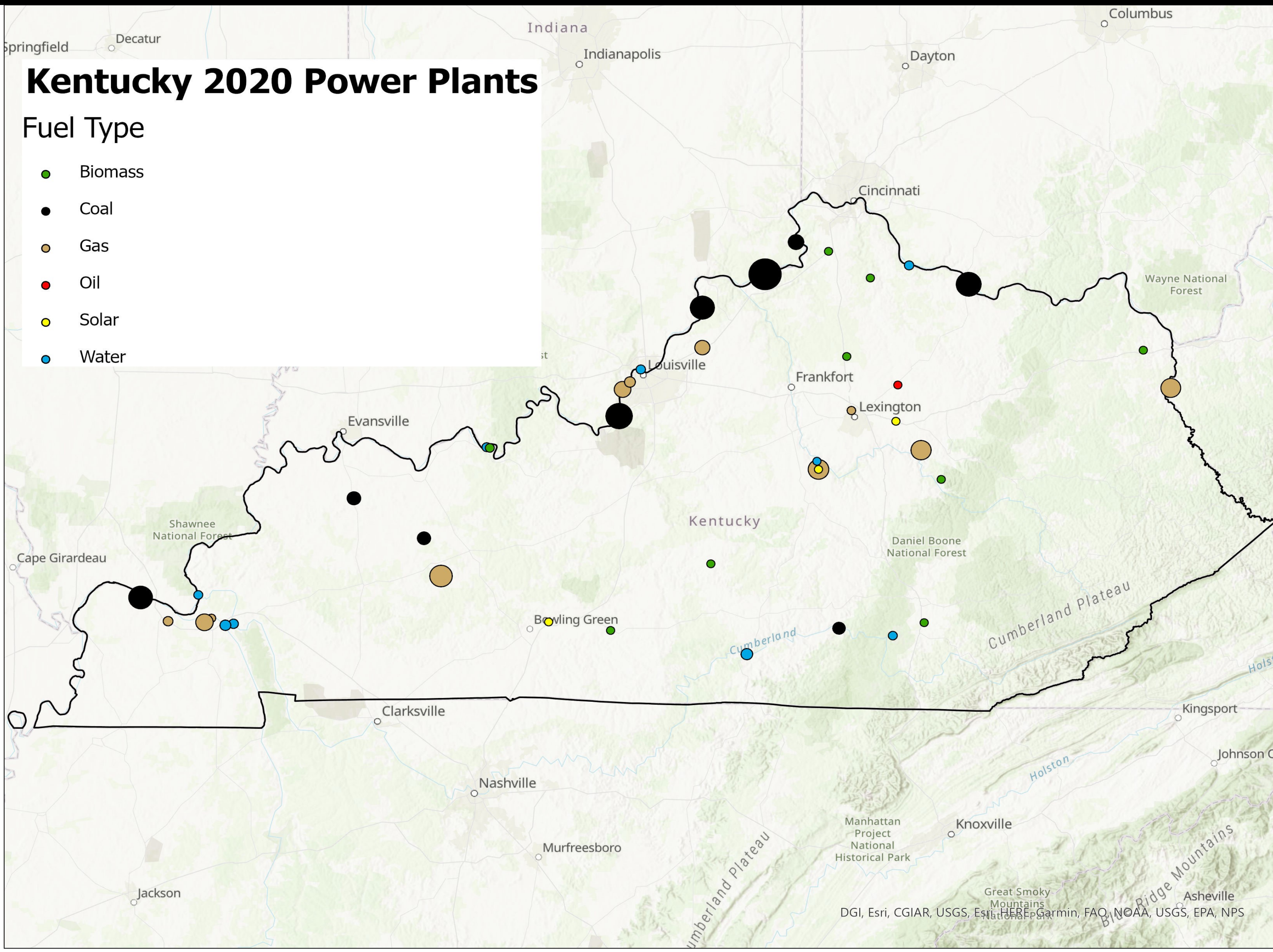
The capacity factor of a generating unit is a ratio of actual power output from a unit versus the maximum possible output from a unit over a period of time. To calculate the maximum possible output of a unit, the rated nameplate capacity (MW) is multiplied by time (typically, hours per year). The actual output (MWh) is then divided by the maximum possible output (MWh) to determine the capacity factor of the unit.

Many variable factors influence the actual capacity factor of a given generating unit including operational costs, operational design, age of a unit, emissions of criteria pollutants, electricity demand fluctuations, and the particular generation and environmental plans of individual power producers.

	Name	Online Year	Owner
1	Dix Dam	1925	LG&E-KU
2	Mother Ann Lee Hydro	1927	Salt River Electric Coop
3	Ohio Falls	1928	LG&E-KU
4	Paris, KY	1934	Paris City of KY
5	Kentucky	1944	Tennessee Valley Authority
6	Wolf Creek Dam	1951	USCE - Nashville District
7	Shawnee	1953	Tennessee Valley Authority
8	E.W. Brown	1957	LG&E-KU
9	Big Sandy	1963	Kentucky Power Co.
10	J. Sherman Cooper	1965	E KY Power Coop
11	Barkley	1966	USCE - Nashville District
12	Paddy's Run	1968	LG&E-KU
13	Haefling	1970	LG&E-KU
14	Mill Creek	1972	LG&E-KU
15	Ghent	1974	Kentucky Utilities Co.
16	R.A. Reid	1976	Big Rivers Electric Corp.
17	Laurel	1977	USCE - Nashville District
18	H.L. Spurlock	1977	E KY Power Coop
19	R.D. Green	1979	Big Rivers Electric Corp.
20	Elmer Smith	1981	Owensboro Municipal
21	East Bend	1981	Duke Energy Kentucky Inc.
22	D.B. Wilson	1984	Big Rivers Electric Corp.
23	Trimble County	1990	Louisville Gas & Electric Co.
24	Cox Waste-to-Energy	1995	Cox Waste-To-Energy Inc
25	J.K. Smith	1999	E KY Power Coop
26	Calvert City	2000	DTE Energy Services Inc.
27	Kentucky Mill	2001	Domtar Paper Co. LLC

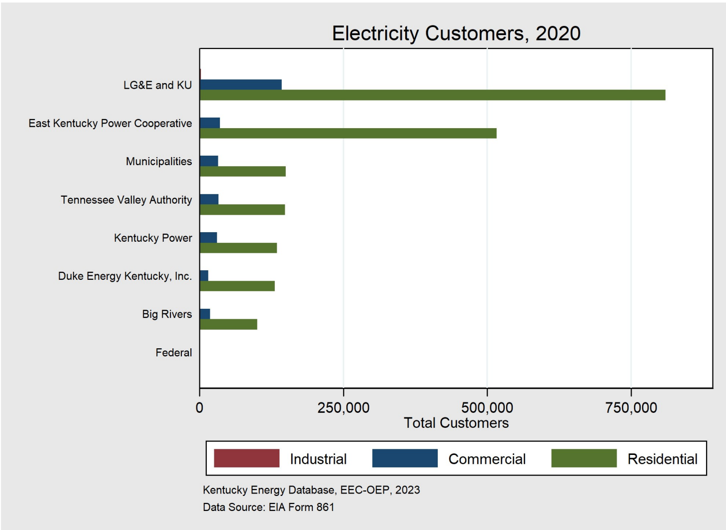
	Name	Online Year	Owner
28	Riverside Generating Project	2001	LS Power Group
29	Bluegrass Generation Project	2002	E KY Power Coop
30	Marshall County Generating Station	2002	Tennessee Valley Authority
31	Bavarian Landfill	2003	E KY Power Coop
32	Green Valley Landfill	2003	E KY Power Coop
33	Laurel Ridge Landfill	2003	E KY Power Coop
34	Hardin County LFGTE	2006	E KY Power Coop
35	Pendleton County Landfill	2007	E KY Power Coop
36	PPS Power Plant No 1	2010	Paducah Power System Co.
37	Bowling Green Solar Project	2011	Scotty's Dev. Co. LLC
38	Blue Ridge Generating	2013	North Amer Natural Resources
39	Glasgow Regional Landfill	2015	E KY Power Coop
40	Cane Run	2015	LG&E-KU
41	Meldahl Hydropower Project	2016	Hamilton City of (OH)
42	Cannelton Dam	2016	American Mun Power Inc
43	Central KY Landfill	2016	Toyota Motor Sales U.S.A. Inc.
44	Cooperative Solar One	2017	E KY Power Coop
45	Crittenden Solar Facility	2017	Duke Energy Kentucky Inc.
46	Walton Solar Facility	2017	Duke Energy Kentucky Inc.
47	Paradise CC	2017	Tennessee Valley Authority
48	L'Oreal Solar - Florence	2017	L'Oreal USA Products Inc
49	Smithland Lock and Dam	2017	American Mun Power Inc
50	Morehead Generating Facility	2019	North American Bio-Fuels LLC
51	Community Solar Project	2019	LG&E-KU
52	LGE-KU Solar Share Facility	2019	LG&E-KU

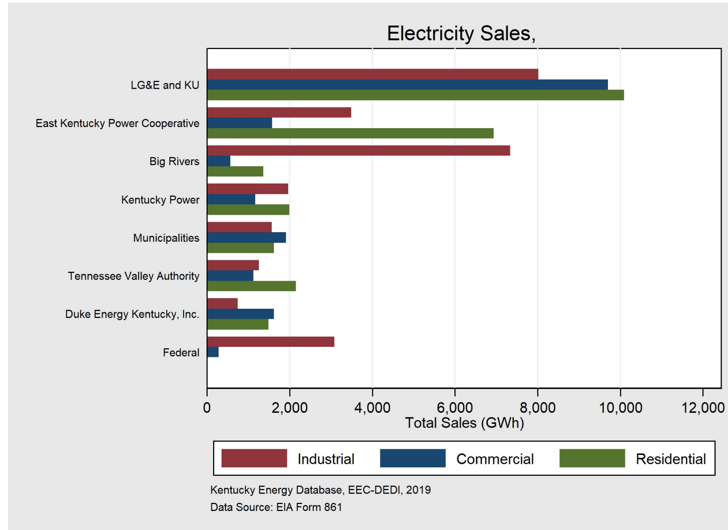
Power Plants in Kentucky



Coal-fired, natural gas, hydroelectric, and biomass-fired generators provide all of the baseload electricity in Kentucky because of their low operating costs. The coal fleet consists of large generators that were constructed between the mid-1950s and 2010. Most of these plants have been retrofitted with environmental controls to meet air quality emissions standards but many may need further upgrades as the standards have become more stringent. Peaking power—the additional electricity needed for short periods of high demand—is generated by natural gas and petroleum. Utilities typically satisfy these short periods of high demand (peaks) with simple cycle natural gas or petroleum generators because they are relatively cheap to build, and can rapidly power up and power down to balance electricity demand. However, peaking units are costlier to operate than baseload generators due to their designs, and are not optimized for baseload generation.

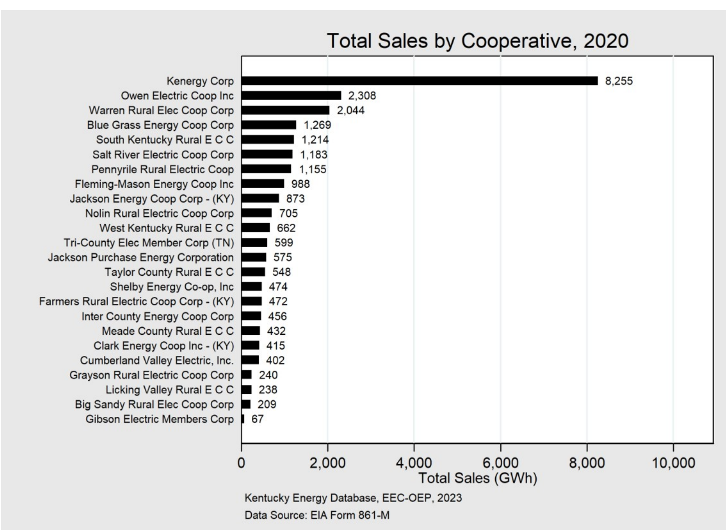
Electricity Utilities in Kentucky

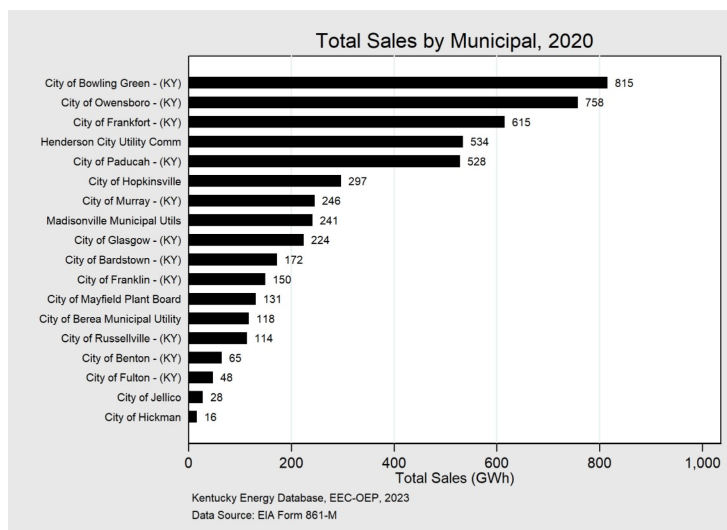




Entity	Customers	Percentage
Total	2,301,520	100%
LG&E and KU	954,959	41.5%
EKPC	552,152	24.0%
Municipalities	182,314	7.9%
TVA	181,689	7.9%
Kentucky Power	165,763	7.2%
Duke Energy	145,957	6.3%
Big Rivers	118,686	5.2%

Entity	Sales (GWh) 2020	Percentage
Total	67,655	100%
LG&E and KU	27,816	41.1%
EKPC	11,994	17.7%
Big Rivers	9,261	13.7%
TVA	4,527	6.7%
Municipalities	5,091	7.5%
Kentucky Power	5,116	7.6%
Duke Energy	3,850	5.7%

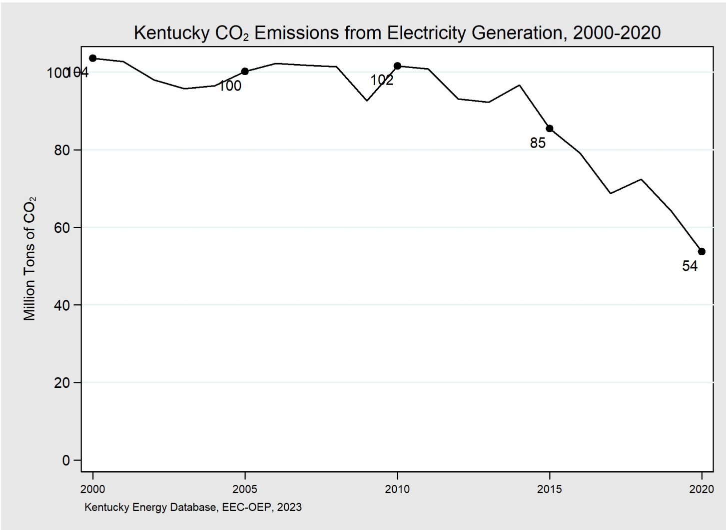


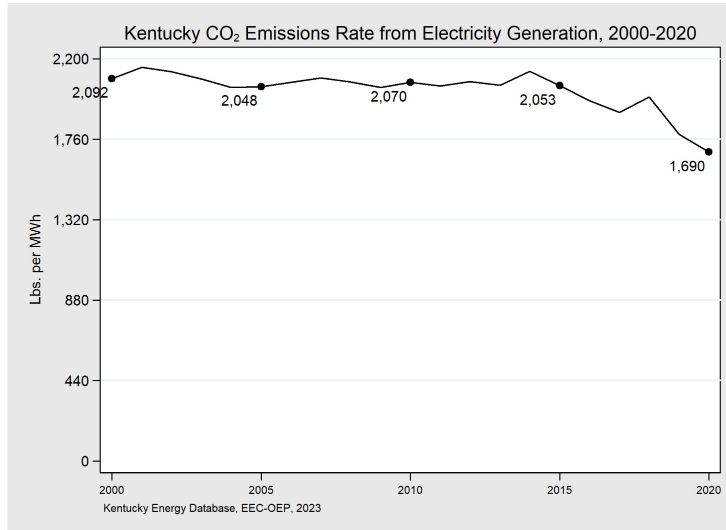


Utilities in Kentucky sold 68 TWh to 2.3 million consumers in 2020. Households accounted for 86% of consumers, but were 36% of consumption. The 5,982 industrial firms are less than 1% of total customers, but used 38% of all electricity consumed in Kentucky in 2020. LG&E and KU sell to 41.5% of consumers in the Commonwealth, while East Kentucky Power Cooperative sells to 24%, and the rest 34.5%.

All of the sales from the Big Rivers Electric Corporation, East Kentucky Power Cooperative, and the majority from the Tennessee Valley Authority, are to RECCs and municipalities. Together, cooperatives consume more than all investor-owned corporations except LG&E and KU. Kenergy Corporation, a cooperative, sells 12.2% of Kentucky's total—more electricity than Kentucky Power, all municipalities, and Duke Energy.

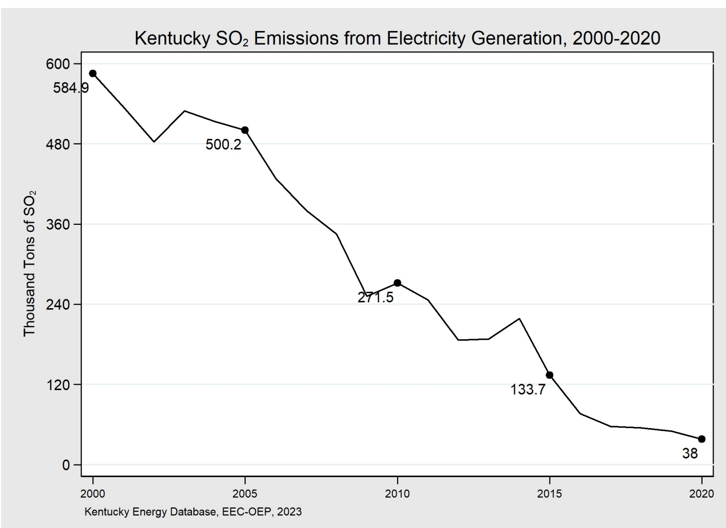
Kentucky Electric Power Emissions

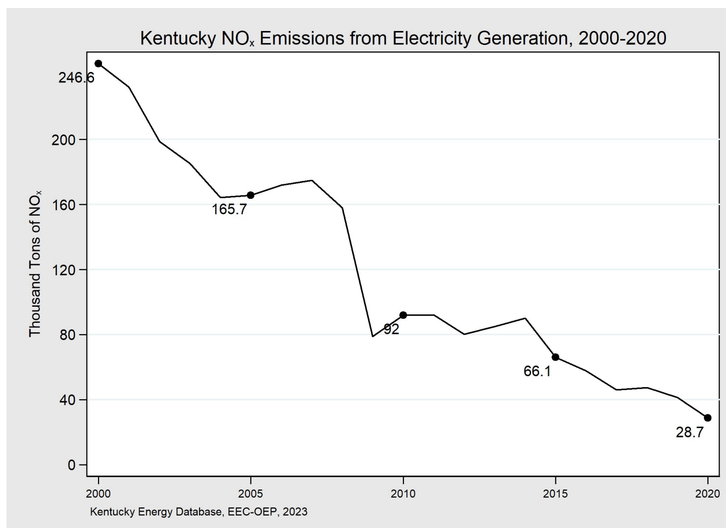




Emission	Tons	Since 2000
Carbon Dioxide	53,725,429	-48.2%
Sulfur Dioxide	37,979	-93.5%
Nitrogen Oxides	28,679	-88.4%

In 2020, power plants in Kentucky emitted 53.7 million tons of carbon dioxide, a decrease of 48% compared with 2020. In terms of emissions rate, power plants emit 19% less carbon dioxide as they did in 2000.

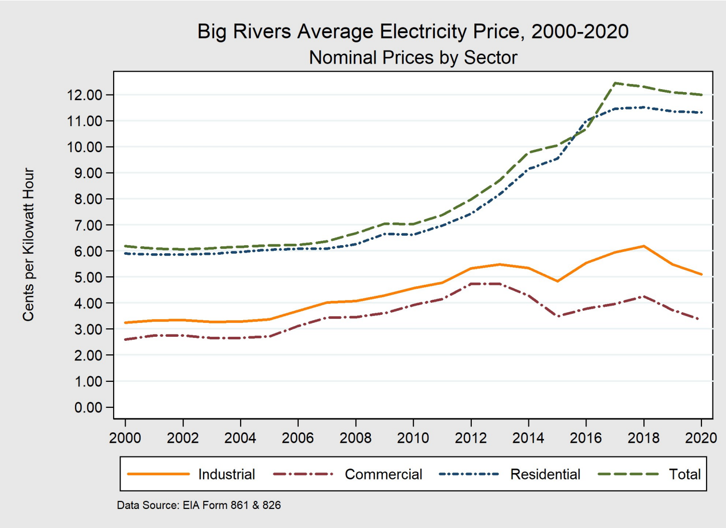


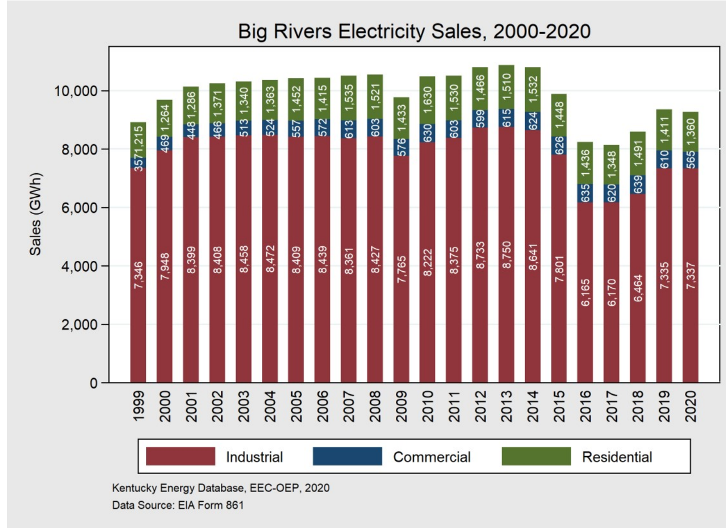


Sulfur dioxide (SO_2) is a highly reactive gas and major pollutant that is monitored and regulated by the state and federal government due to its connection to acid rain, incidence of asthma, and other respiratory problems. In 2020, the electric power sector of Kentucky emitted 37,979 tons of sulfur dioxide, a 93.5% decrease from 2000 and a 31% decrease from 2018.

Nitrogen oxides (NO_x) are a group of highly reactive regulated pollutants: Nitric oxide (NO), Nitrogen dioxide (NO_2), and Nitrous oxide (N_2O). Nitrogen oxide, which is displayed here, has been shown to cause acid rain and exacerbate respiratory disease, while nitrous oxide, or laughing gas, is a greenhouse gas 312 times more potent than carbon dioxide. In 2020, the electric power sector of Kentucky emitted 28,679 tons of nitrogen oxides, a decrease of 88% from 2000 and a 39% decrease from 2018.

Big Rivers



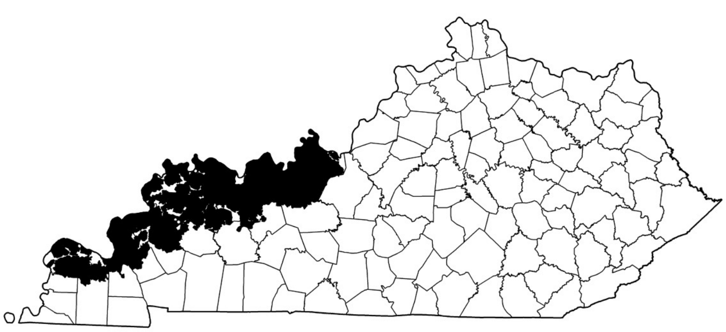


Sector	Price (Cents/kWh)	Since 2010
Total†	5.10	+11.6%
Residential	12.00	+70.7%
Commercial	11.32	+80.0%
Industrial	3.35	-14.5%

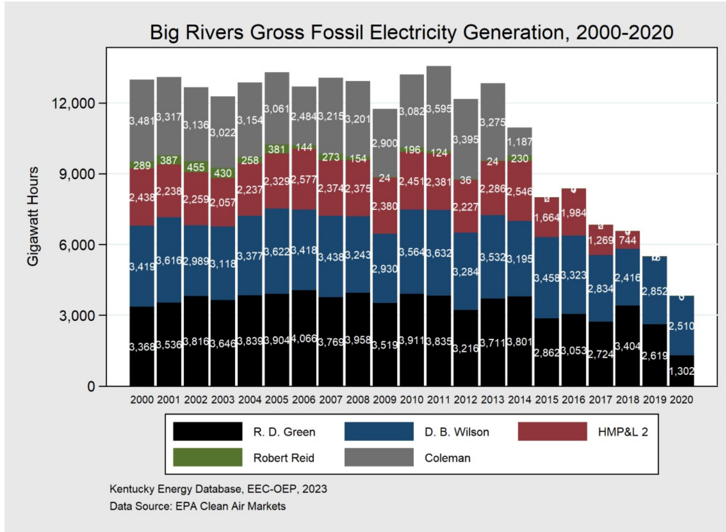
Sector	Sales (GWh)	Percentage
Total†	9,262	100%
Industrial	7,337	79.2%
Residential	1,360	14.7%
Commercial	565	6.1%

†Includes direct sales and sales to rural electric cooperatives

Big Rivers Electricity Corporation Service Territory



Kentucky Public Service Commission
Kentucky Energy Database, EEC-DEDI

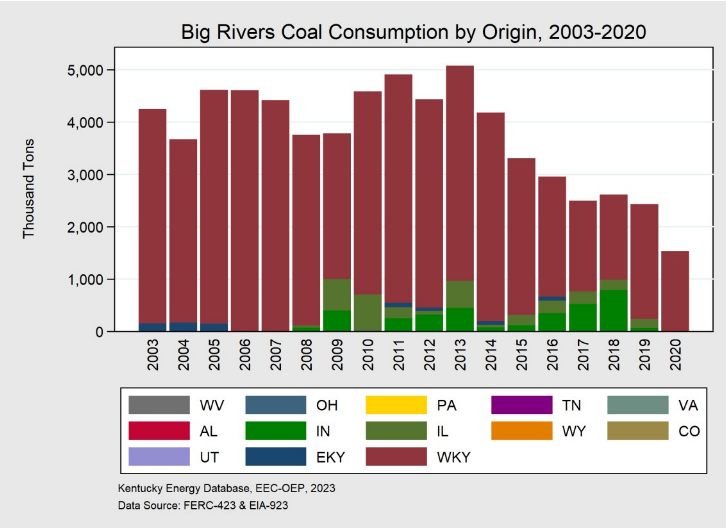


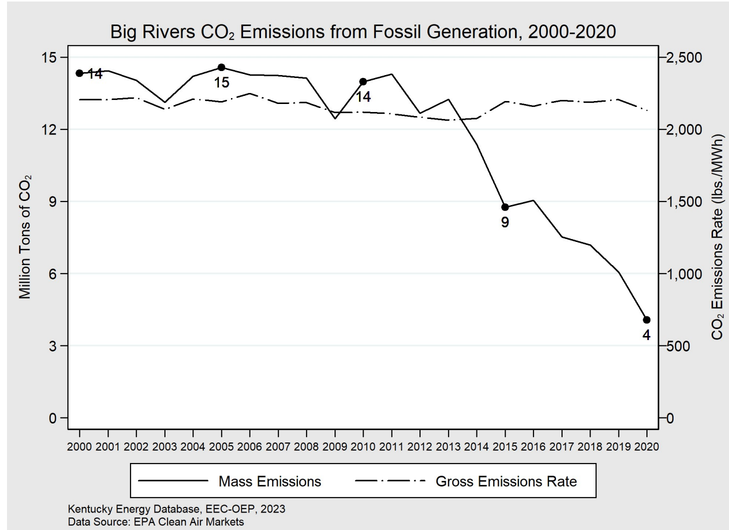
Big Rivers Electric Corporation generates and sells electricity in northwestern Kentucky. Total electricity prices in 2020 were 9.15 cents per kWh and have increased by 100% since 2010. Big Rivers serves three RECCs: Kenergy Corporation, Meade County RECC, and Jackson Purchase Energy Corporation. Big Rivers operates two coal-fired generating stations.

Electricity Generation	2020	Since 2010
Gigawatt Hours	3,812	-71.1%

Big Rivers generated 3.8 TWh and sold 9.3 TWh of electricity in 2020. Since the retirements of Henderson, Coleman and Reid power plants, fossil fuel generation has continued to decrease since 2013. When electricity sales are greater than generation, it means that the utility purchased power from another source. In many cases this includes a Regional Transmission Organization which serves as a market for generated power among its members.

Big Rivers

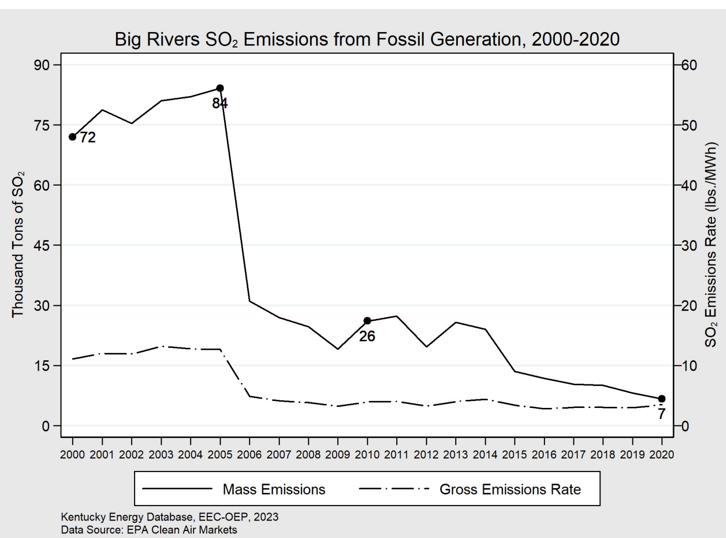


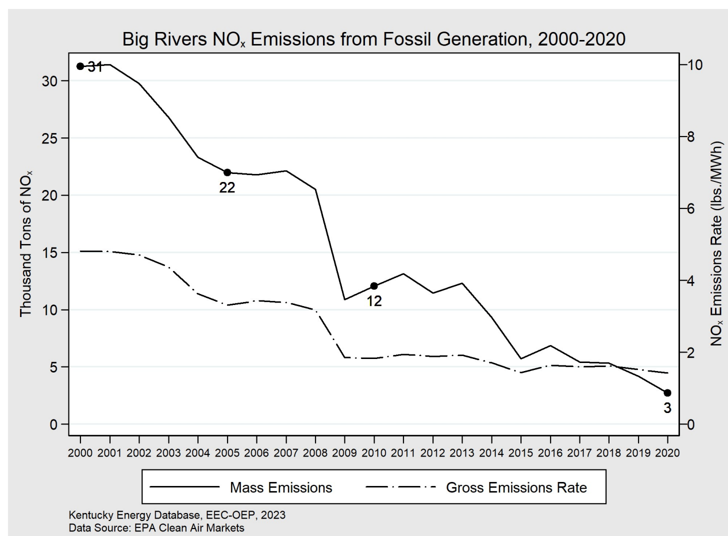


State	2020 Tons	Percentage
Total	1,531,524	100%
Western Kentucky	1,531,524	100%

Carbon Dioxide	2020	Since 2010
Emissions (Tonnage)	4,065,261	-70.9%
Rate (lbs./MWh)	2,131	+1.9%

Big Rivers Electric Corporation emitted 4 million tons of CO_2 in 2018, a decrease of 71% since 2010. The rate of CO_2 emissions has increased by 2% during that period.





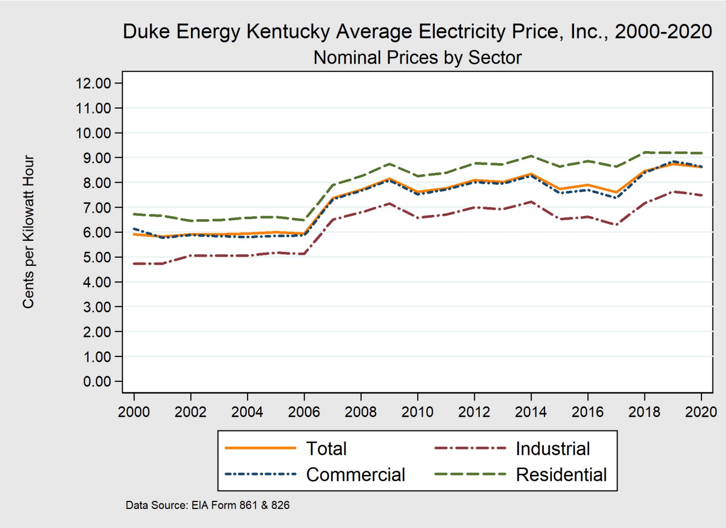
Sulfur Dioxide	2020	Since 2010
Emissions (Tonnage)	6,655	-74.5%
Rate (lbs./MWh)	3.4	-46.0%

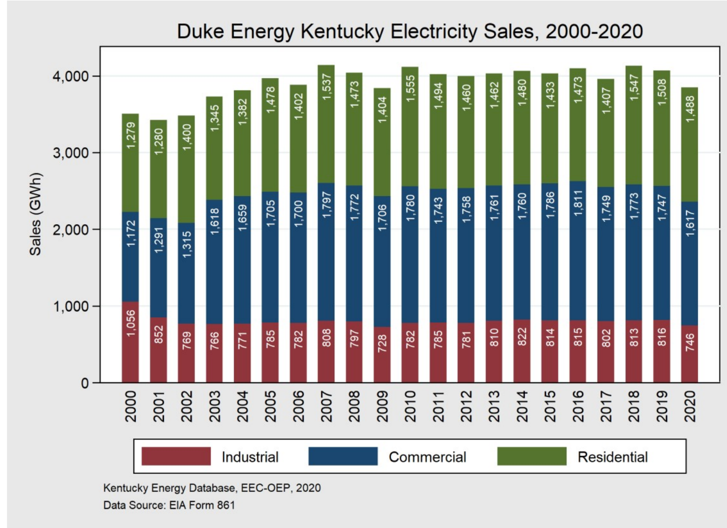
Nitrogen Dioxide	2020	Since 2010
Emissions (Tonnage)	2,718	-77.5%
Rate (lbs./MWh)	1.26	-28%

Big Rivers Electric Corporation emitted 6,655 tons of SO_2 in 2020, a decrease of 74.5% since 2010. The rate of SO_2 emissions decreased by 46% during that period.

Big Rivers Electric Corporation emitted 2,718 tons of NO_x in 2020, a reduction of 78% since 2010. The rate of NO_x emissions decreased by 28% during that period.

Duke Energy Kentucky

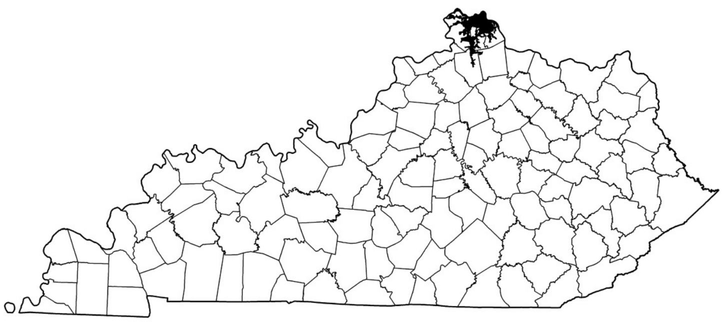




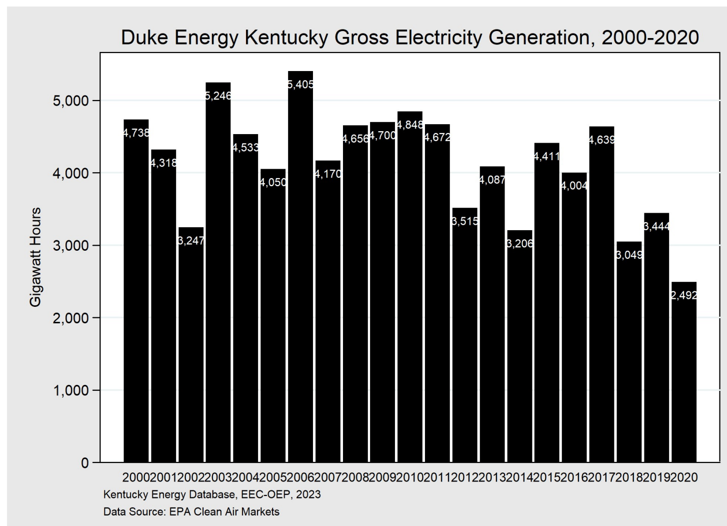
Sector	Price (Cents/kWh)	Since 2010
Total†	8.63	+13.3%
Residential	9.18	+11.1%
Commercial	8.64	+14.9%
Industrial	7.49	+13.8%

Sector	Sales (GWh)	Percentage
Total†	3,851	100%
Commercial	1,617	42.0%
Residential	1,488	38.6%
Industrial	746	19.4%

Duke Energy Kentucky Service Territory



Kentucky Public Service Commission
Kentucky Energy Database, EEC-DEDI

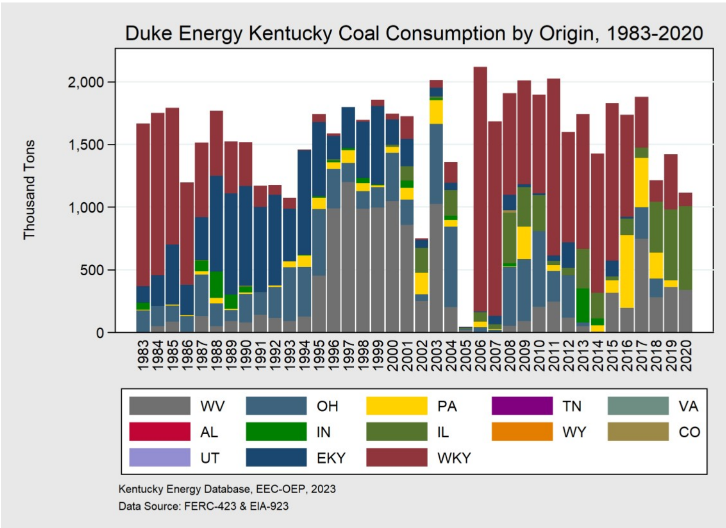


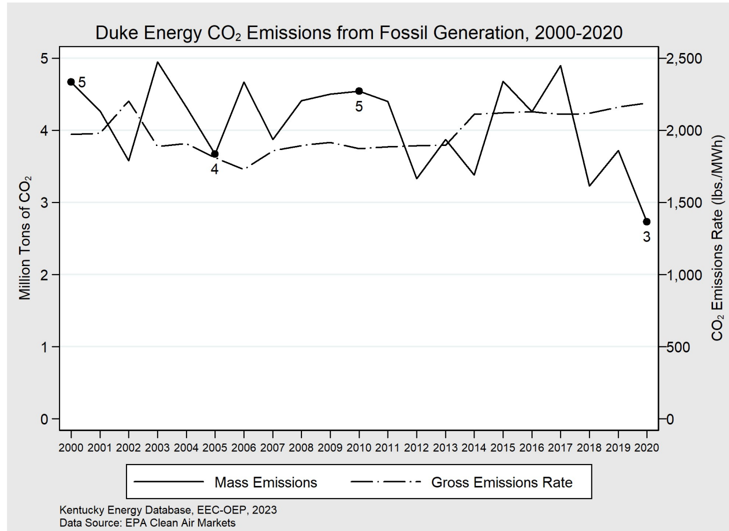
Duke Energy Kentucky generates and sells electricity in northern Kentucky and is owned and operated by Duke Energy. Total electricity prices in 2020 were 8.63 cents per kWh and has increased by 13.3% since 2010. Duke Energy owns and operates the East Bend coal-fired power plant in Boone County. Duke Energy also sells electricity throughout North and South Carolina, Indiana, and southwest Ohio.

Electricity Generation	2020	Since 2010
Gigawatt Hours	2,492	-48.6%

Duke Energy Kentucky generated 2.5 TWh of electricity in 2020, a decrease of 48.6% from 2010, when it generated 4.8 TWh.

Duke Energy Kentucky

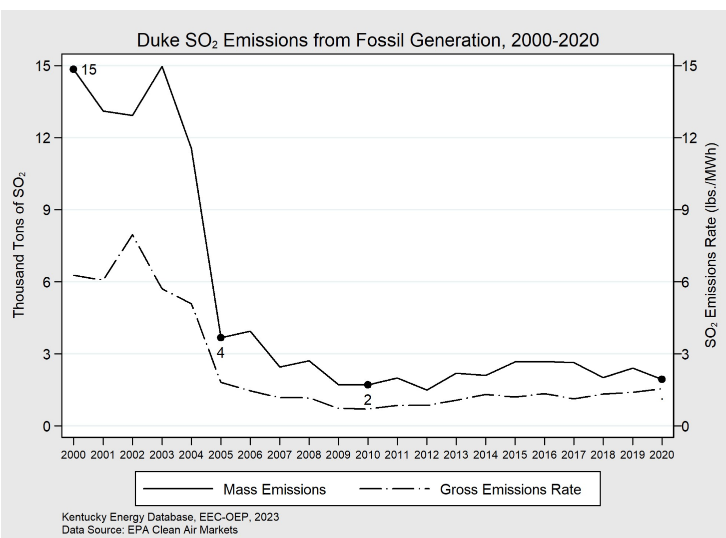


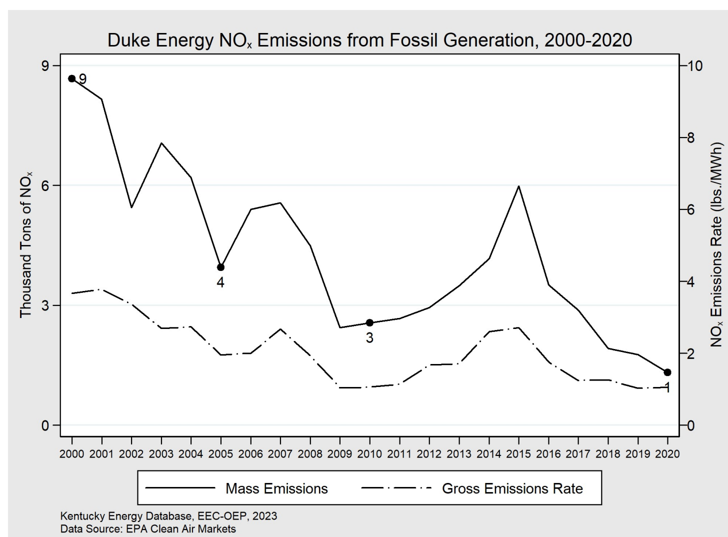


State	2020 Tons	Percentage
Total	1,115,715	100%
Western Kentucky	107,839	9.7%
Illinois	670,821	60.1%
West Virginia	337,055	30.2%

Carbon Dioxide	2020	Since 2010
Emissions (Tonnage)	2,730,063	-39.9%
Rate (lbs./MWh)	2,190	+17.0%

Duke Energy Kentucky emitted 2.7 million tons of CO_2 in 2020, a decrease of 39.9% since 2010. The rate of CO_2 emissions has increased by 17% during that period.





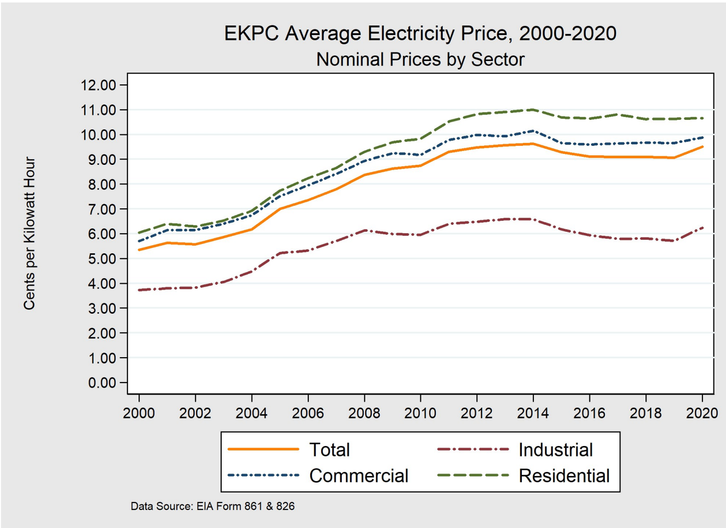
Sulfur Dioxide	2020	Since 2010
Emissions (Tonnage)	1,932	+13.0%
Rate (lbs./MWh)	1.55	+118.3%

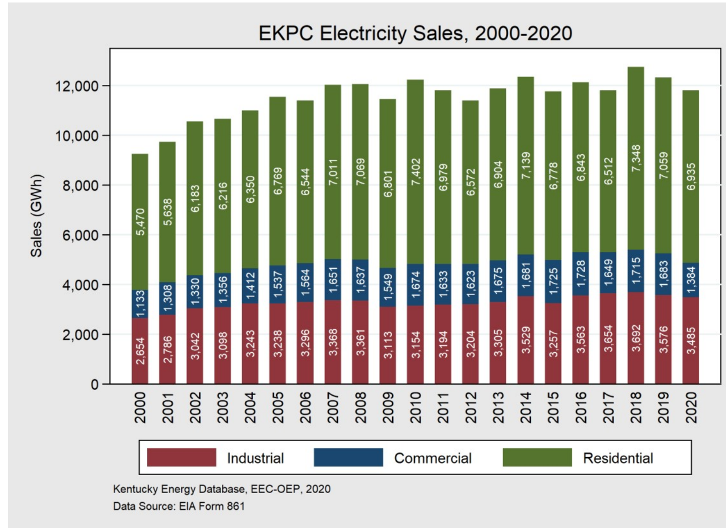
Nitrogen Dioxide	2020	Since 2010
Emissions (Tonnage)	1,320	-48.5%
Rate (lbs./MWh)	1.06	0%

Duke Energy Kentucky emitted 1,932 tons of SO_2 in 2020, an increase of 13% since 2010. The rate of SO_2 emissions increased by 118.3% during that period while still remaining within the range of rates emitted by other utilities.

Duke Energy Kentucky emitted 1,320 tons of NO_x in 2020, a reduction of 48.5% since 2010. The rate of NO_x emissions remains the same as it was in 2010.

East Kentucky Power Cooperative



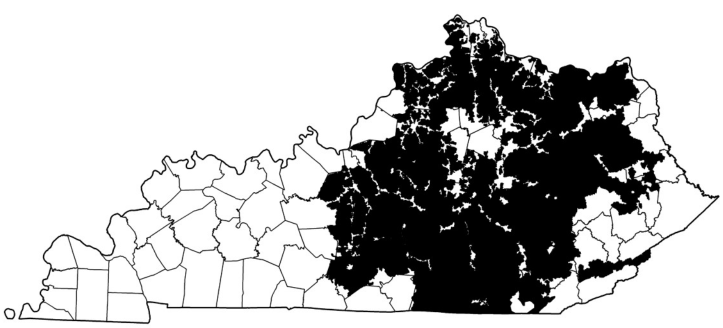


Sector	Price (Cents/kWh)	Since 2010
Total	9.51	+8.8%
Residential	10.66	+8.4%
Commercial	9.87	+7.5%
Industrial	6.24	+4.7%

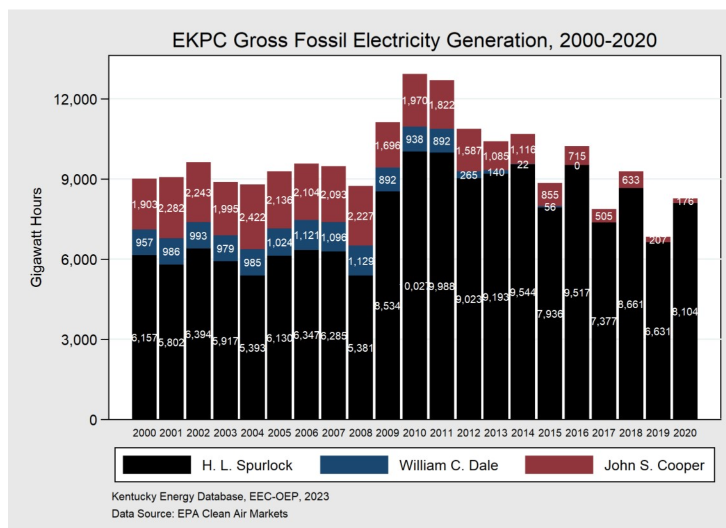
Sector	Sales (GWh)	Percentage
Total	11,805	100%
Residential	6,935	58.8%
Industrial	3,486	29.5%
Commercial	1,384	11.7%

†Includes direct sales and sales to rural electric cooperatives

Eastern Kentucky Power Cooperative Service Territory



Kentucky Public Service Commission
Kentucky Energy Database, EEC-DEDI

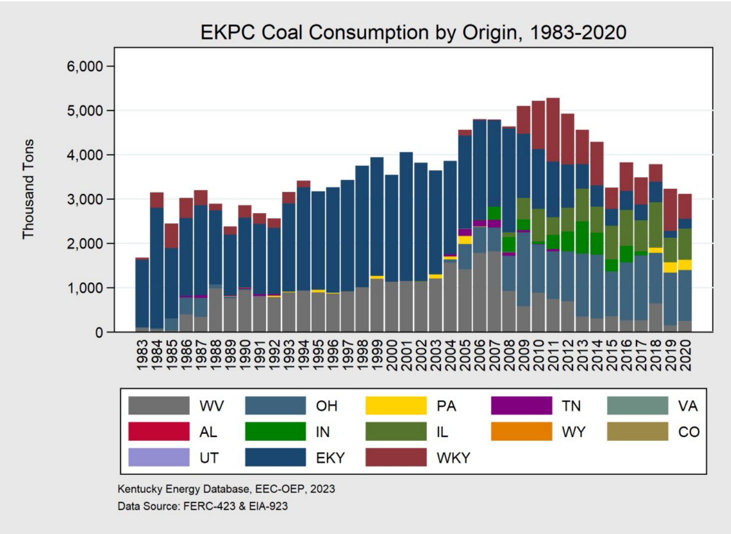


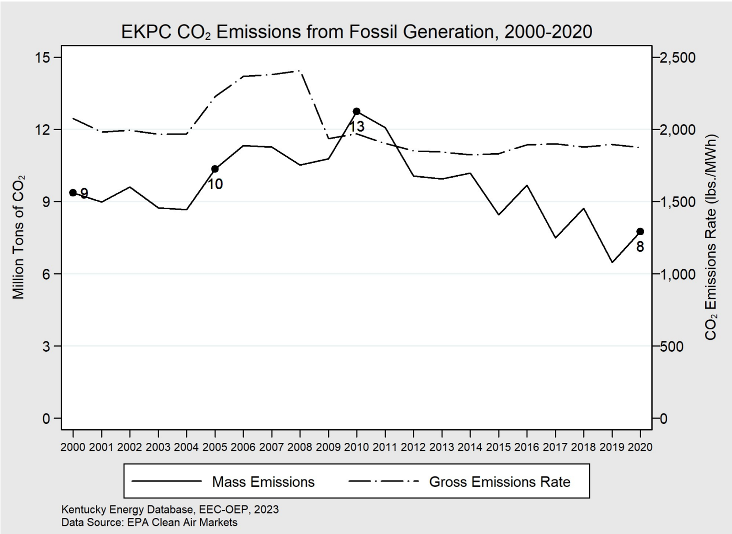
East Kentucky Power Cooperative serves central and eastern Kentucky where 16 RECCs jointly own and purchase electricity from EKPC. Total electricity prices in 2020 were 9.51 cents per kWh and have increased by 8.8% since 2010. EKPC owns and operates two coal-fired power plants, two natural gas electricity generating stations, and six landfill gas generating stations.

Electricity Generation	2020	Since 2010
Gigawatt Hours	8,280	-36%

East Kentucky Power Cooperative generated 8.2 TWh but sold 11.8 TWh of electricity in 2020. When electricity sales are greater than generation, it means that the utility purchased power from another source. In many cases this includes a Regional Transmission Organization which serves as a market for generated power among its members.

East Kentucky Power Cooperative

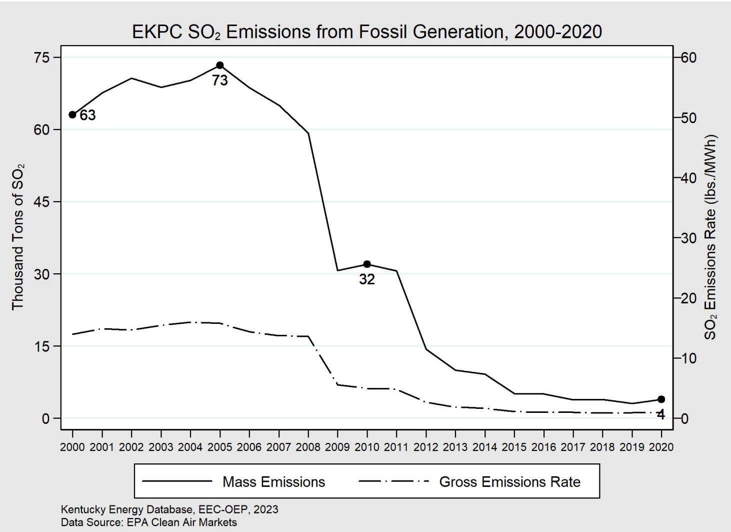


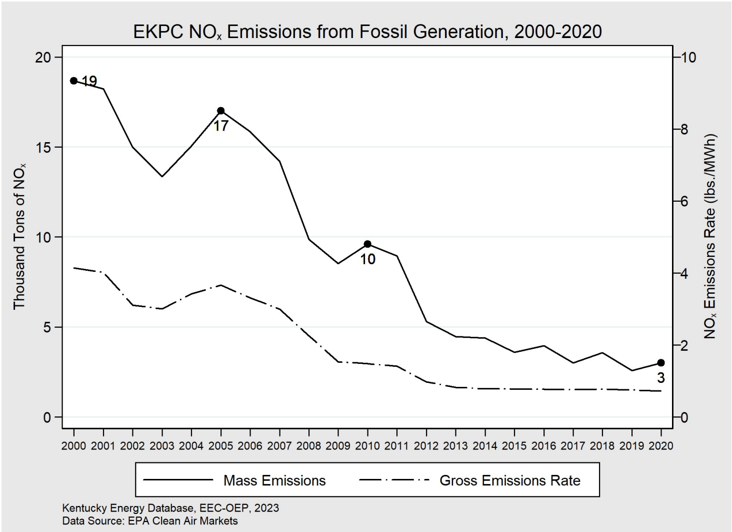


State	2020 Tons	Percentage
Total	3,115,315	100%
Ohio	1,149,563	36.9%
Western Kentucky	558,970	17.9%
Illinois	703,878	22.6%
Eastern Kentucky	223,247	7.2%
West Virginia	245,886	7.9%
Pennsylvania	233,771	7.5%

Carbon Dioxide	2020	Since 2010
Emissions (Tonnage)	7,753,863	-38.9%
Rate (lbs./MWh)	1,894	-6.1%

East Kentucky Power Cooperative emitted 7.8 million tons of CO_2 in 2020, a decrease of 38.9% since 2010. The rate of CO_2 emissions has decreased by 6.1% during that period.





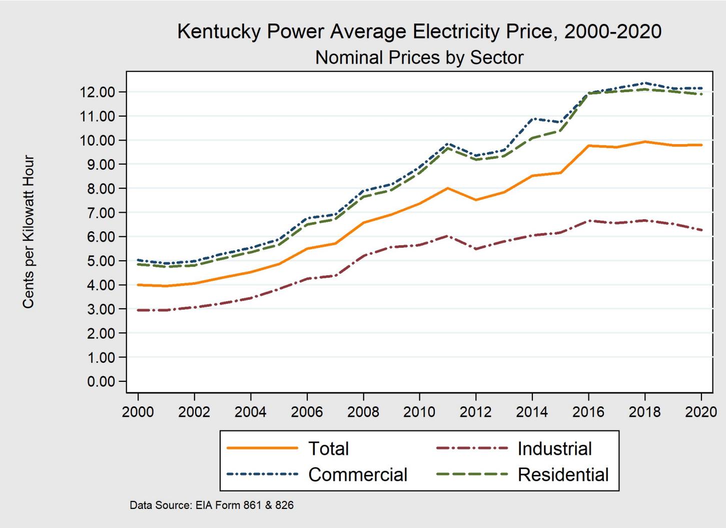
Sulfur Dioxide	2020	Since 2010
Emissions (Tonnage)	3,878	-87.9%
Rate (lbs./MWh)	0.56	-99.4%

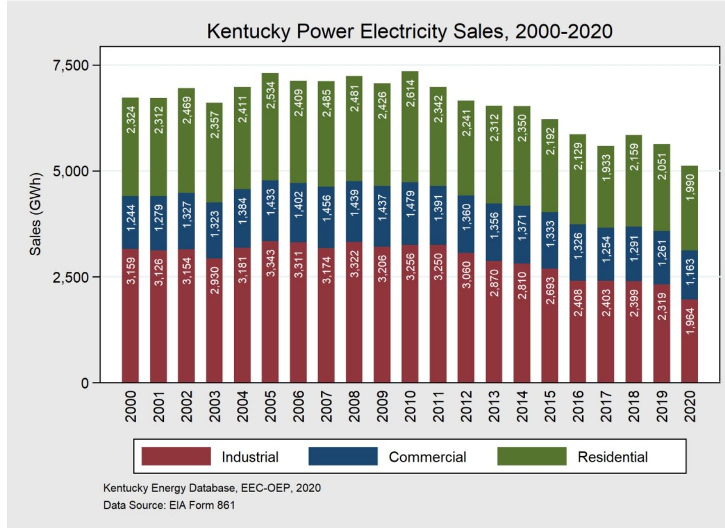
Nitrogen Dioxide	2020	Since 2010
Emissions (Tonnage)	3,004	-68.7%
Rate (lbs./MWh)	0.58	-79.9%

East Kentucky Power Cooperative emitted 3,878 tons of SO_2 in 2020, a decrease of 87.9% since 2010. The rate of SO_2 emissions decreased by 99.4% during that period.

East Kentucky Power Cooperative emitted 3,004 tons of NO_x in 2020, a reduction of 68.7% since 2010. The rate of NO_x emissions decreased by 79.9% during that period and is the lowest in Kentucky.

Kentucky Power

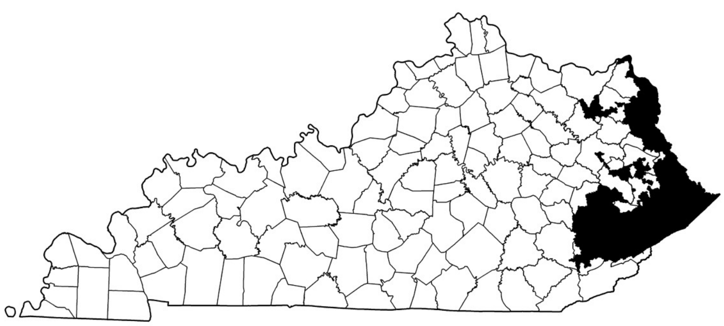




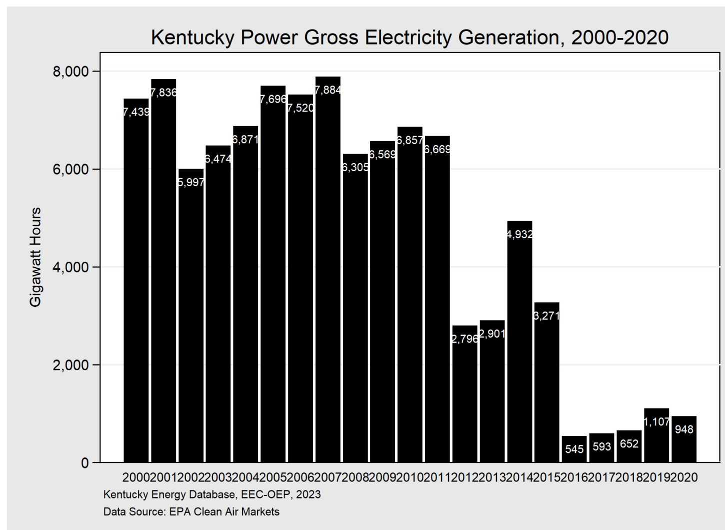
Sector	Price (Cents/kWh)	Since 2010
Total	9.80	+33.2%
Residential	11.91	+37.8%
Commercial	12.15	+36.8%
Industrial	6.27	+11.2%

Sector	Sales (GWh)	Percentage
Total†	5,117	100%
Industrial	1,964	38.4%
Residential	1,990	38.9%
Commercial	1,163	22.7%

Kentucky Power Service Territory



Kentucky Public Service Commission
Kentucky Energy Database, EEC-DEDI

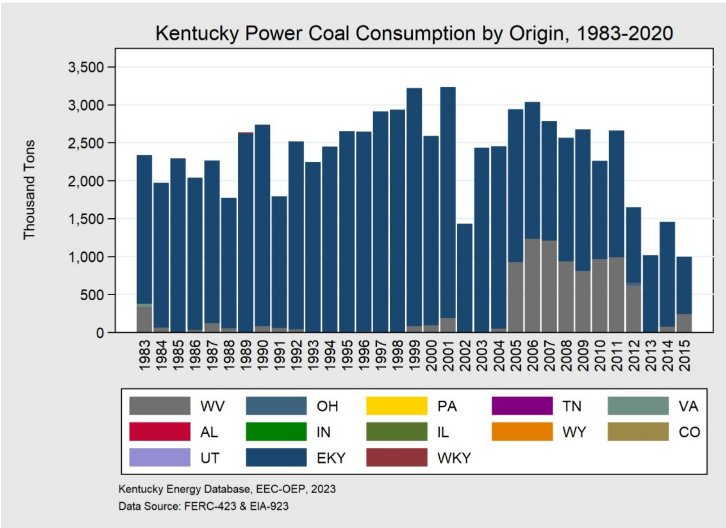


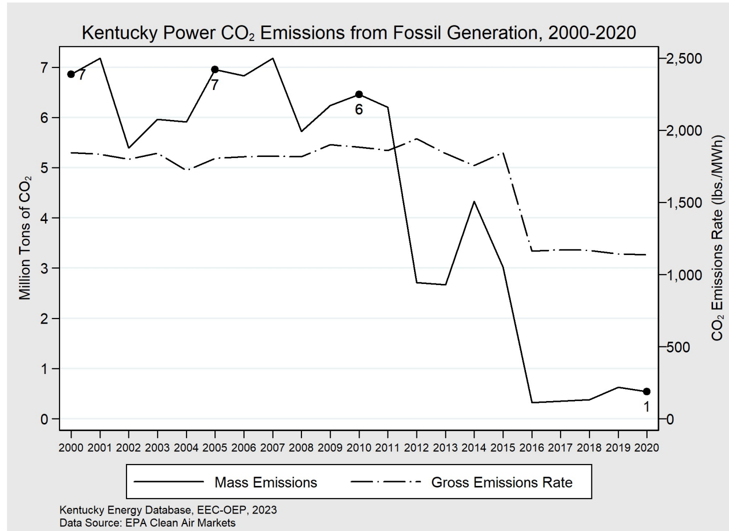
Kentucky Power, a subsidiary of American Electric Power, generates and distributes electricity in eastern Kentucky. Total electricity prices in 2020 were 9.8 cents per kWh and have increased by 33.2% since 2010. Kentucky Power operates the Big Sandy power plant in Louisa Kentucky.

Electricity Generation	2020	Since 2010
Gigawatt Hours	948	-86.2%

Kentucky Power generated 984 GWh and sold 5.1 TWh of electricity in 2020. Since 2010 generation has decreased by 86%.

Kentucky Power

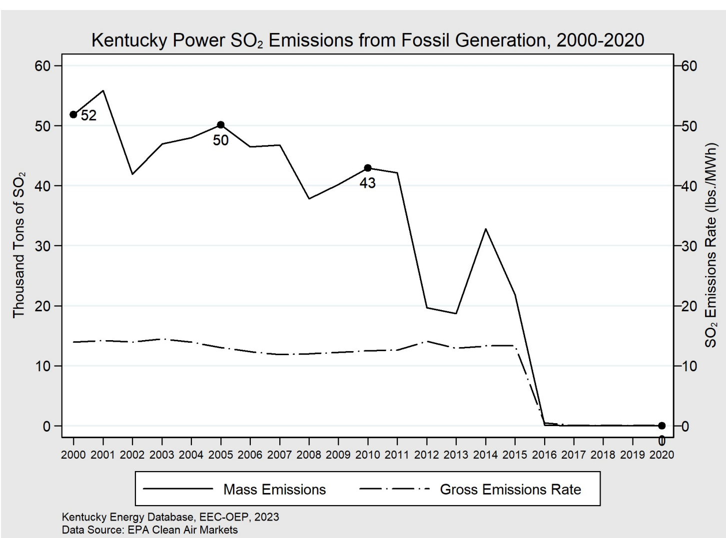


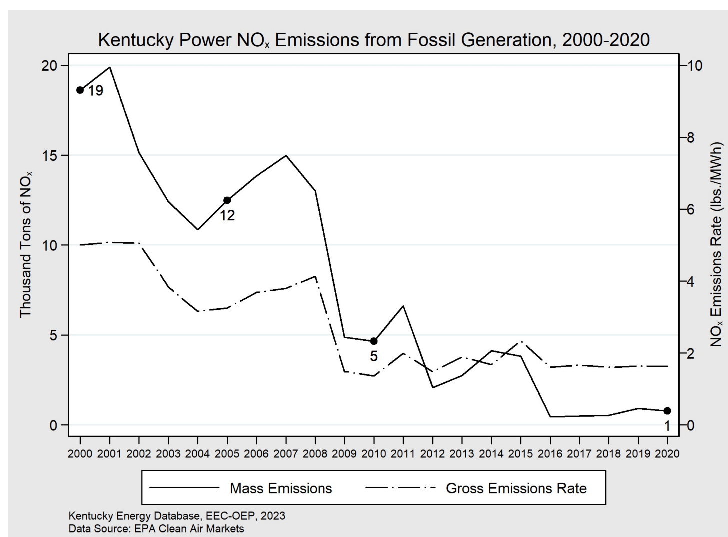


All units for the Big Sandy were retired in May of 2015 except unit 1, which was converted to natural gas.

Carbon Dioxide	2020	Since 2010
Emissions (Tonnage)	539,187	-91.0%
Rate (lbs./MWh)	1,126	-33.7%

Kentucky Power emitted 539 thousand tons of CO_2 in 2020, a decrease of 91% since 2010. The rate of CO_2 emissions has decreased by 34% in that period of time.





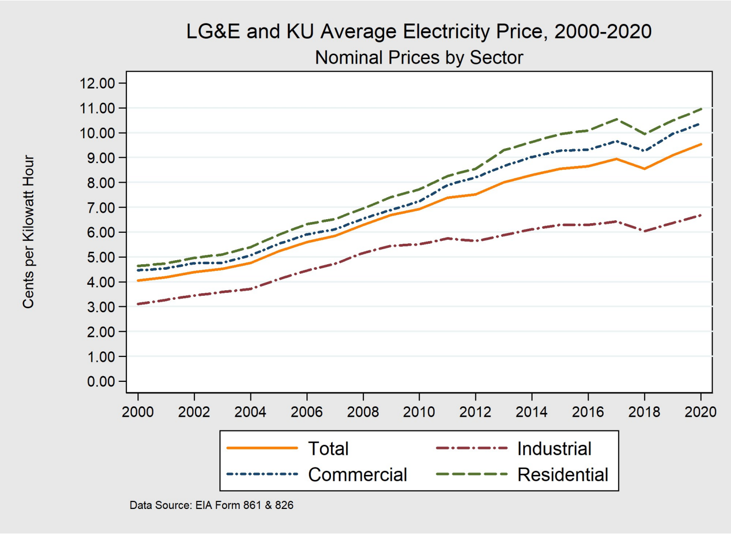
Sulfur Dioxide	2020	Since 2010
Emissions (Tonnage)	23.4	-99.9%
Rate (lbs./MWh)	0.03	-99.6%

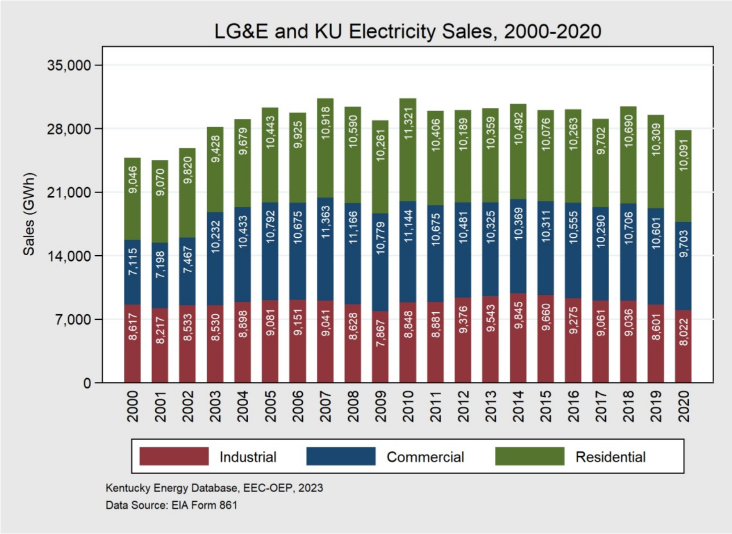
Kentucky Power emitted 23.4 tons of SO_2 in 2020, a decrease of 99.9% since 2010. The rate of SO_2 emissions reduced by 99.7% during that period.

Nitrogen Dioxide	2020	Since 2010
Emissions (Tonnage)	772.0	-84.2%
Rate (lbs./MWh)	1.7	+21.4%

Kentucky Power emitted 772 tons of NO_x in 2020, a reduction of 84.2% since 2010. The rate of NO_x emissions increased by 21.4% during that period. This is due to the unit's conversion to natural gas in 2016.

LG&E and KU

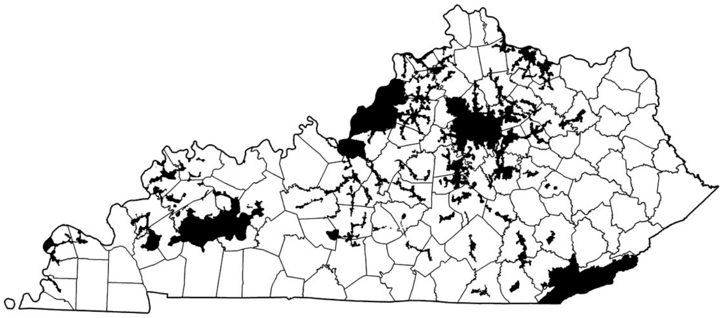




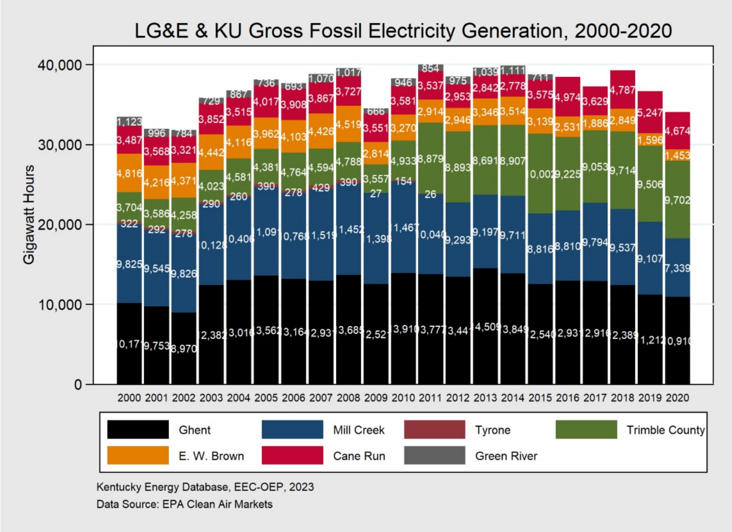
Sector	Price (Cents/kWh)	Since 2010
Total	9.54	+37.9%
Residential	10.95	+41.8%
Commercial	10.38	+43.4%
Industrial	6.68	+21.2%

Sector	Sales (GWh)	Percentage
Total	27,816	100%
Residential	10,091	36.3%
Commercial	9,703	34.9%
Industrial	8,022	28.8%

Louisville Gas & Electric and Kentucky Utilities



Kentucky Public Service Commission
Kentucky Energy Database, EEC-DEDI

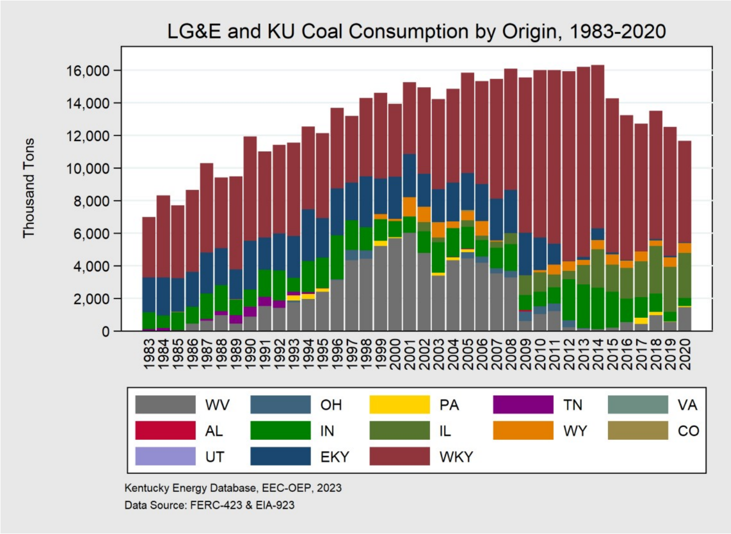


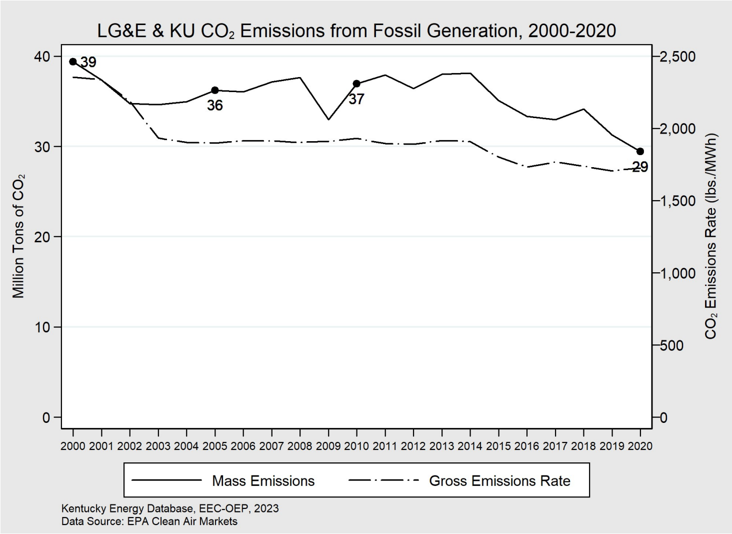
Electricity Generation	2020	Since 2010
Gigawatt Hours	34,078	-11%

LG&E and KU is the single largest utility by sales in Kentucky and sells electricity throughout the state, primarily in densely populated areas. Total electricity prices in 2020 were 9.54 cents per kWh and have increased by 37.9% since 2010. LG&E and KU operate numerous electricity generation facilities throughout the state including four coal-fired power plants, two hydroelectric dams, five natural gas facilities and four solar operations.

LG&E and KU generated just over 34 TWh and sold almost 27 TWh of electricity in 2020. Since 2010, generation has decreased by 11%.

LG&E and KU

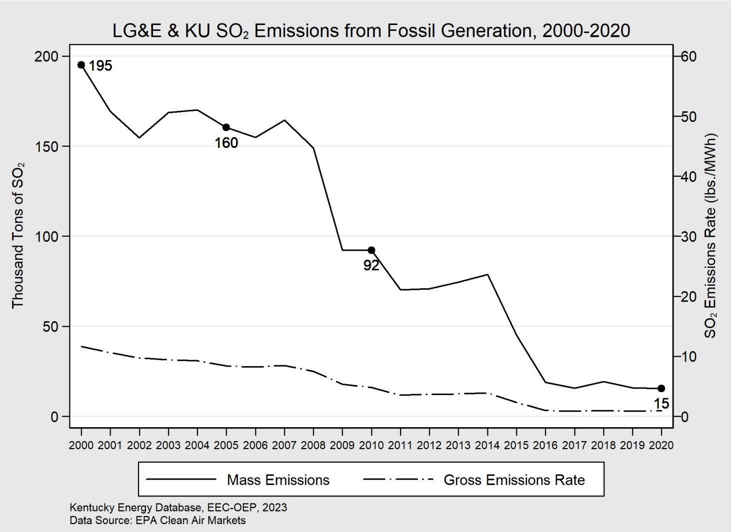


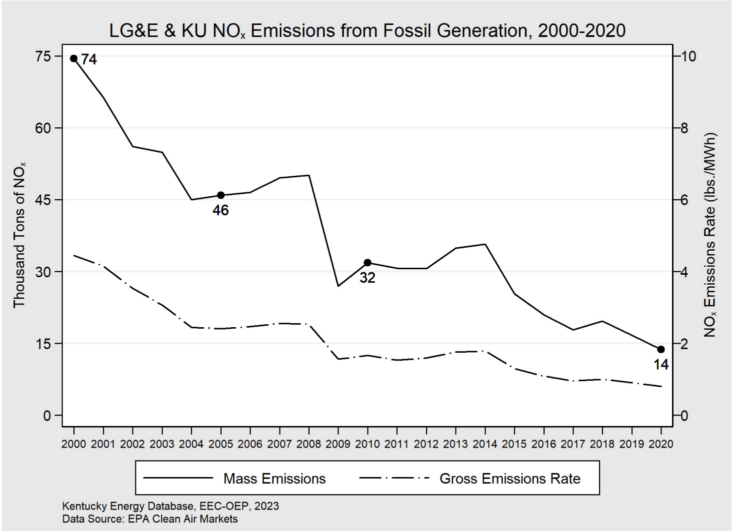


State	2020 Tons	Percentage
Total	11,586,349	100%
Western Kentucky	6,214,292	53.6%
Indiana	492,787	4.4%
Illinois	2,759,305	23.8%
Wyoming	605,446	5.2%
Eastern Kentucky	63,270	0.5%
West Virginia	1,451,249	12.5%

Carbon Dioxide	2020	Since 2010
Emissions (Tonnage)	29,417,229	-20.3%
Rate (lbs./MWh)	1,767	-7.1%

LG&E and KU emitted 29 million tons of CO_2 in 2020, a decrease of 20.3% since 2010. The rate of CO_2 emissions decreased by 7.1% during that period.





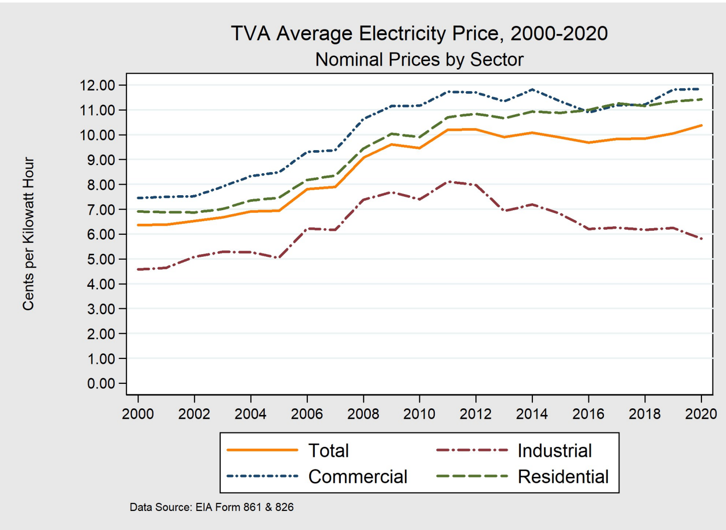
Sulfur Dioxide	2020	Since 2010
Emissions (Tonnage)	15,480	-83.2%
Rate (lbs./MWh)	1.23	-72.4%

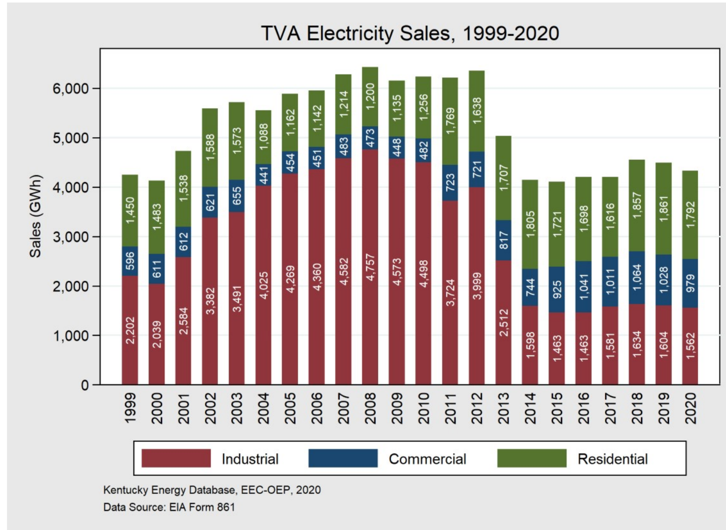
Nitrogen Dioxide	2020	Since 2010
Emissions (Tonnage)	13,710	-56.9%
Rate (lbs./MWh)	0.96	-47.0%

LG&E and KU emitted 15,480 tons of SO_2 in 2020, a decrease of 83.2% since 2010. The rate of SO_2 emissions reduced by 72.4% during that period.

LG&E and KU emitted 13,710 tons of NO_x in 2020, a reduction of 56.9% since 2010. The rate of NO_x emissions decreased by 47% during that period.

Tennessee Valley Authority

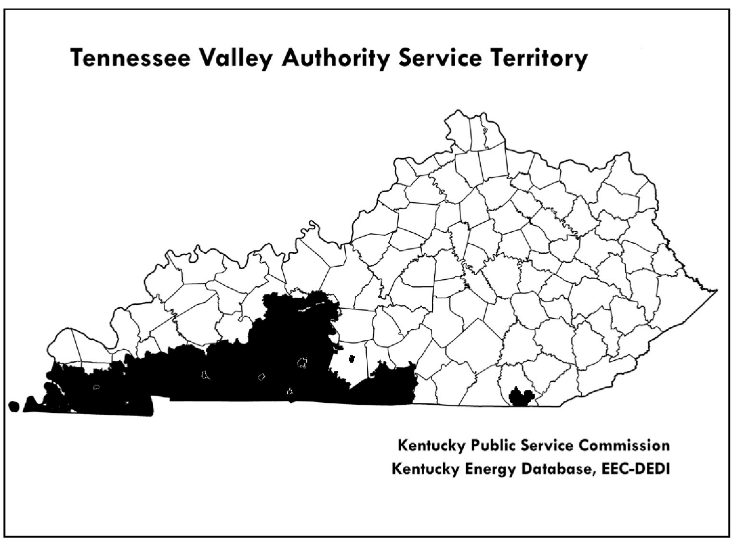


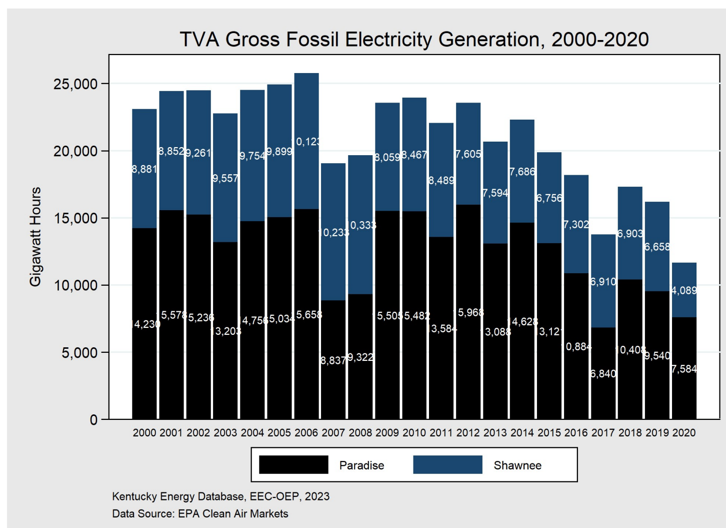


Sector	Price (Cents/kWh)	Since 2010
Total†	10.37	+9.5%
Residential	11.43	+15.5%
Commercial	11.84	+6.0%
Industrial	5.82	-21.4%

Sector	Sales (GWh)	Percentage
Total†	4,527	100%
Industrial	1,257	27.8%
Residential	2,151	47.5%
Commercial	1,119	24.7%

†Includes direct sales and sales to rural electric cooperatives



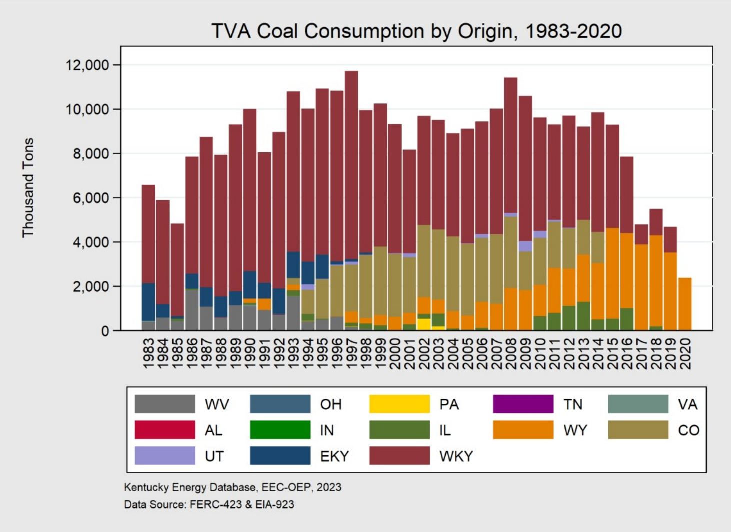


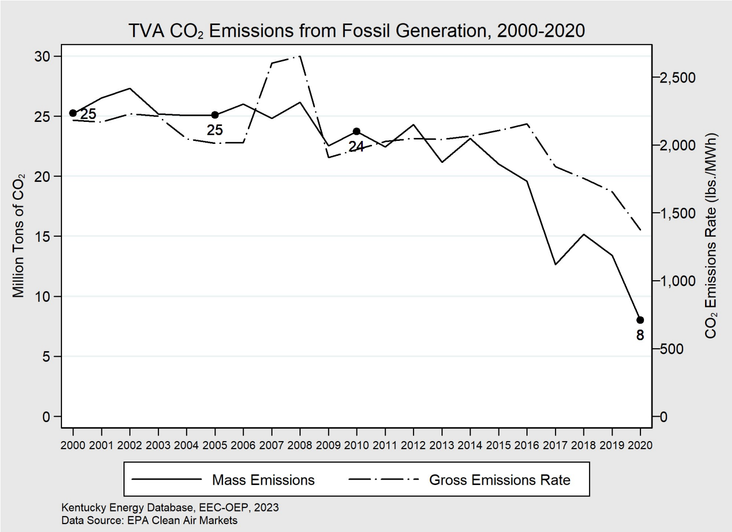
Electricity Generation	2020	Since 2010
Gigawatt Hours	11,673	-51.3%

The Tennessee Valley Authority generates and sells electricity to five RECCs, 10 municipalities, and several industrial consumers in southwest Kentucky. Total electricity prices in 2020 were 10.37 cents per kWh and have increased by 9.5% since 2010. In Kentucky, TVA operates the Marshall Combustion Turbine Plant near Calvert City as well as the coal-fired power plants of Paradise and Shawnee.

TVA generated 11.7 TWh and sold 4.5 TWh of electricity in 2020. Since 2010, generation has decreased by 51%. TVA directly sells electricity to a number of industrial manufacturers and five RECCs. The 10 municipalities TVA supplies are not shown in the figures above.

Tennessee Valley Authority

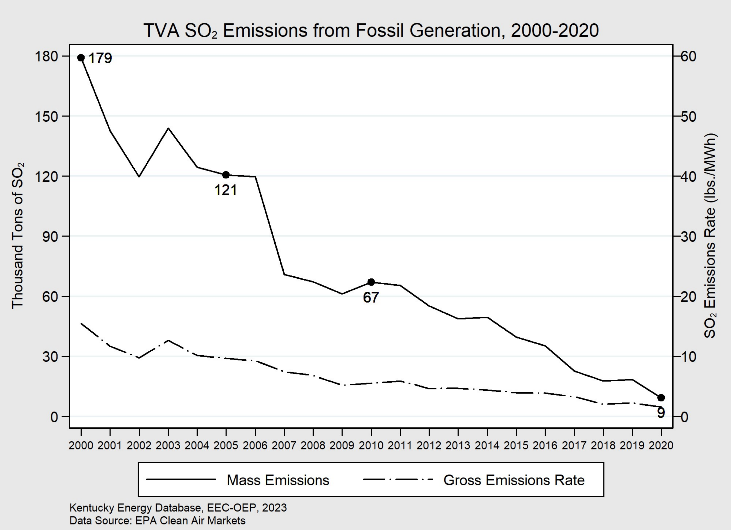


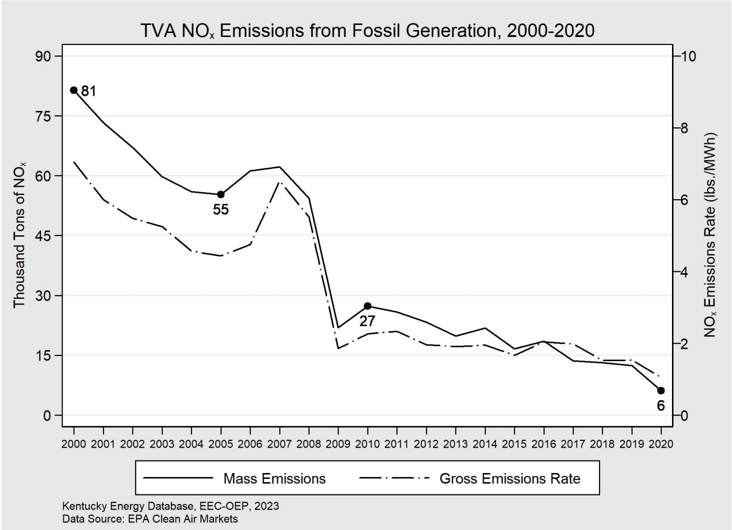


State	2020 Tons	Percentage
Total	2,382,441	100%
Wyoming	2,382,441	100%

Carbon Dioxide	2020	Since 2010
Emissions (Tonnage)	8,022,049	-66.2%
Rate (lbs./MWh)	1,412	-27.1%

The Tennessee Valley Authority emitted 8 million tons of CO_2 in Kentucky in 2020, a decrease of 66.2% since 2010. The rate of CO_2 emissions has decreased by 27.1% during that period.





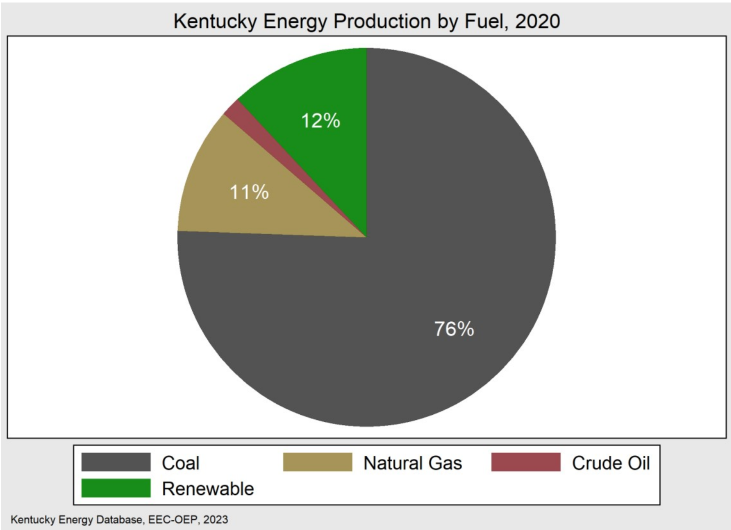
Sulfur Dioxide	2020	Since 2010
Emissions (Tonnage)	9,419	-85.9%
Rate (lbs./MWh)	1.06	-84.7%

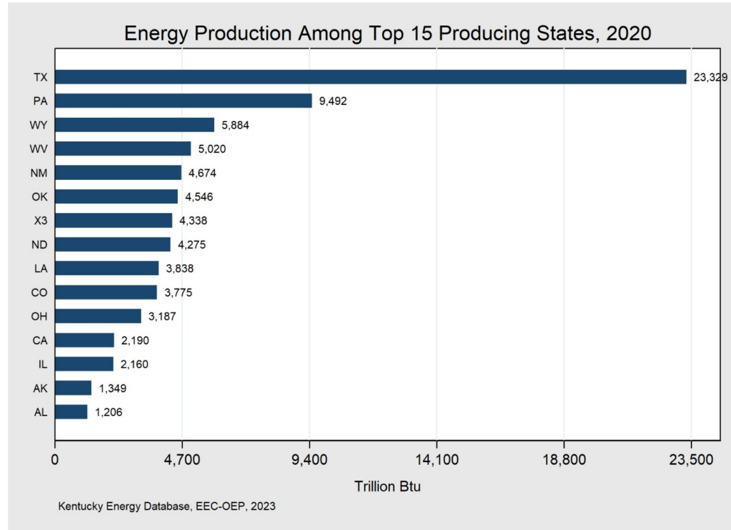
Nitrogen Dioxide	2020	Since 2010
Emissions (Tonnage)	6,126	-77.6%
Rate (lbs./MWh)	1.34	-35.8%

The Tennessee Valley Authority emitted 9,419 tons of SO_2 in 2020, a decrease of 86% since 2010. The rate of SO_2 emissions reduced by 85% during that period.

The Tennessee Valley Authority emitted 6,126 tons of NO_x in 2020, a reduction of 77.6% since 2010. The rate of NO_x emissions decreased by 35.8% during that period.

Kentucky Energy Production

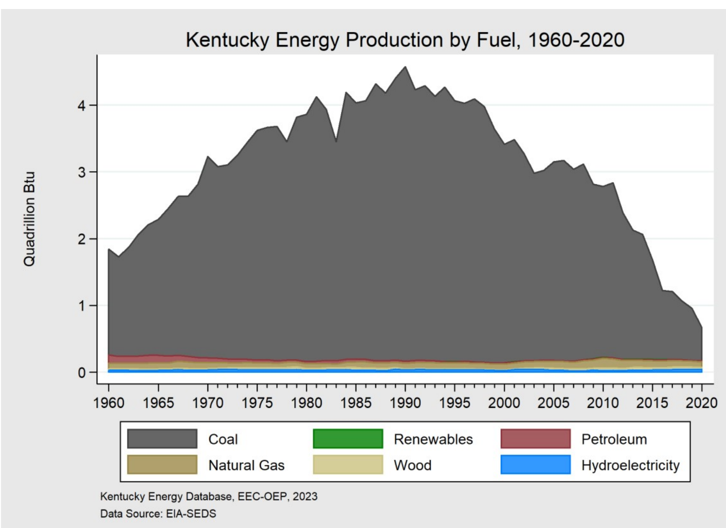


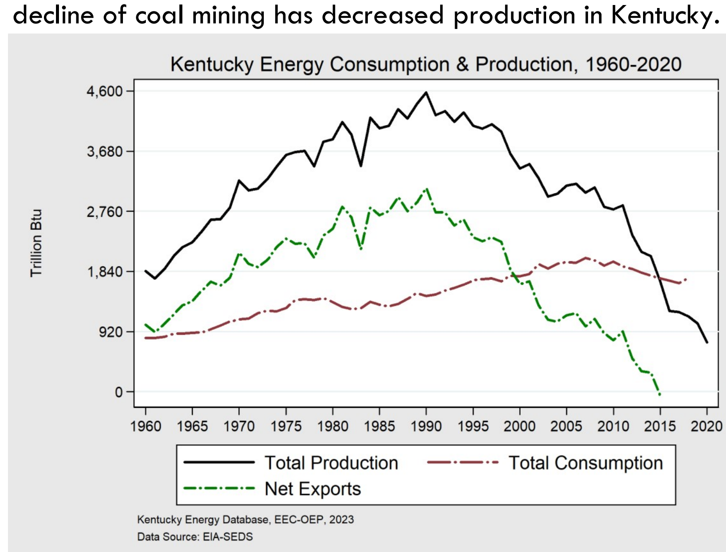


Fuel Type	Billion Btu	1 Year Change
Total	756,015	-32.2%
Coal	571,089	-39.6%
Natural Gas	81,708	-8.9%
Renewable	90,327	+1.2%
Crude Oil	12,890	-10.2%

State	Quadrillion Btu	Rank
Texas	23.3	1st
Kentucky	.8	23rd

Kentucky was the 23rd largest producer of energy in 2020. As recently as 2009, Kentucky ranked 4th among all states; however, the increased adoption of horizontal hydraulic fracturing has increased production in other states and the decline of coal mining has decreased production in Kentucky.

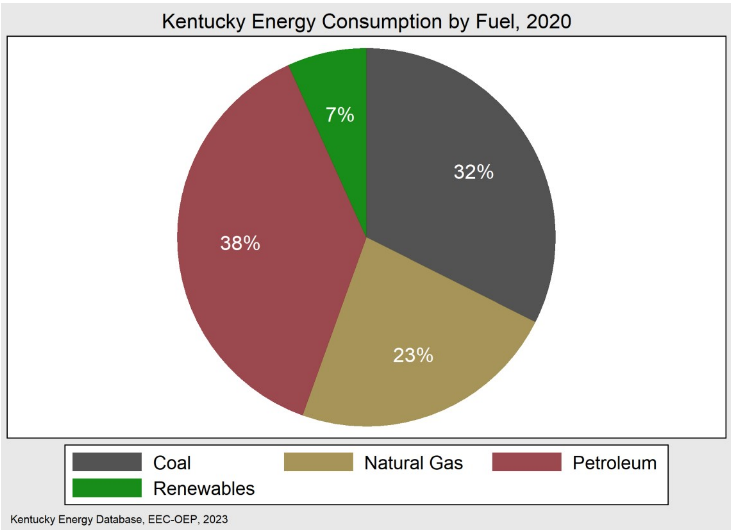


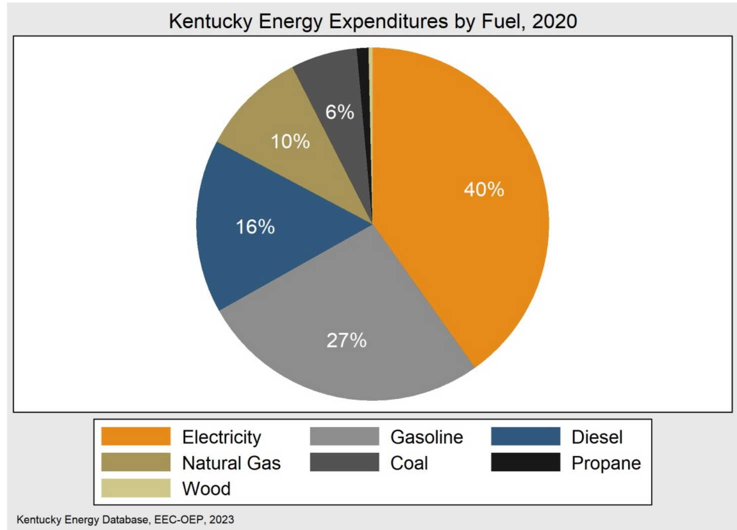


Kentucky produced 756 Trillion Btu of energy in 2020. Despite declining production since 1990, coal supplies the vast majority of energy production in Kentucky at 571 Trillion Btu, or 76% of all energy produced. Natural gas, renewable resources, and crude oil—despite significant growth in recent years—combined to only account for 24% of energy production.

Due to abundant coal resources, Kentucky has historically been a net exporter of energy. The trend in coal production in Kentucky has always driven the trend in overall energy production. However, with decreasing coal production and stable demand, Kentucky's net exports of energy have declined since 1990.

Kentucky Energy Consumption

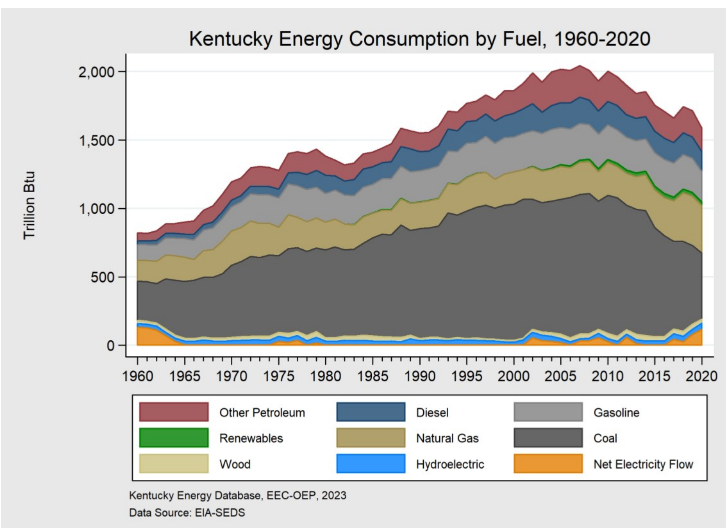


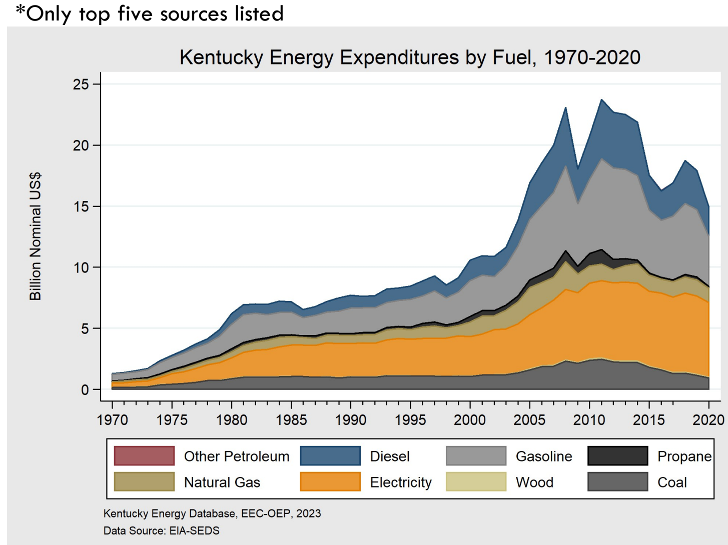


Fuel Type	Billion Btu	1 Year Change
Total	1,510,853	-7.7%
Coal	482,266	-17.5%
Petroleum	561,889	-9.5%
Natural Gas	365,869	+6.2%
Renewables	100,829	-0.9%

Fuel Type*	Million ($ US)	1 Year Change
Total	15,419	-18.1%
Gasoline	4,071	-30.4%
Electricity	6,117	-5.1%
Diesel	2,422	-27.3%
Coal	929	-20.0%
Natural Gas	1,482	-12.6%

*Only top five sources listed

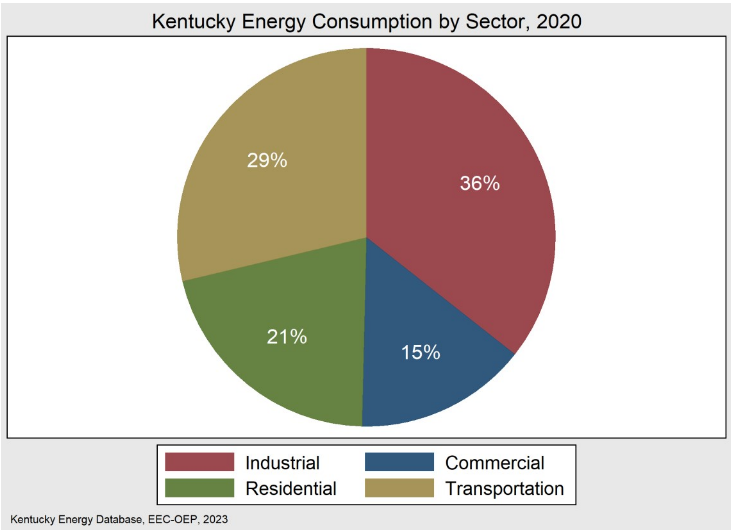


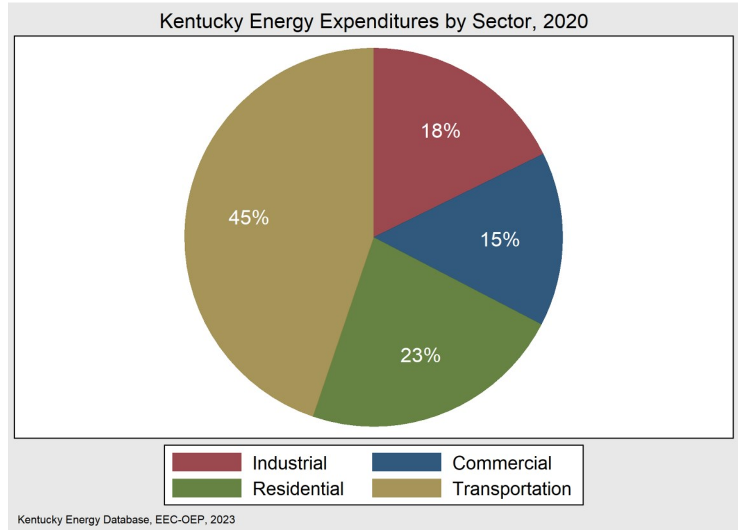


During 2020, Kentucky consumed 1.51 quadrillion Btu of energy, a decrease of 7.7% compared with 2019. Petroleum was Kentucky's primary energy source, providing 38% of the state's energy requirements. Coal was the second largest source of energy at 32%. The remainder of energy consumption was supplied by natural gas, at 23%, and renewable energy sources at 7%.

More than $15 billion was spent on energy in Kentucky in 2020, a significant decrease in energy expenditures compared with 2019. During the year, electricity was 40% of energy expenditures and gasoline was 27%. Diesel fuel accounted for 16% of energy expenditures. Coal and natural gas consumption, other than electricity, together accounted for approximately 16% of energy expenditures.

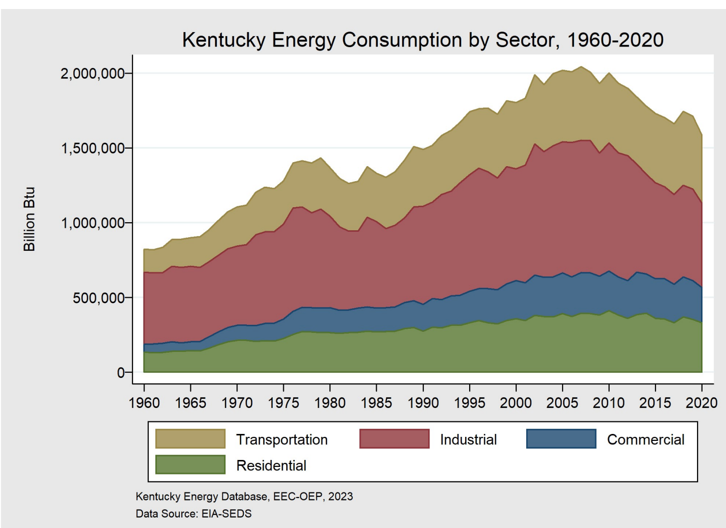
Kentucky Energy Consumption

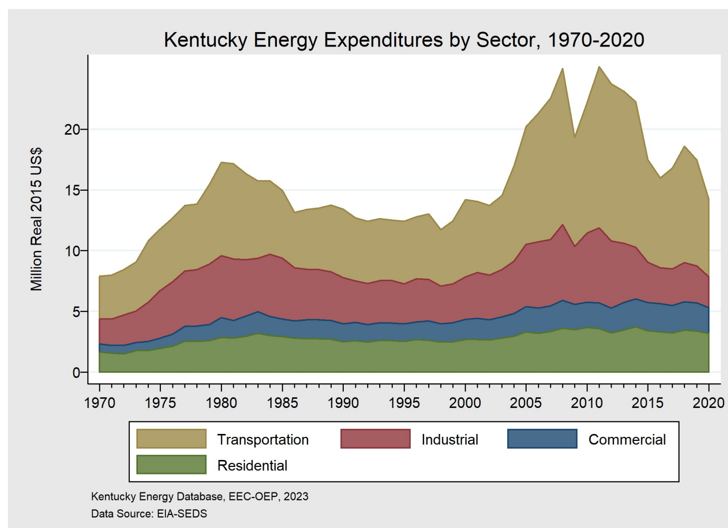




Sector	Billion Btu	1 Year Change
Total	1,585,798	-7.7%
Industrial	564,615	-8.1%
Transportation	455,595	-7.0%
Residential	331,466	-6.1%
Commercial	234,122	-10.5%

Sector	Million Dollars	1 Year Change
Total	15,508	-20.0%
Transportation	6,905	-30.6%
Industrial	2,732	-18.0%
Residential	3,483	-4.3%
Commercial	2,299	-8.8%

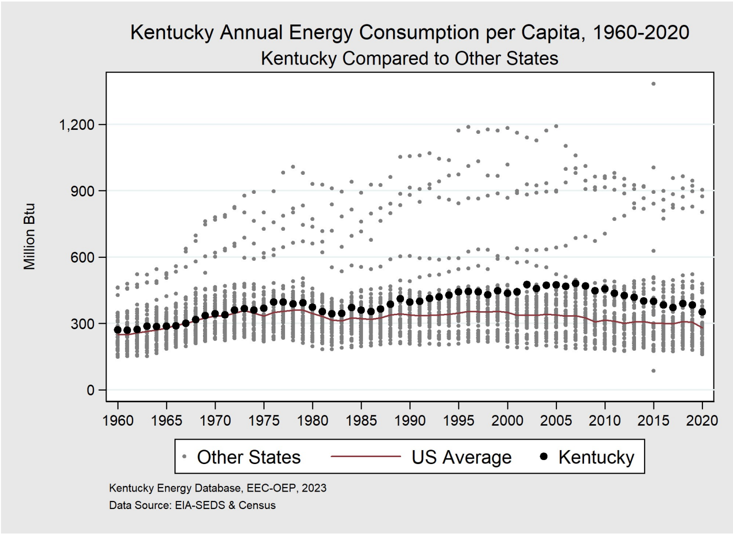




During 2020, manufacturing operations in Kentucky consumed 35.6% of all energy consumed within the Commonwealth. Kentucky's industrial energy use was slightly larger than the national average of 34% in 2020. After manufacturing, transportation was the second largest use of energy, with 29% of total energy demand, followed by residential energy use at 21%. The commercial sector accounted for 15% of energy consumption.

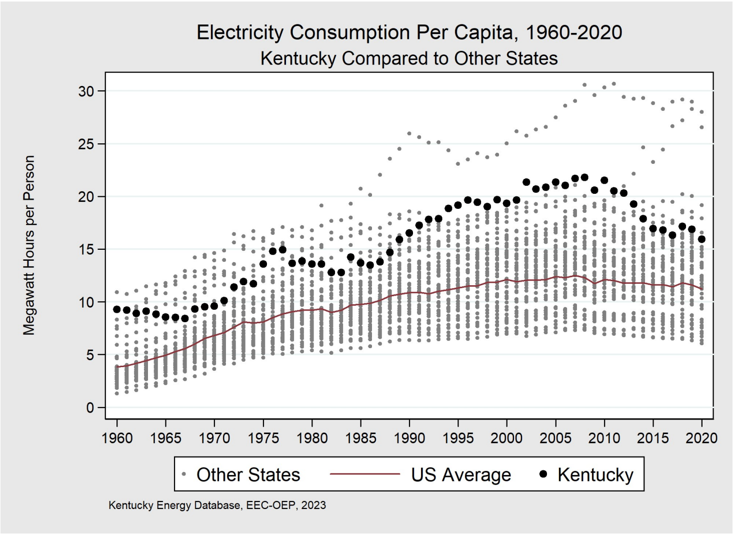
The Kentucky transportation energy use was the majority of energy expenditures in the state during the year. A total of $6.9 billion was spent in 2020 on transportation fuels—primarily on gasoline and diesel. Manufacturers spent $2.7 billion on various energy commodities, while the residential and commercial sectors spent $3.4 billion and $2.3 billion, respectively.

Kentucky Energy Intensity



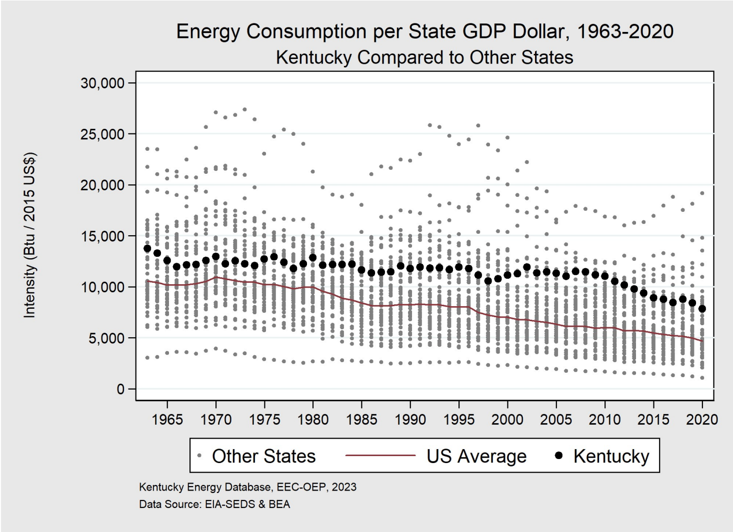
State	MMBtu per Capita	Rank
Louisiana	903.07	1st
Kentucky	351.82	15th
U.S. Average	280.24	-
Hawaii	160.21	52nd

Kentucky total energy consumption per capita decreased by 8.6% compared to 2019, which is 15th highest of all states.



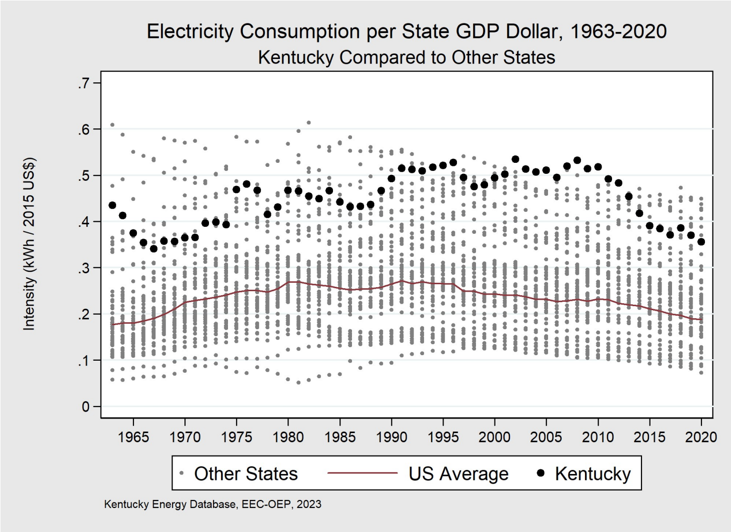
State	MWh per Capita	Rank
North Dakota	28.0	1st
Kentucky	15.93	6th
U.S. Average	11.21	-
Hawaii	6.06	52nd

In 2020, Kentucky ranked 6th in terms of total electricity consumption per capita. Total electricity consumption per capita decrease by 5.7% compared with 2019.



State	Btu/$U.S. GDP	Rank
Louisiana	19,165	1st
Kentucky	7,845	13th
U.S. Average	4,700	-
DC	1,060	52nd

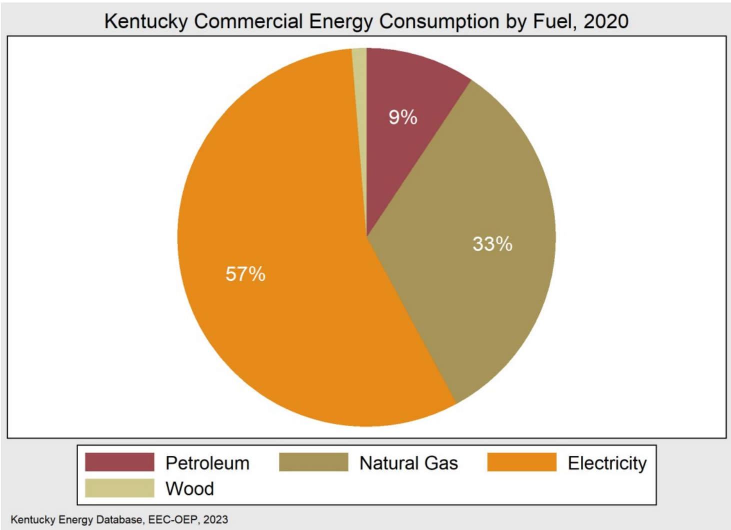
Kentucky ranked 13th in terms of total energy consumption per dollar of state GDP in 2020. Total energy intensity decreased by 7.03% compared with 2019.

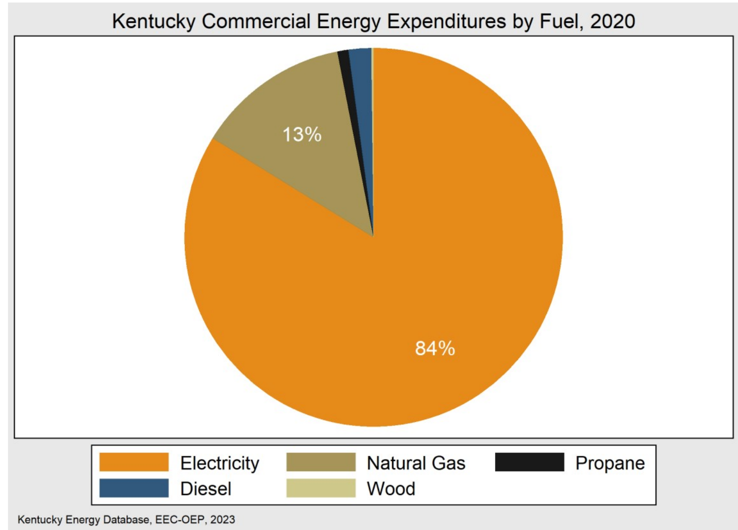


State	kWh/$U.S. GDP	Rank
Wyoming	0.45	1st
Kentucky	0.36	8th
U.S. Average	0.19	-
DC	0.07	52nd

In 2020, Kentucky had the 8th most electricity-intensive economy in the United States, and total electricity intensity decreased by 2.74% compared with 2019.

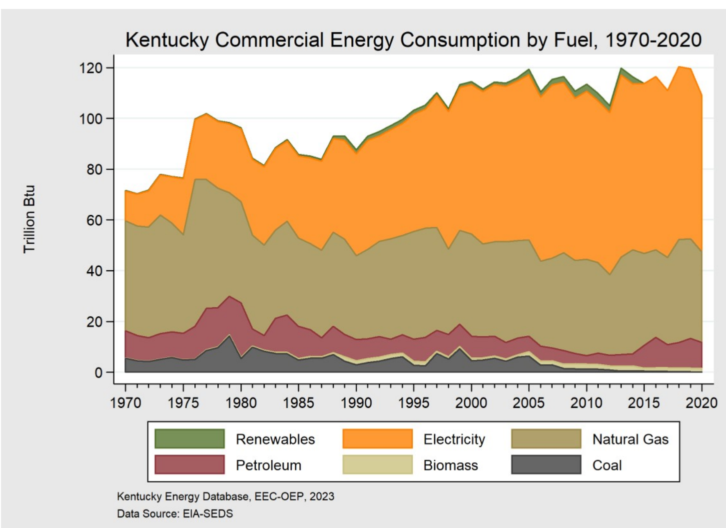
Commercial Energy Consumption

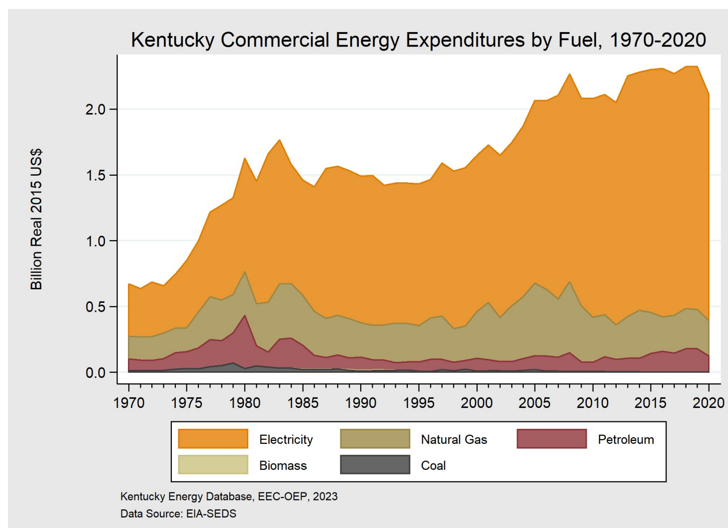




Fuel Type	Billion Btu	1 Year Change
Total Net	108,908	-10.5%
Electricity	61,625	-8.2%
Natural Gas	35,647	-9.5%
Petroleum	10,178	-13.8%
Wood	1,390	-6.7%
Coal	68	-79.1%

Fuel Type	Million Dollars	1 Year Change
Total	2,299	-8.8%
Electricity	1,867	-6.4%
Natural Gas	293	-9.1%
Diesel	44	-53.3%
Propane	21	-41.5%
Wood	4	-25.3%

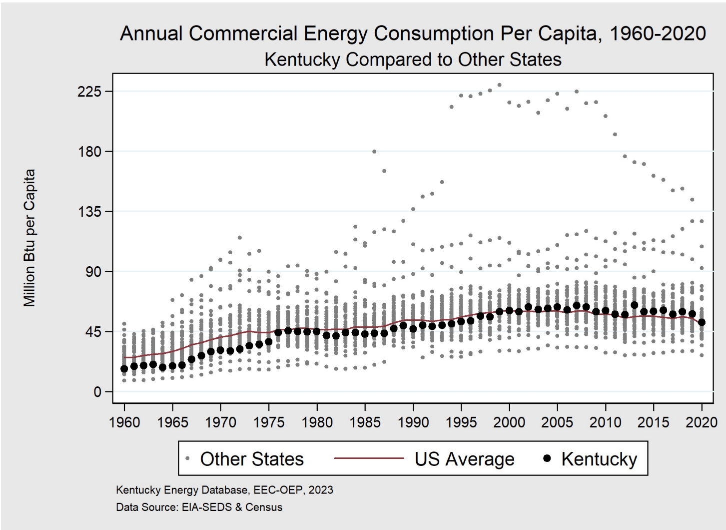




In 2020, non-manufacturing businesses in Kentucky consumed 108,908 billion Btu of energy, a 10.5% decrease in net commercial energy consumption compared with 2019. Electricity constituted 57% of commercial energy consumption, followed by natural gas at 33%. Other commodities such as petroleum products, wood, coal, and ethanol accounted for approximately 10% of commercial energy consumption in 2020. The commercial sector, which includes service industries, primarily uses natural gas for heating during the winter and cooking.

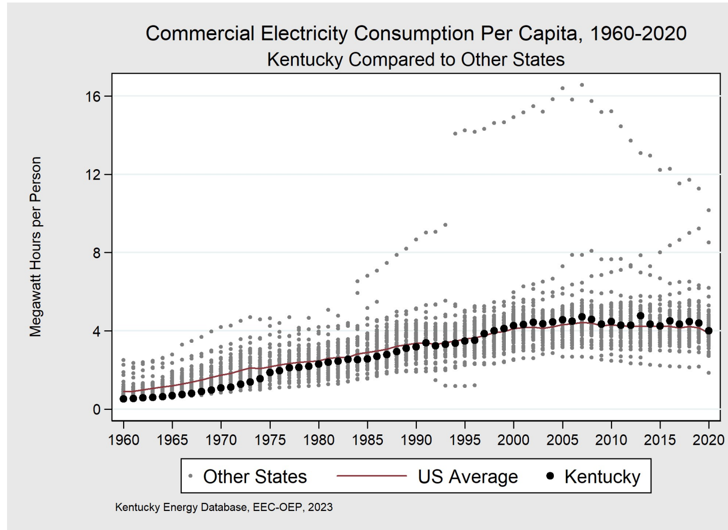
In 2020, non-manufacturing businesses in Kentucky spent nearly $2.3 billion on energy consumption—a 8.8% decrease in commercial energy expenditures compared with 2019. Electricity was the largest energy expenditure, at 84%. Natural gas was 13% of commercial energy expenditures.

Commercial Energy Intensity



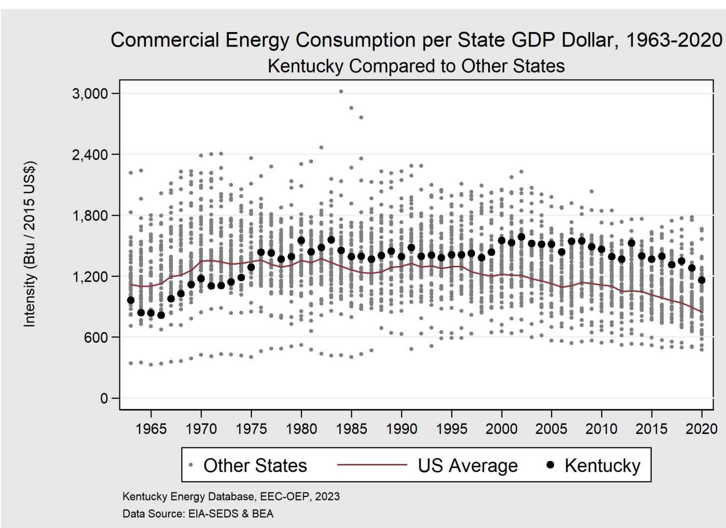
State	MMBtu per Capita	Rank
DC	127.5	1st
Kentucky	57.7	27th
U.S. Average	50.5	-
Hawaii	27.1	52nd

Kentucky commercial energy consumption per capita decreased by 0.86% compared with 2019, and ranks 27th of all states.



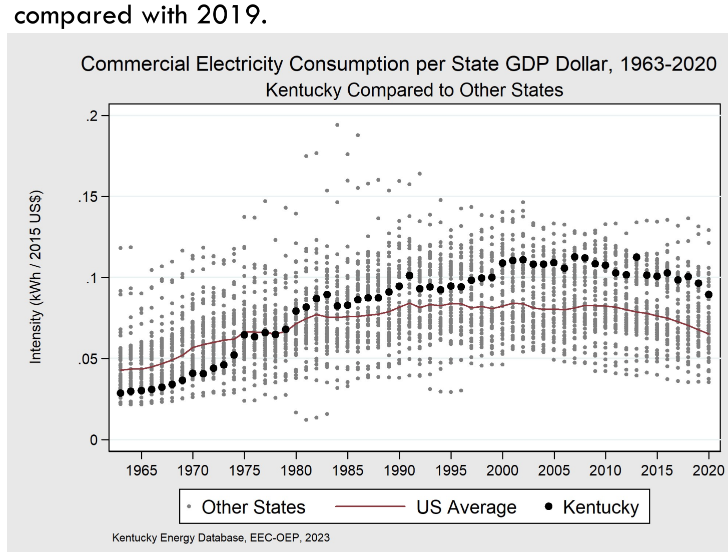
State	MWh per Capita	Rank
DC	10.16	1st
Kentucky	4.01	23rd
U.S. Average	3.88	-
Hawaii	1.85	52nd

Kentucky ranked 23rd in terms of commercial electricity consumption per capita in 2020, a decrease of 9.05% compared with 2019.



State	Btu/$U.S. GDP	Rank
Montana	1,667	1st
Kentucky	1,159	16th
U.S. Average	847	-
California	476	52nd

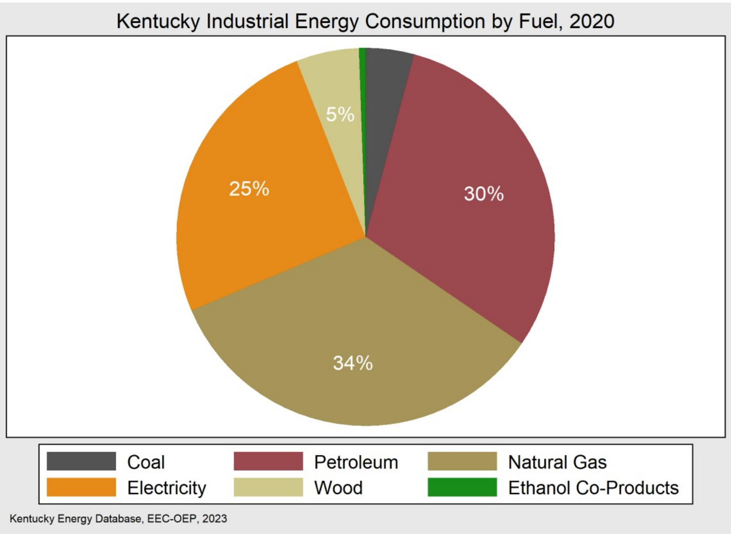
Kentucky ranked 16th highest in terms of commercial energy consumption per dollar of state GDP in 2020. Commercial energy intensity decreased by 9.8% compared with 2019.

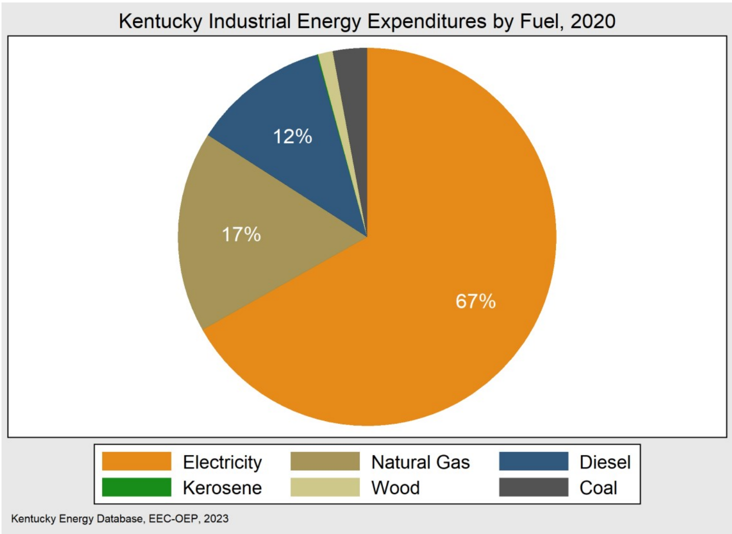


State	kWh/$U.S. GDP	Rank
North Dakota	0.13	1st
Kentucky	0.09	13th
U.S. Average	0.07	-
Hawaii	0.04	52nd

In 2020, Kentucky ranked 13th in terms of commercial electricity use per dollar of state GDP. Commercial electricity intensity decreased by 10.5% compared with 2019.

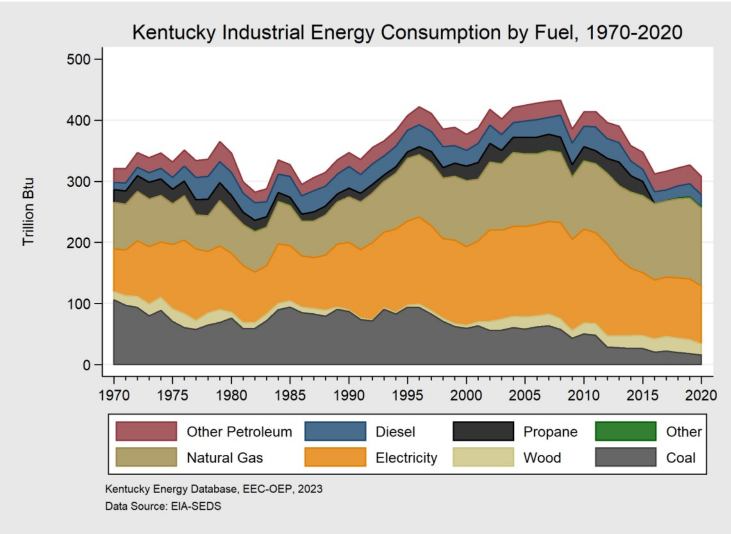
Industrial Energy Consumption

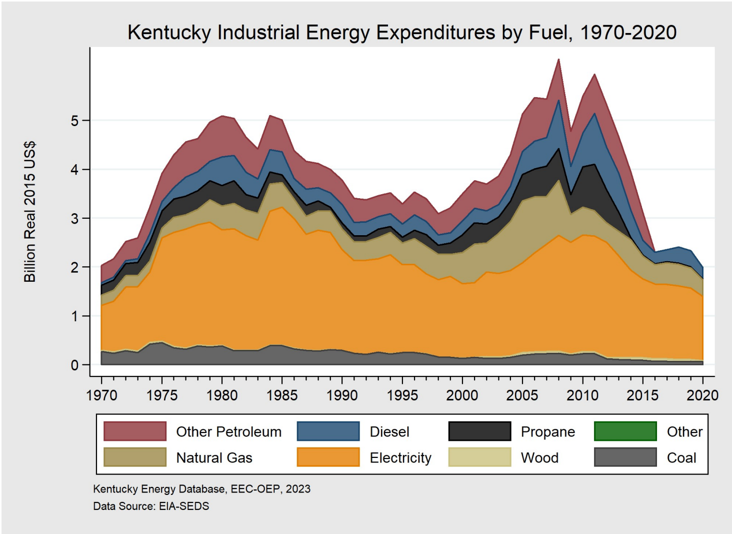




Fuel Type	Billion Btu	1 Year Change
Total Net	371,339	-8.1%
Petroleum	113,587	-12.2%
Electricity	94,867	-4.8%
Natural Gas	127,334	-4.2%
Coal	15,430	-15.4%
Wood	20,121	-19.2%

Fuel Type	Million Dollars	1 Year Change
Total	2,113	-18.0%
Electricity	1,430	-9.6%
Diesel	250	-35.5%
Kerosene	2	+20.0%
Natural Gas	369	-19.8%
Coal	62	-13.5%

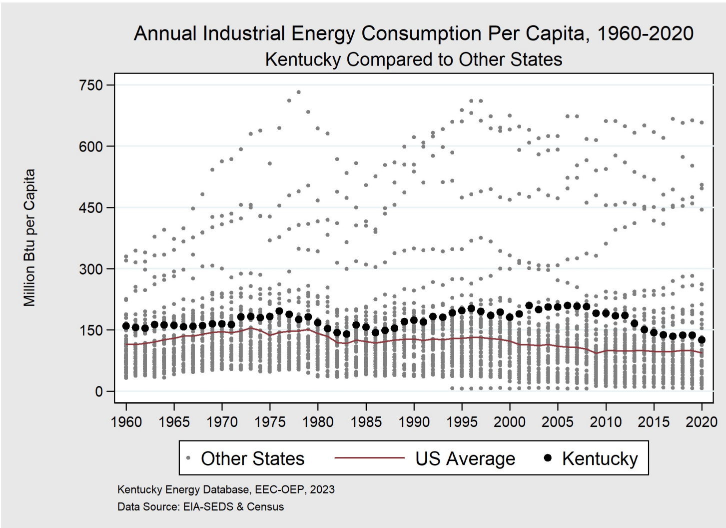




Kentucky-based manufacturing operations and farms consumed 371 trillion Btu of energy in 2020, a decrease of 8.1% from 2019. Natural gas was the largest component of industrial energy use in 2020, attributing to 34% of total industrial energy consumption. Electricity and petroleum accounted for 25% and 30% of industrial energy consumption, respectively.

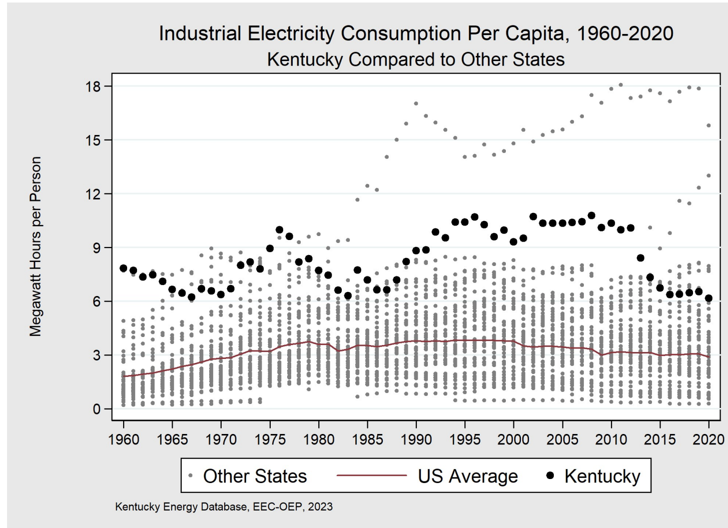
Kentucky spent more than $2.1 billion to fuel factories and farms within the Commonwealth, which was a 18% decrease in industrial energy spending compared with 2019. Electricity was the largest expenditure—67% of industrial energy spending. Diesel and natural gas accounted for 12% and 17% of industrial expenditures, respectively. Coal, wood, and ethanol accounted for the remainder of industrial energy expenditures in 2020.

Industrial Energy Intensity



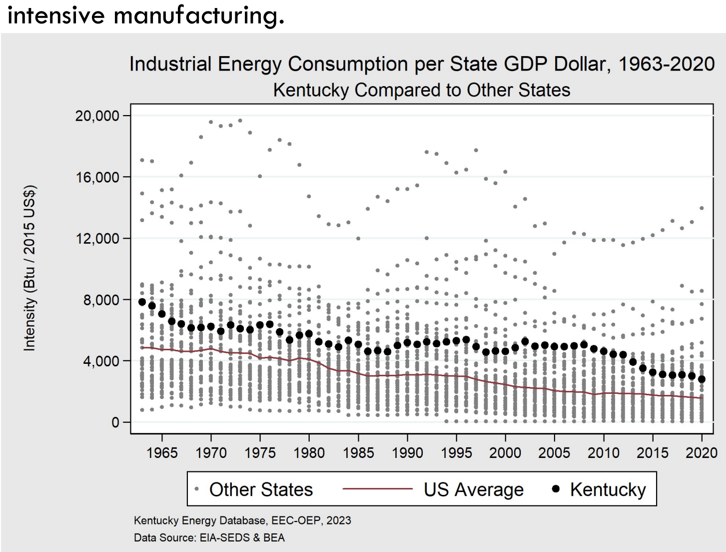
State	MMBtu per Capita	Rank
Louisiana	657.6	1st
Kentucky	125.3	15th
U.S. Average	94.4	-
DC	7.2	52nd

Kentucky industrial energy consumption per capita decreased by 9% in 2020, but remains above average due to energy-intensive manufacturing.



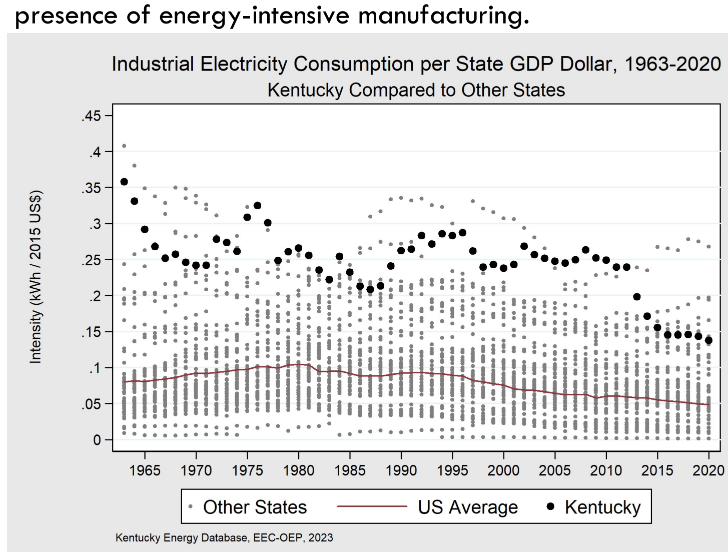
State	MWh per Capita	Rank
Wyoming	15.8	1st
Kentucky	6.2	7th
U.S. Average	2.9	-
DC	0.3	52nd

Industrial electricity consumption per capita decreased by 4.7% in 2020, but remains above average due to the presence of energy-intensive manufacturing.



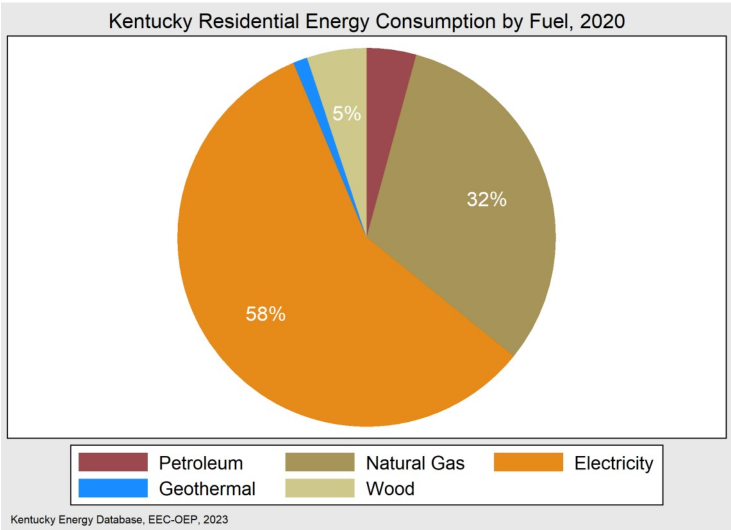
State	Btu/$U.S. GDP	Rank
Louisiana	13,955	1st
Kentucky	2,795	15th
U.S. Average	1,583	-
DC	36	52nd

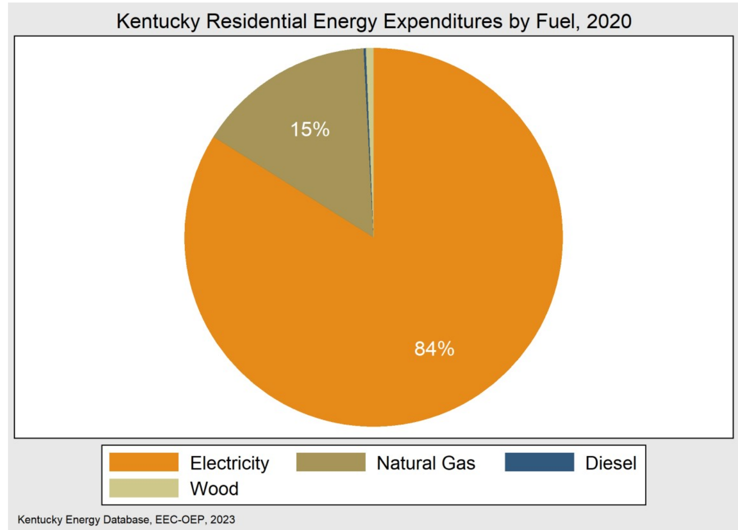
Kentucky industrial energy intensity decreased by 7.4% compared with 2019, and is decreasing significantly faster than the national average.



State	kWh/$U.S. GDP	Rank
Wyoming	0.27	1st
Kentucky	0.14	7th
U.S. Average	0.05	-
DC	0.001	52nd

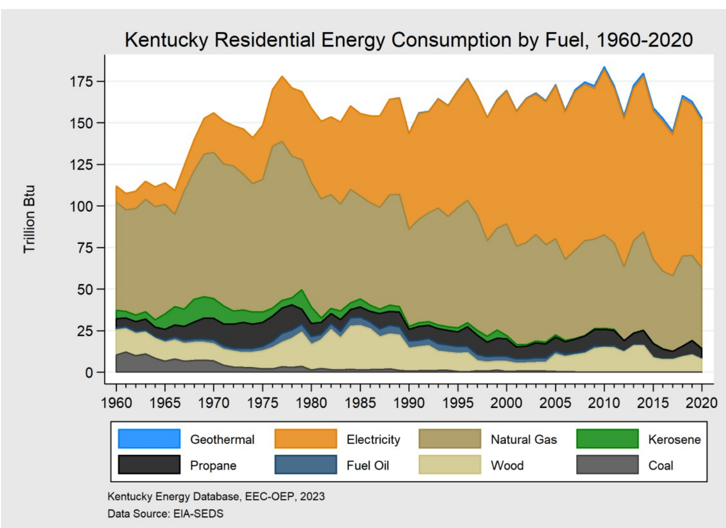
In 2020, Kentucky was 7th in terms of industrial electricity use per dollar of GDP, but changed by a negligible amount from 2019.

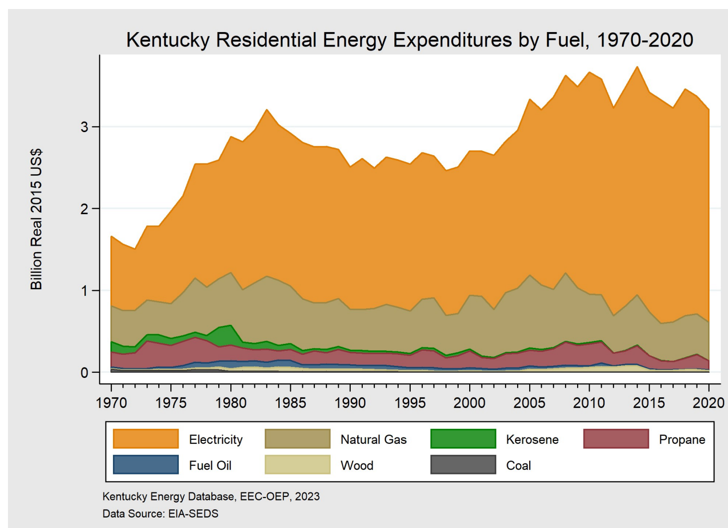




Fuel Type	Billion Btu	1 Year Change
Total Net	217,640	-6.1%
Electricity	153,243	-2.4%
Natural Gas	48,259	-7.9%
Wood	7,781	-27.9%
Petroleum	6,497	-30.6%
Geothermal	1,860	+0.0%

Fuel Type	Million Dollars	1 Year Change
Total	3,357	-4.3%
Electricity	2,818	-1.8%
Natural Gas	512	-3.3%
Wood	21	-46.3%
Diesel	6	-43.6%

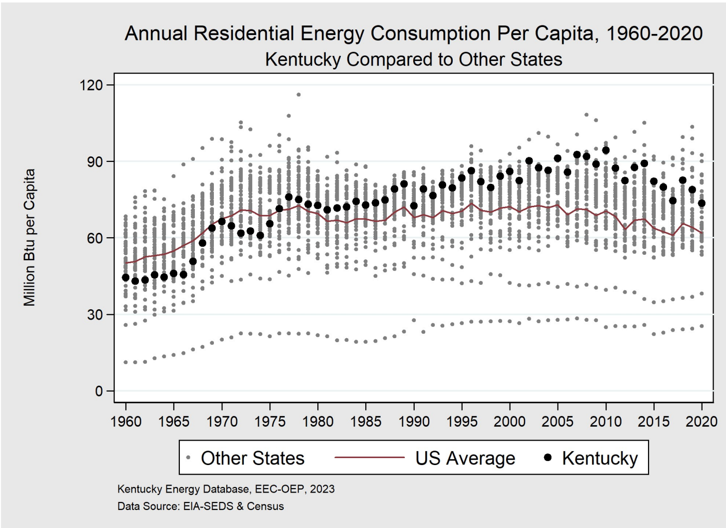




Households in Kentucky consumed 217 trillion Btu of energy in 2020, a 6.1% decrease in net residential energy consumption compared with 2019. The largest portion of energy used in the residential sector—58%—was through electricity and the second largest was natural gas. Over time, electricity has increased its share of domestic energy consumption while natural gas, primarily used for home heating, has decreased.

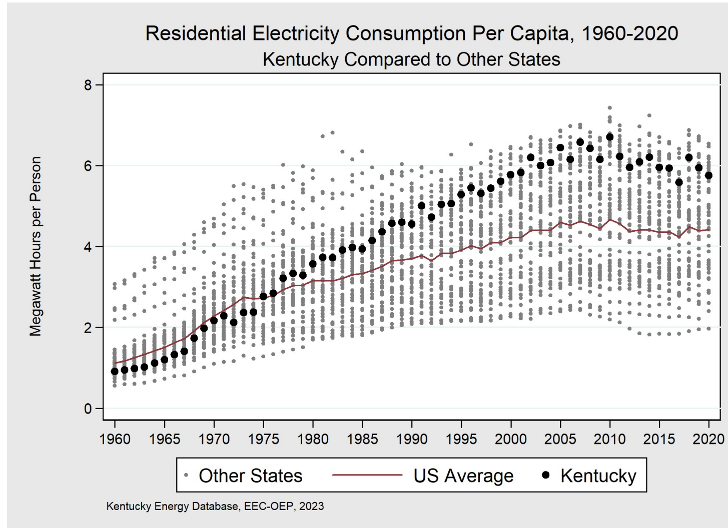
Kentucky households spent nearly $3.4 billion on energy commodities and energy consumption in 2020, a 4.3% decrease in residential energy expenditures compared with 2019. Electricity expenditures comprised 84% of spending, which totaled $2.8 billion during the year.

Residential Energy Intensity



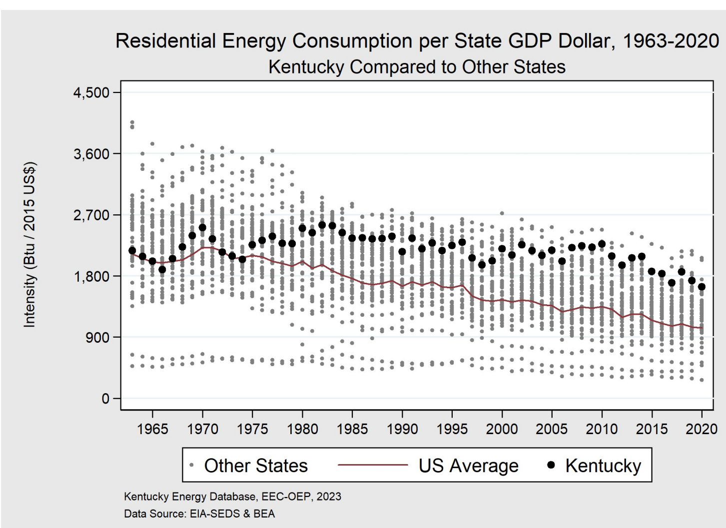
State	MMBtu per Capita	Rank
Montana	92.4	1st
Kentucky	73.5	13th
U.S. Average	61.9	-
Hawaii	25.4	52nd

Kentucky residential energy consumption per capita decreased in 2020 by 7%, and is 13th highest of all states.



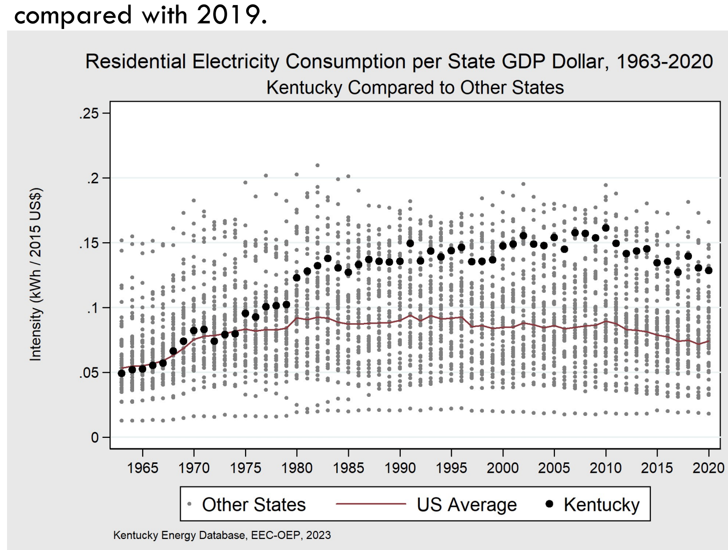
State	MWh per Capita	Rank
Louisiana	6.5	1st
Kentucky	5.8	11th
U.S. Average	4.4	-
Hawaii	2.0	52nd

In 2020, Kentucky ranked 11th nationally in terms of residential electricity use per capita, a decrease of 1.7% compared with 2019.



State	Btu/$U.S. GDP	Rank
West Virginia	2,062	1st
Kentucky	1,641	6th
U.S. Average	1,039	-
DC	270	52nd

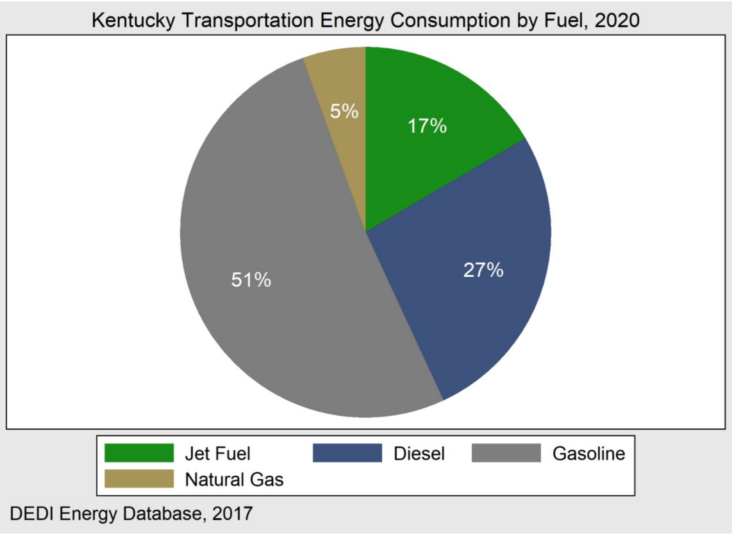
Kentucky ranked 6th in terms of residential energy consumption relative to one dollar of state GDP. Residential energy intensity decreased by 5.3% compared with 2019.

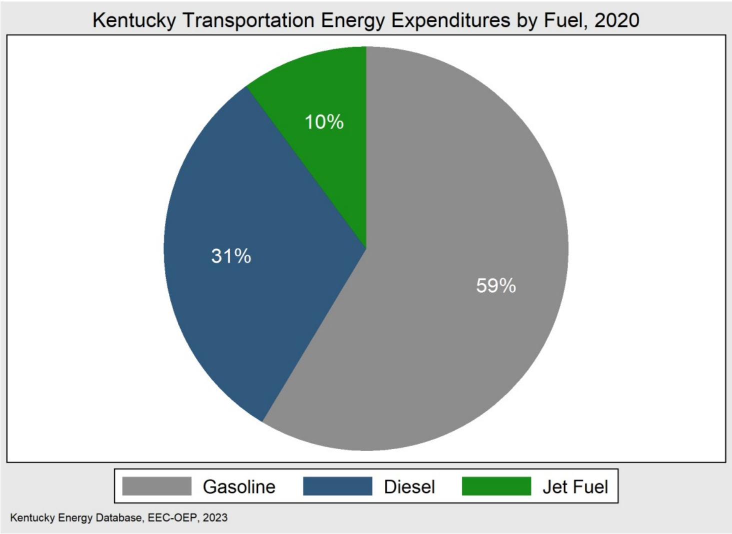


State	kWh/$U.S. GDP	Rank
Mississippi	0.17	1st
Kentucky	0.13	8th
U.S. Average	0.07	-
DC	0.02	52nd

In 2020, Kentucky ranked 8th in terms of residential electricity use relative to one dollar of state GDP. There was negligible change compared to 2019.

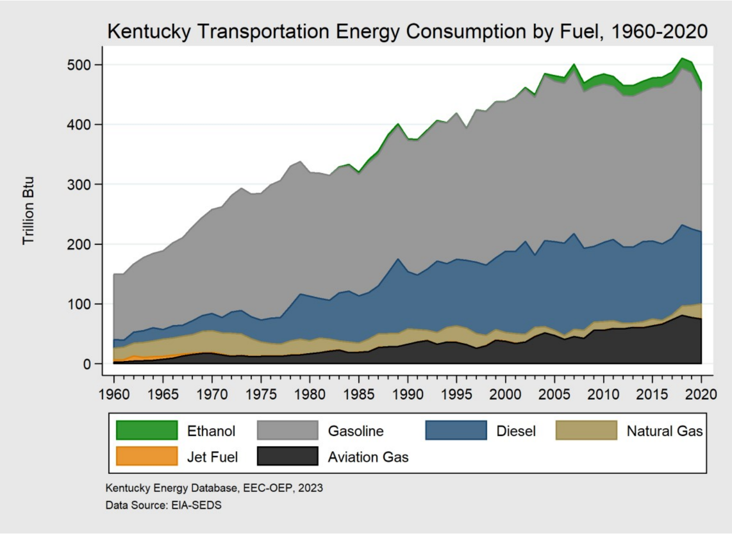
Transportation Energy Consumption

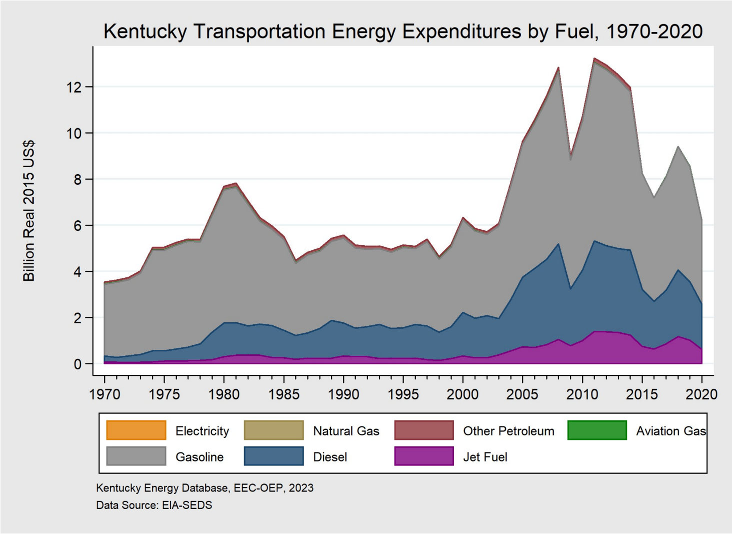




Fuel Type	Billion Btu	1 Year Change
Total	455,595	-6.7%
Gasoline	232,948	-10.6%
Diesel	120,545	-5.9%
Jet Fuel	74,919	-2.9%
Natural Gas	24,926	+23.7%

Fuel Type	Million Dollars	1 Year Change
Total	6,836	-30.8%
Gasoline	3,954	-30.7%
Diesel	2,111	-25.6%
Jet Fuel	771	-47.2%

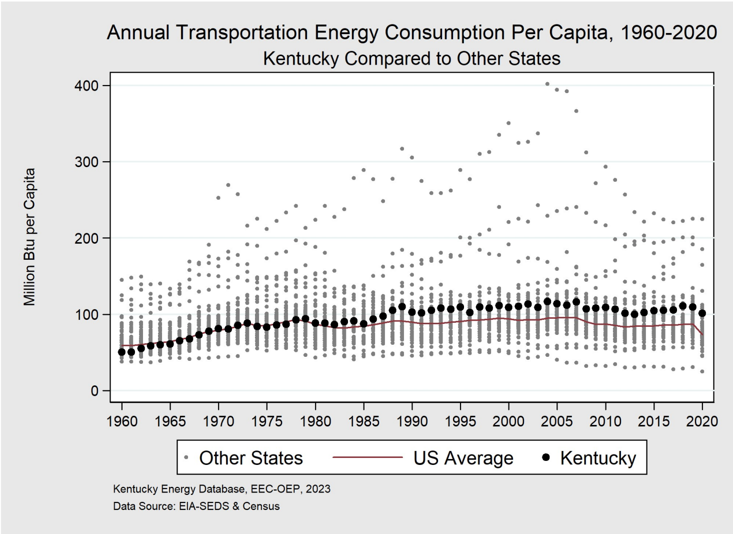


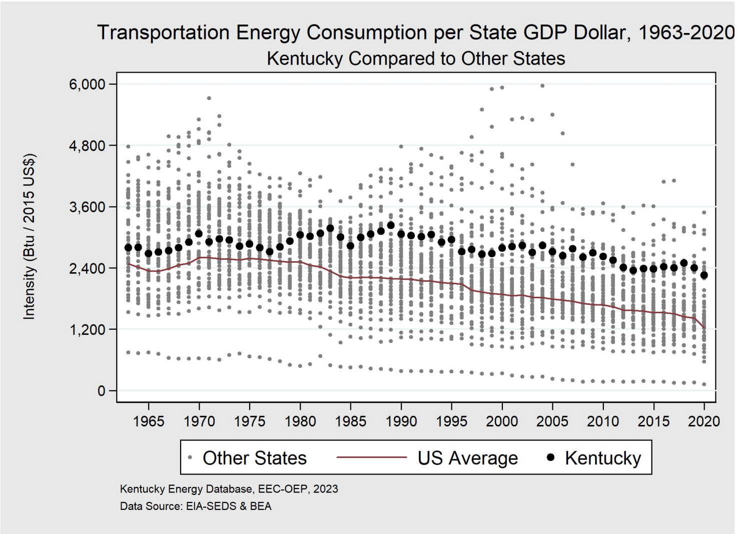


Transportation sector energy consumption in Kentucky was 456 trillion Btu in 2020, a 6.7% decrease compared with 2019. Gasoline was 51% of transportation energy consumption in 2020, followed by diesel at 27%. The other 22% of transportation energy consumption came from jet fuel, natural gas and propane.

Transportation energy expenditures were approximately $6.8 billion in Kentucky in 2020. Compared with 2019, transportation energy expenditures decreased by 31%. Gasoline was the largest component of transportation energy expenditures with 59% of spending in 2020. Diesel expenditures were 31% of transportation energy costs in Kentucky in 2020. (Consumption of natural gas by way of transmission pipelines is not tabulated in terms of transportation sector energy expenditures).

Transportation Energy Intensity





State	MMBtu per Capita	Rank
Alaska	224.75	1st
Kentucky	101.08	10th
U.S. Average	73.48	-
DC	25.05	52nd

In 2020, Kentucky transportation energy consumption per capita decrease by 7.8 compared with 2019, which is 10th highest of all states.

State	Btu/$U.S. GDP	Rank
Alaska	3,485	1st
Kentucky	2,255	11th
U.S. Average	1,232	-
DC	124	52nd

In 2020, Kentucky ranked 11th in terms of transportation energy consumption per dollar of state GDP. Transportation energy intensity decreased by 6.19% compared with 2019.

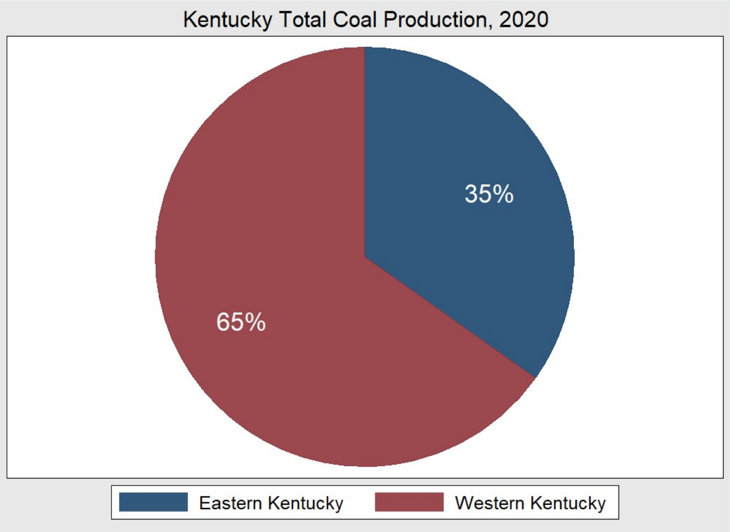
Kentucky Coal Production

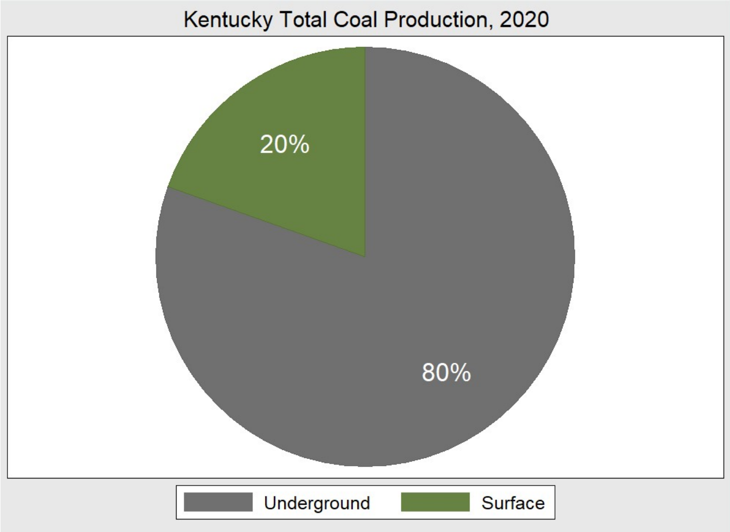
County	Tons	1 Year Change	Percentage
Total	24,483,398	-39.30%	100.00%
Union	9,412,068	-18.60%	38.44%
Hopkins	3,564,441	-2.80%	14.56%
Pike	2,199,587	-26.60%	8.98%
Muhlenberg	2,120,338	-2.50%	8.66%
Perry	1,731,150	-45.30%	7.07%
Harlan	1,192,882	-53.60%	4.87%
Leslie	743,342	-45.20%	3.04%
Knott	644,404	-16.10%	2.63%
Bell	486,636	-37.50%	1.99%
Floyd	404,262	-91.30%	1.65%
Johnson	395,698	-31.80%	1.62%
Daviess	303,557	6.80%	1.24%
McLean	260,370	-130.20%	1.06%
Ohio	251,094	-160.20%	1.03%
Whitley	223,814	-48.50%	0.91%
Martin	189,142	-90.50%	0.77%
Knox	178,228	-45.00%	0.73%
Letcher	105,872	-109.30%	0.43%
Morgan	9,356	-162.40%	0.04%
Breathitt	4,922	-139.00%	0.02%
Magoffin	1,412	-198.10%	0.01%

During 2020, coal production in the Commonwealth decreased to 24.5 million tons. Union County remained the top producer of coal in Kentucky throughout the entire year. Pike County, the largest producer from 1978 to 2011, mined the most in eastern Kentucky.

In Kentucky, coal mining is divided between two different geologic basins—the Central Appalachian Basin of eastern Kentucky and the Illinois Basin of western Kentucky. Kentucky is the only major coal exporting state to span two geologic basins, and the chemical composition and accessibility of the coal from each is distinct. Eastern Kentucky has recorded coal mining since as early as 1790 and western Kentucky is known to have had mining operations in 1820. The coalfield of eastern Kentucky has coal with a relatively higher heat content and lower sulfur content than western Kentucky. Eastern Kentucky coal is also more difficult to mine. As a result of differences regarding the extractability and quality of the coal, eastern Kentucky is overall more expensive than western Kentucky coal. The difference in the delivered price of coal between the two coalfields is a result of numerous factors that affect both the supply of and demand for coal, including transportation costs, the ease of accessing coal and the subsequent mining techniques employed, and the chemical properties and heat content of the coal.

Kentucky Coal Production



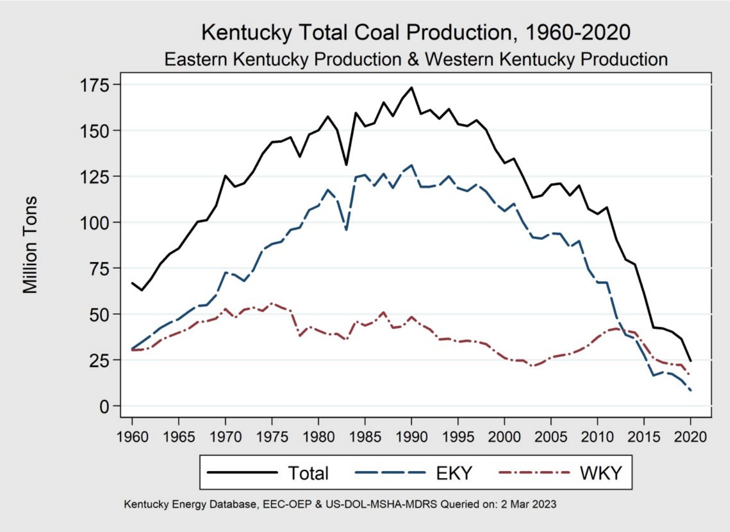


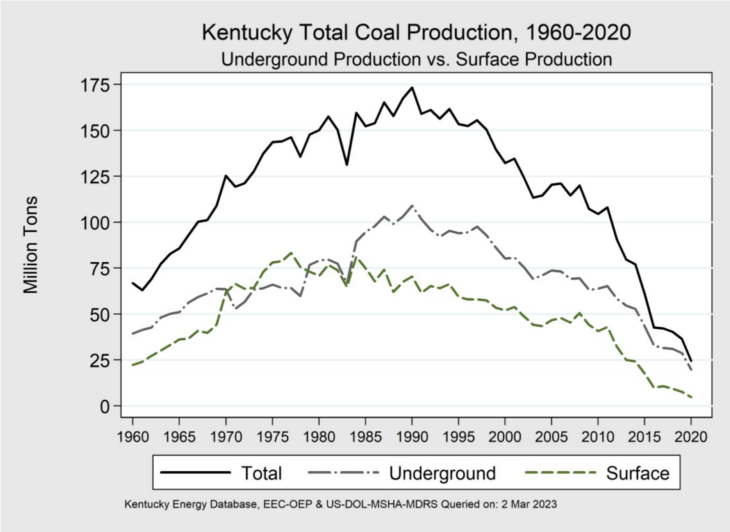
Region	2020 Tonnage	Annual Change
Total	24,483,398	-39.3%
Western Kentucky	15,911,868	-33.2%
Eastern Kentucky	8,571,530	-49.0%

Kentucky coal mines produced 24.5 million tons in 2020, a decrease of 39.3% from 2019. Production decreased in both the eastern and western coalfields in 2020.

Mine Type	2020 Tonnage	Annual Change
Total	24,483,398	-39.3%
Underground	19,693,610	-37.4%
Surface	4,789,788	-46.6%

The majority of Kentucky coal production has been from underground operations since 1979, following the passage of the Surface Mine Control and Reclamation Act of 1977.

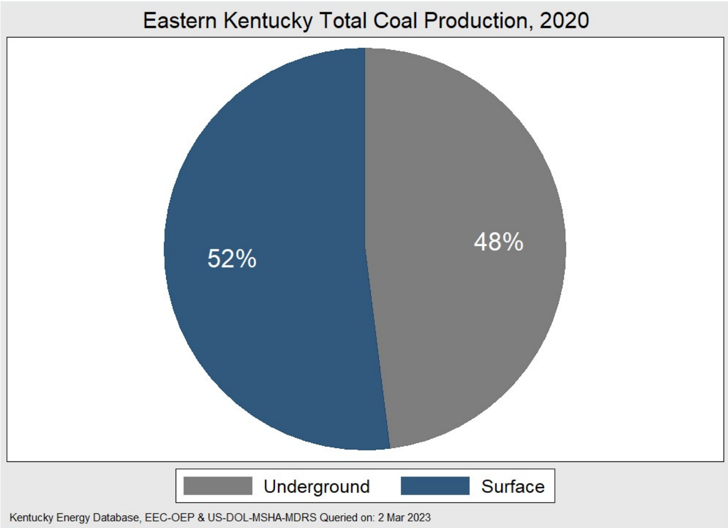


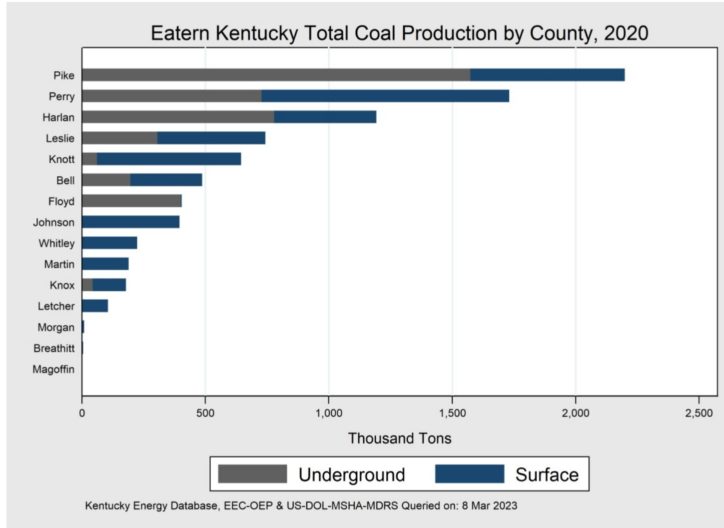


Eastern Kentucky was the top-producing region in Kentucky between 1912 and 2013. Western Kentucky coal mines have produced the majority of coal in the Commonwealth since the third quarter of 2013.

Underground coal mines produced 19.7 million tons of coal, or 80% of total Kentucky production in 2020, a decrease of 37% from 2019. Surface mining operations, which mined 4.8 million tons of coal, decreased production by 47% since 2019. Production has trended down in both surface and underground mining since 1990 and have been concentrated in the eastern coalfield.

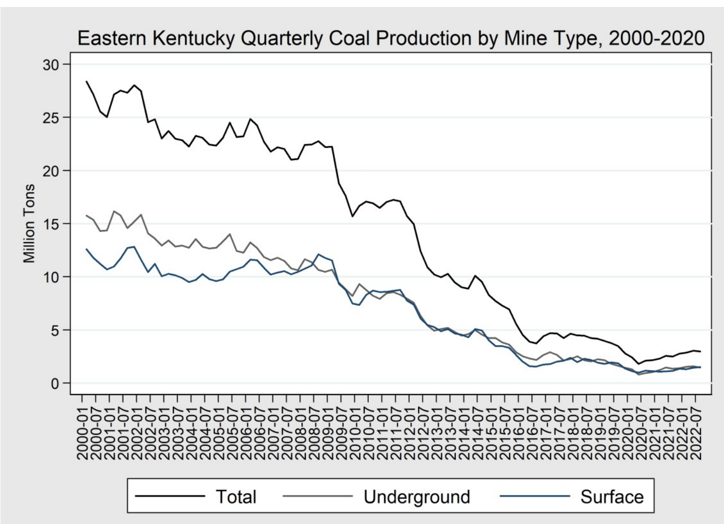
Eastern Kentucky Coal Production





Mine Type	2020 Tonnage	Annual Change
Total	8,571,530	-49.0%
Surface	4,486,232	-43.4%
Underground	4,085,298	-53.3%

Eastern Kentucky coal production decreased in 2020 by 49% to 8.6 million tons of coal, 48% from underground mines and 52% from surface mines.

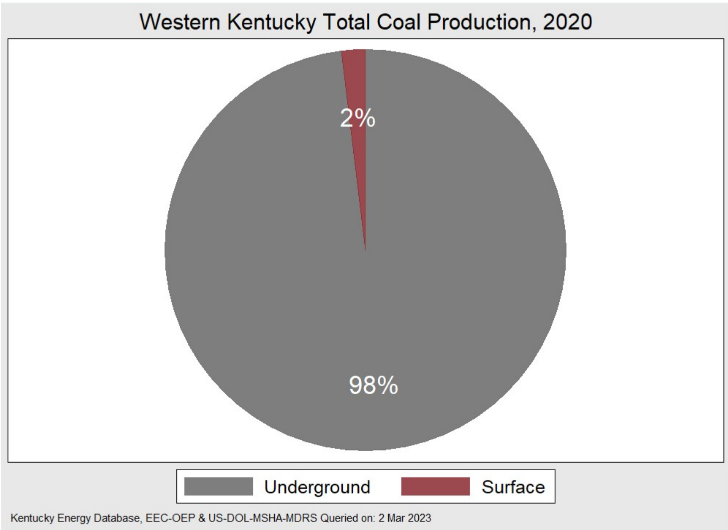


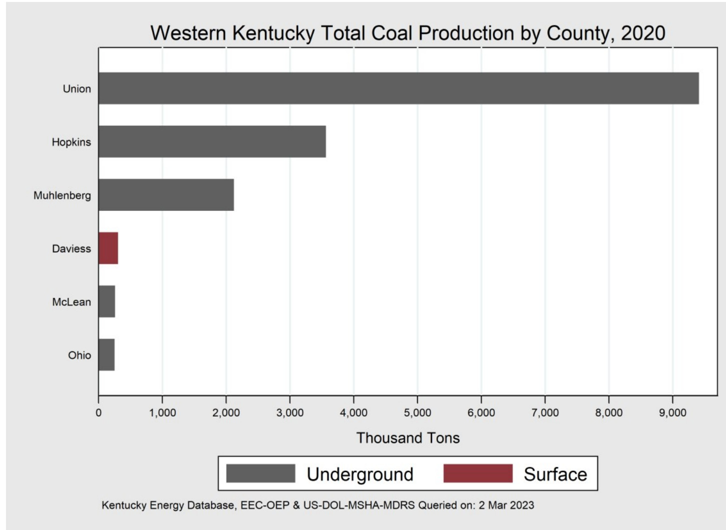
Annual production decreased at both underground and surface mining operations in eastern Kentucky in 2020, by 53.3% and 43.4% respectively.

Eastern County	2020 Tonnage	Annual Change
Pike	2,199,587	-26.6%
Perry	1,731,150	-45.3%
Harlan	1,192,882	-53.6%
Leslie	743,342	-45.2%
Knott	644,404	-16.1%
Bell	486,636	-37.5%
Floyd	404,262	-91.3%
Johnson	395,698	-31.8%
Whitley	223,814	-48.5%
Martin	189,142	-90.5%
Knox	178,228	-45.0%
Letcher	105,872	-109.3%
Morgan	9,356	-162.4%
Breathitt	4,922	-139.0%
Magoffin	1,412	-198.1%

The largest producing counties experienced increases in production during 2020. Pike County decreased coal production by 26.6% and Perry County decreased by 45.3%. Pike county still remained the highest coal-producing county in eastern Kentucky and third-highest coal producing county in Kentucky.

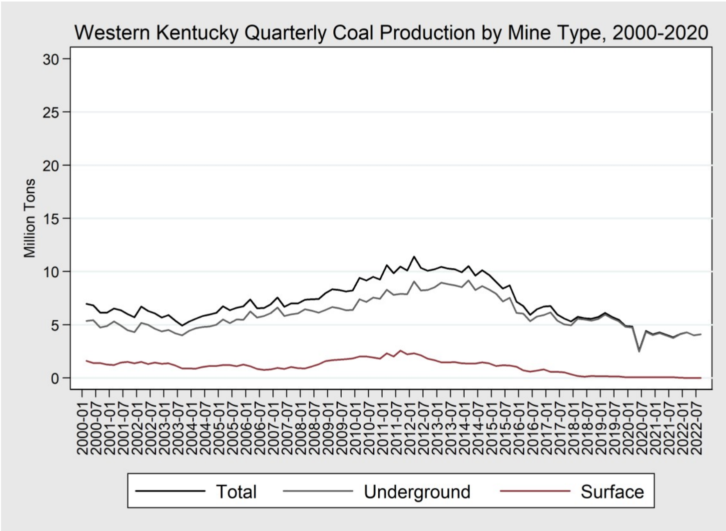
Western Kentucky Coal Production





Mine Type	2020 Tonnage	Annual Change
Total	15,911,868	-33.2%
Underground	15,608,310	-32.6%
Surface	303,558	-57.1%

Western Kentucky mined 15.9 million tons of coal in 2020, a decrease of 33.25 from 2019. Underground mines accounted for 98% of regional production in 2020.



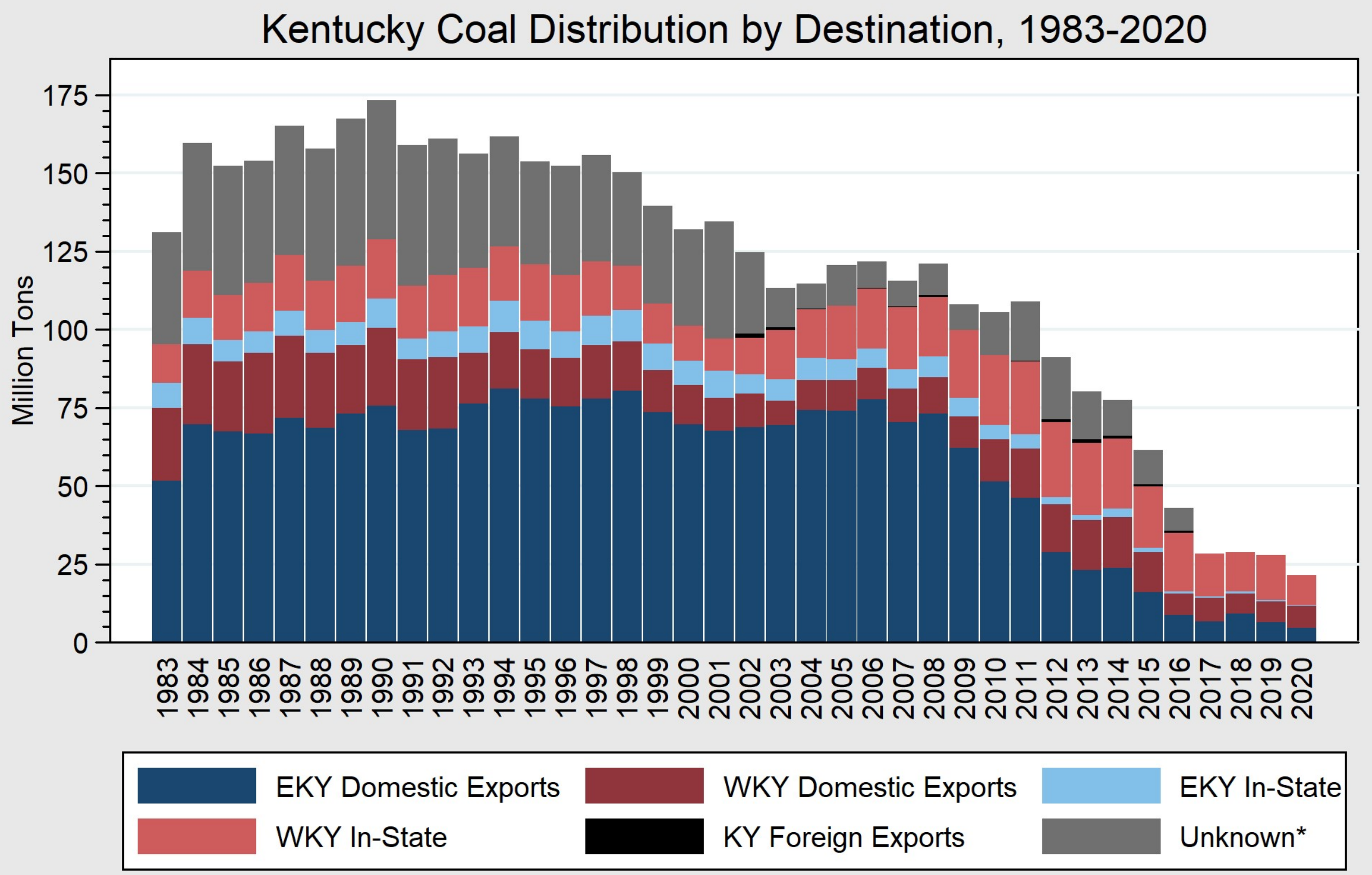
Surface mining made up 2% of coal production in western Kentucky. The majority of western Kentucky coal production was excavated by surface mining until 1985. In fact, Muhlenberg County was the Commonwealth's leading coal producer from 1961 to 1978, predominantly through the utilization of surface mining techniques.

Western County	2020 Tonnage	Annual Change
Union	9,412,068	-18.6%
Hopkins	3,564,441	-2.8%
Muhlenberg	2,120,338	-2.5%
Daviess	303,557	6.8%
McLean	260,370	-130.2%
Ohio	251,094	-160.2%

Union County remained Kentucky's leading coal producing county, mining 9.4 million tons during 2020. Production in the county decreased by 18.6% from the year prior.

Most western Kentucky mining since 1985 has been underground. As a result of the topography and basinal structure of the Illinois Basin, surface coal production is relatively more accessible on the edges of the coalfield, further from the Ohio River, where much of the economically viable coal has been extracted in years past. The topography, in part, explains the relative increase in underground mining in the region since 1983 and the relative decrease in surface mining since peak regional surface production in 1972.

Kentucky Coal Distribution, 2020



Kentucky Energy Database, EEC-OEP, 2023
Data Source: EIA-923 & U.S. Census Bureau-Foreign Trade Division

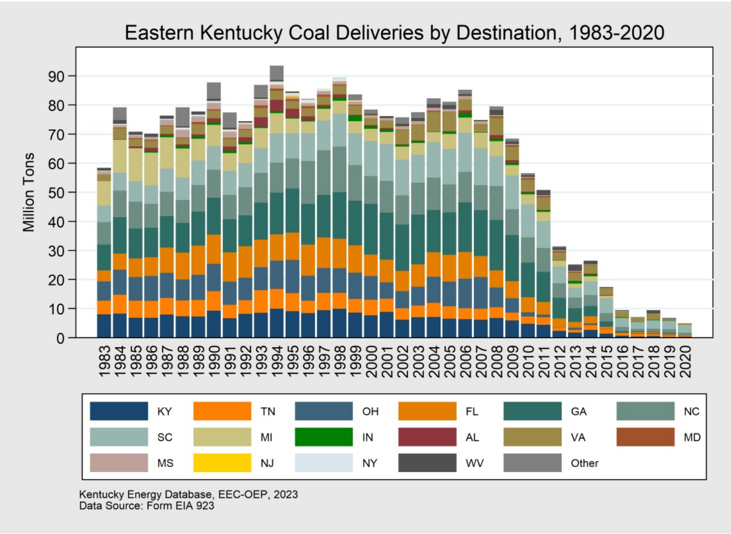
*Combination of Industrial, Institutional, & Unknown

Coal Distribution by Destination, 2020		
Coal and Destination	**Thousand Tons**	**Percentage**
Total Production	21,608	100%
WKY In-State	9,702	45%
WKY Out-of-State	7,032	32.5%
EKY Out-of-State	4,593	21.2%
EKY In-State	283	1.3%

The annual distribution of coal mined in Kentucky is a combination of in-state consumers, out-of-state power plants, factories, and foreign exports.

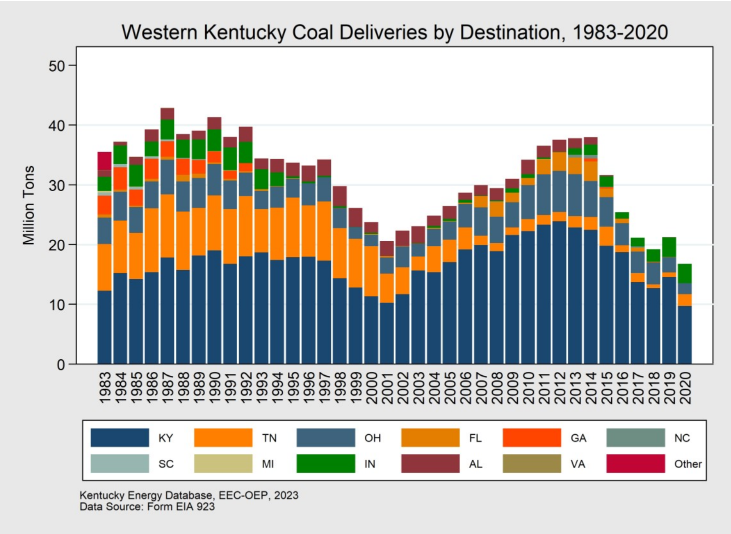
Eastern Kentucky coal has predominantly been sold to states in the southeastern United States. Conversely, western Kentucky coal has mostly been mined for in-state consumption. Kentucky remains the single-largest consumer of Kentucky coal, increasing its consumption as other states have decreased their consumption of coal from Kentucky. The Cooper, H.L. Spurlock, and Mill Creek were the only power plants that consumed eastern Kentucky coal in Kentucky.

Kentucky Coal Deliveries



Eastern Kentucky Coal Deliveries, 2020		
Destination	Thousand Tons	Percentage
Total	4,842	100%
South Carolina	2,508	51.7%
Virginia	482	10.0%
North Carolina	740	15.3%
Tennessee	489	10.0%
Florida	13	0.3%
Kentucky	287	5.9%
West Virginia	68	1.4%
Ohio	32	0.7%
Georgia	109	2.3%
Michigan	114	2.4%

Known shipments of steam coal from eastern Kentucky to power plants within the United States decreased to 4.8 million tons in 2020. The largest markets for eastern Kentucky coal are traditionally located in the southeast, and were led by South Carolina and Virginia. Overall, coal mined in the region was shipped to 10 different states in 2020.



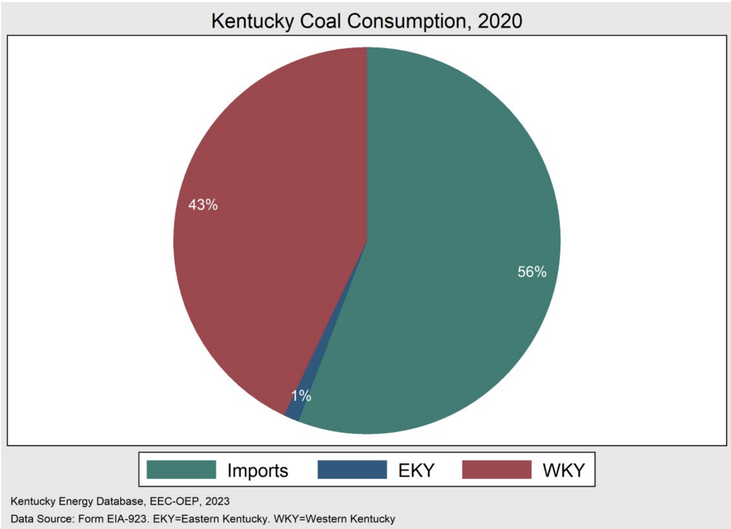
Western Kentucky Coal Deliveries, 2020		
Destination	Thousand Tons	Percentage
Total	16,766	100%
Kentucky	9,733	58.1%
Florida	1,847	11.0%
Indiana	3,198	19.1%
Tennessee	1,973	11.7%
Mississippi	15	0.1%

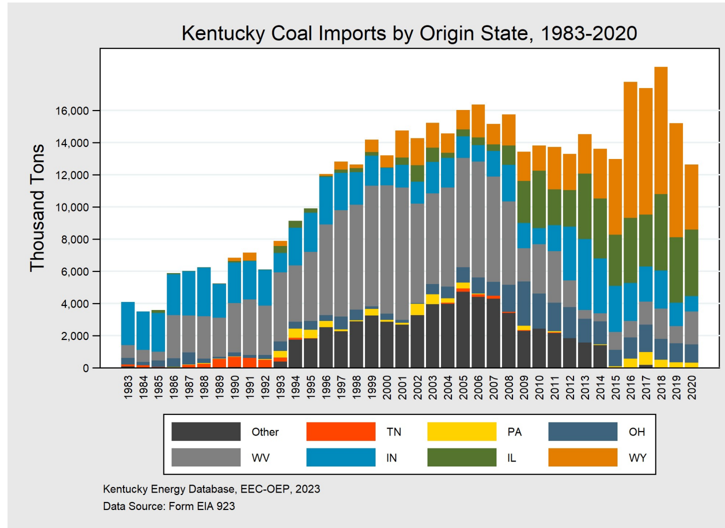
Known shipments of steam coal from western Kentucky to power plants within the United States fell to 16.8 million tons in 2020. The largest market for western Kentucky coal is consistently Kentucky, which represented 58.1% of western Kentucky coal deliveries during the year. Overall, coal mined in western Kentucky was shipped to 5 different states in 2020.

Kentucky Coal Deliveries, 2020		
Origin	Thousand Tons	1 Year Change
Total	21,608	-27.0%
WKY	16,766	-26.3%
EKY	4,482	-29.2%

Total Kentucky coal deliveries have continued to decrease since 2014, primarily because of reduced shipments from eastern Kentucky. Overall, there was a 6.7 million decrease, or 27% since 2019.

Kentucky In-State Coal Consumption

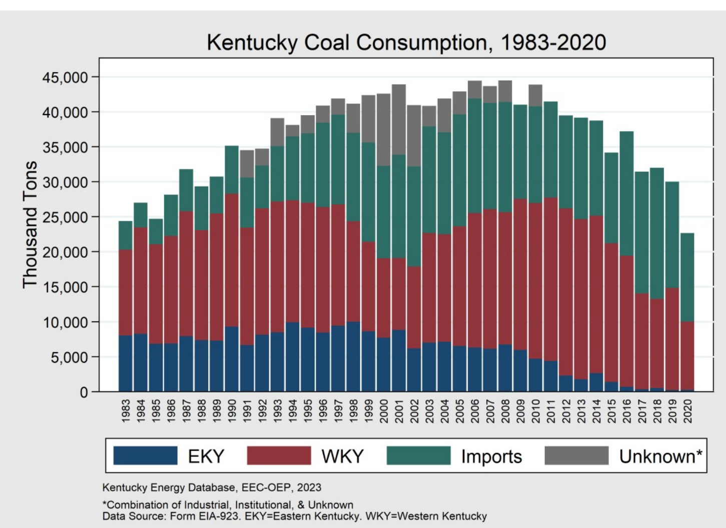




Origin of Coal	Thousand Tons	1 Year Change
Total	22,668	-27.6%
Western Kentucky	9,733	-39.7%
Imports	12,648	-18.3%
Eastern Kentucky	287	+17.8%

Imported Coal	Thousand Tons	1 Year Change
Total Imports	12,648	-18.2%
Wyoming	4,053	-54.5%
Illinois	4,134	+1.7%
Indiana	965	-41.0%
Ohio	1,150	-3.4%
West Virginia	2,034	+62.9%
Pennsylvania	312	-2.5%

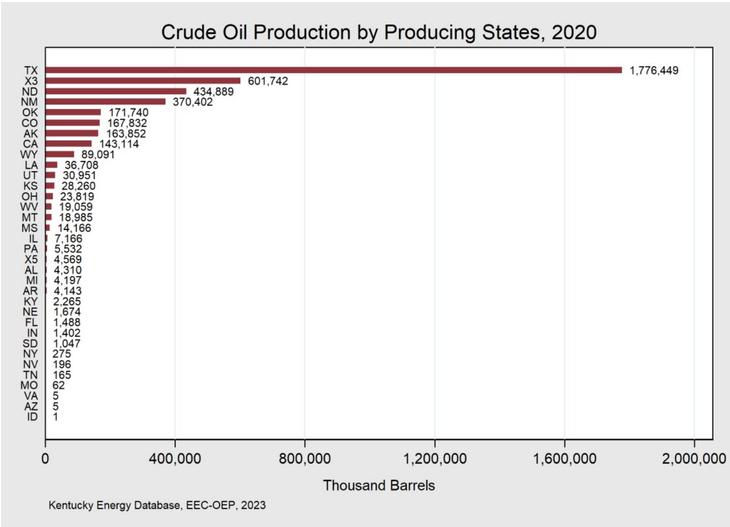
All values have been rounded to the nearest thousand tons.

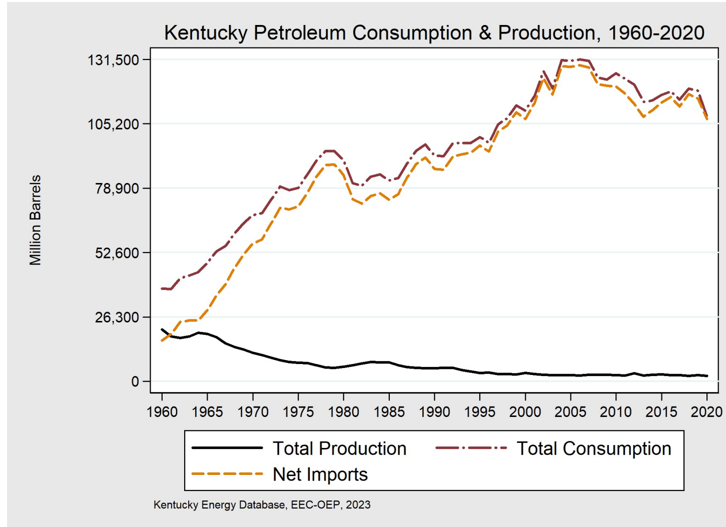


Coal consumption in Kentucky decreased by 27.6% in 2020 to 22.7 million tons. Coal imports were the largest source of coal used within the Commonwealth, representing 56% of coal consumption. Conversely, coal from eastern Kentucky accounted for 1% of the coal consumed in Kentucky in 2020.

Several factors affect the use of imported coal in Kentucky including the price, delivery cost, heat content, and the sulfur content of a particular coal. For electrical power generation, utilities must balance the economic and environmental costs of these factors when purchasing coal. As a result, electric utilities, municipalities, and power producers often blend coal from a variety of sources to maintain a diversified cost-effective fuel resource while complying with environmental regulations. Since 1990, electric utilities in Kentucky have increasingly used coal containing relatively higher sulfur content, a trend accelerated through the installation of sulfur dioxide scrubbers on many coal-fired generators throughout the state. Nationally, many other electric utilities have elected to install similar environmental control systems, thereby altering traditional coal sourcing requirements. The net result of these recent decisions in Kentucky has meant an increasing reliance on western Kentucky coal supplies, and a diminishing demand for eastern Kentucky coal. The relatively low price of coal from several western states has also increased imports for electric power generation.

Kentucky Crude Oil Production





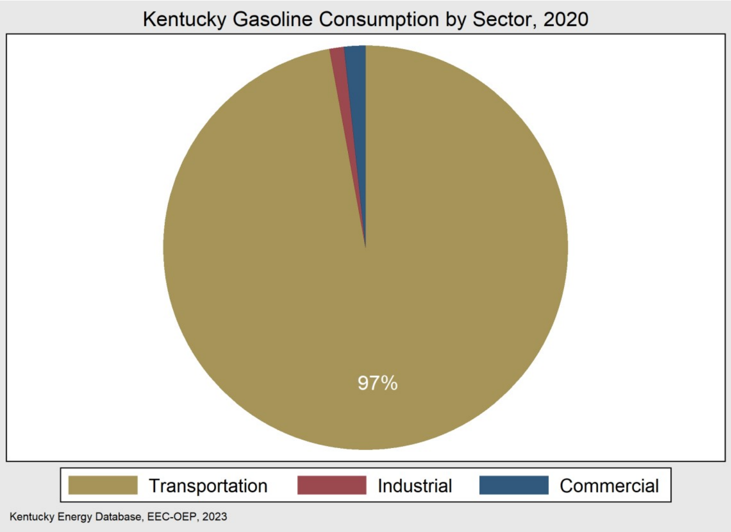
Production	2020 Million Barrels	Rank
Texas	1,766	1st
Kentucky	2	21st

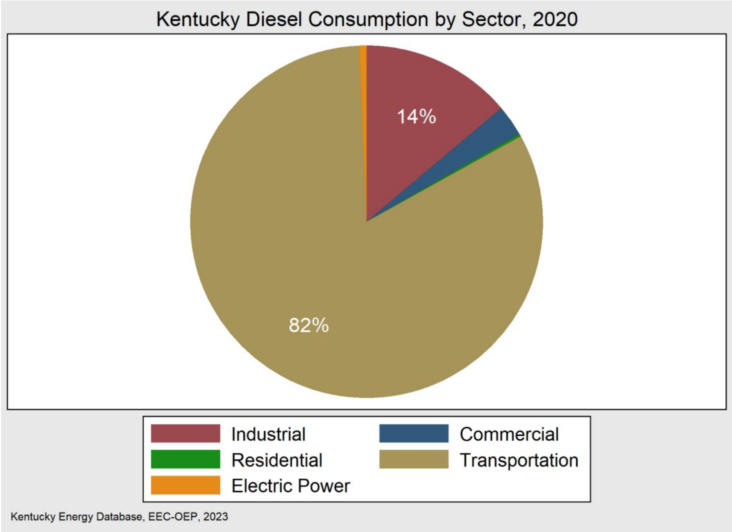
Crude oil production in Kentucky decreased by 10.1% in 2020 to produce 2.3 million barrels. Annual crude oil production in Kentucky had remained between 2.3 and 2.9 million barrels since the year 2000, but has recently increased with more widespread application of horizontal wells and nitrogen foam and hydraulic fracture stimulations. Despite this increase, in-state crude oil production contributes to less than 1% of total U.S. production.

Though Kentucky is a producer of petroleum, statewide consumption has increasingly surpassed production. As a result, Kentucky's petroleum imports have increased from 44% to 98% between 1960 and 2020.

Kentucky has one operating crude oil refinery in the state located in Cattlesburg, KY which has a operating capacity of 291,000 barrels per calendar day. Additional information on the location of oil fields and wells is available from the Kentucky Geological Survey Geologic Map Information Service at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp

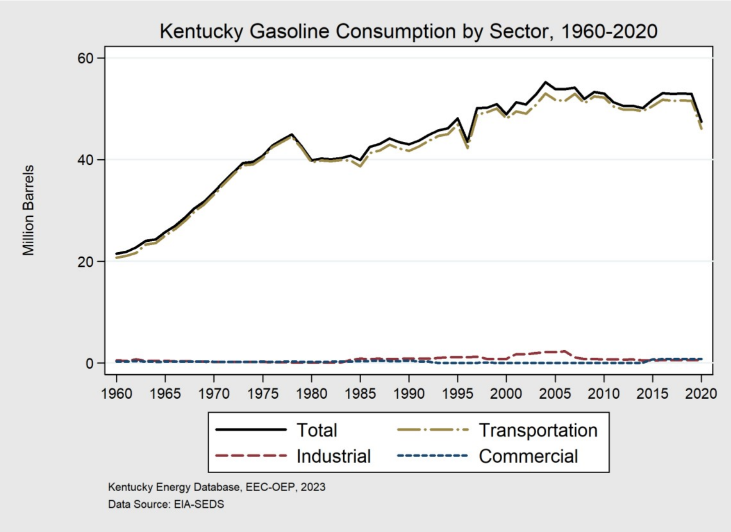
Kentucky Liquid Fuel Consumption

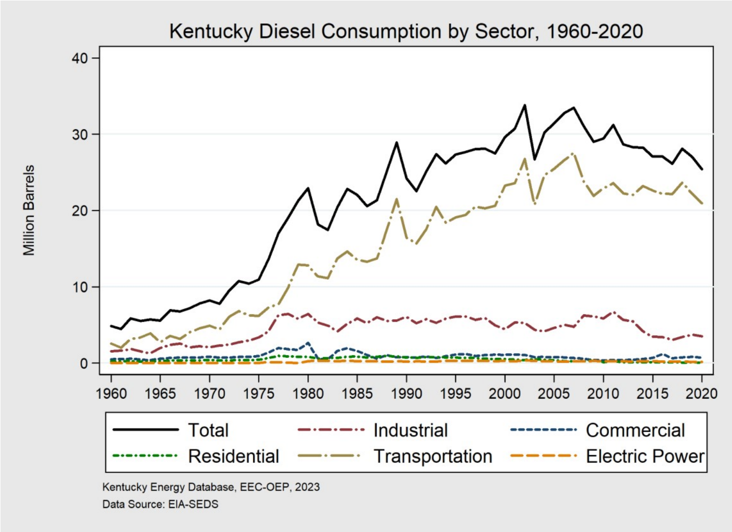




Sector	Thousand Barrels	1 Year Change
Total	47,477	-10.9%
Transportation	46,110	-11.2%
Industrial	562	-0.7%
Commercial	805	+0.1%

Sector	Thousand Barrels	1 Year Change
Total	25,416	-6.3%
Transportation	20,942	-6.0%
Industrial	3,522	-5.4%
Commercial	719	-15.3%
Electric Power	166	-1.8%
Residential	67	-26.0%

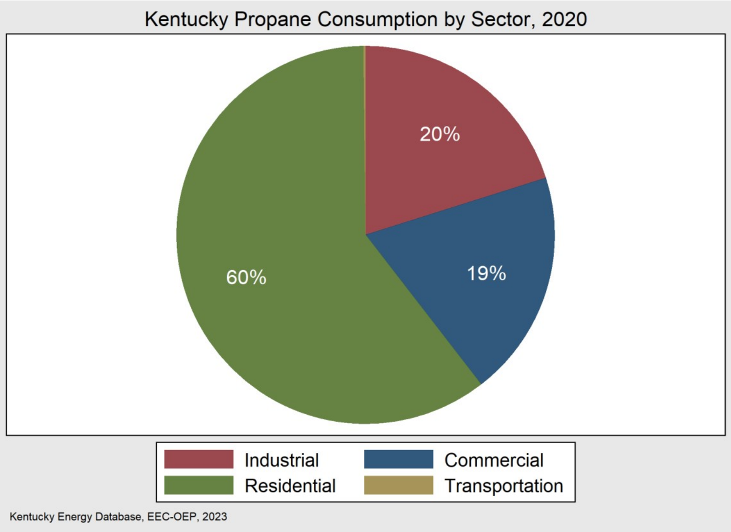


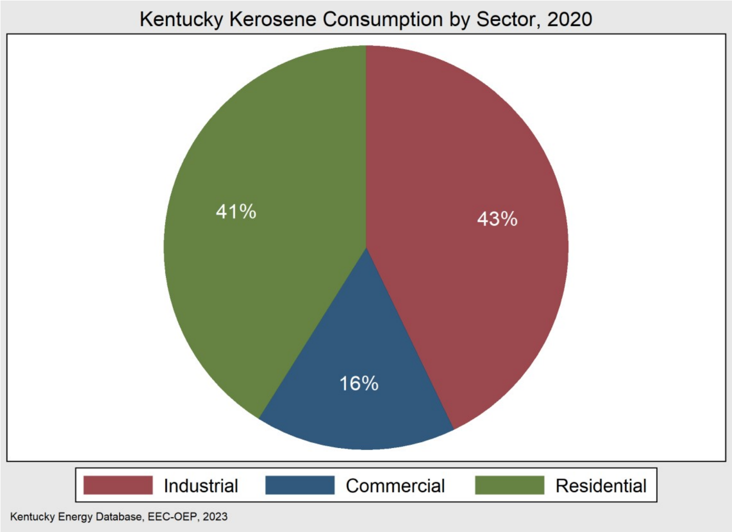


In 2020, Kentucky consumed 47.5 million barrels of gasoline, with 97% used for transportation. Compared with 2019, total gasoline consumption in Kentucky decreased by 11%.

In 2020, Kentucky consumed 25.4 million barrels of diesel fuel, a 6.3% decrease in overall consumption from 2019. The vast majority of diesel consumption—82%—was consumed by the transport sector, mostly for trucking on highways, marine vessels, and railroad consumers. Industrial users, predominately manufacturing facilities and farms, consumed 14%. The commercial, residential, and electric power sectors made up the remaining 4% in 2020.

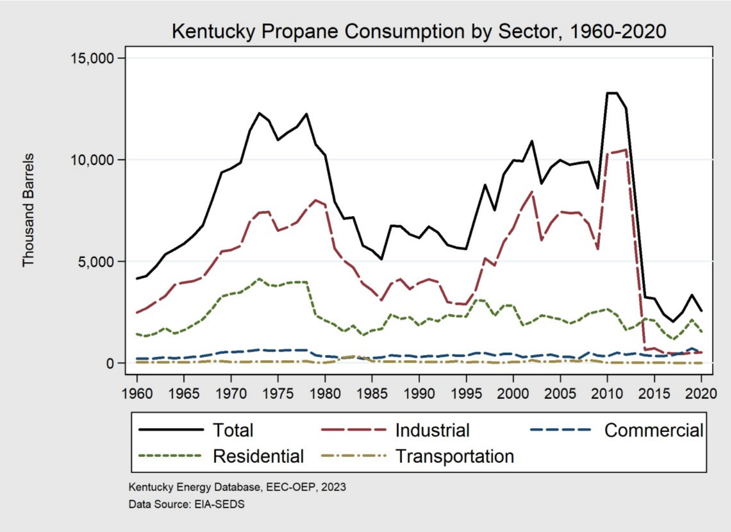
Kentucky Liquid Fuel Consumption

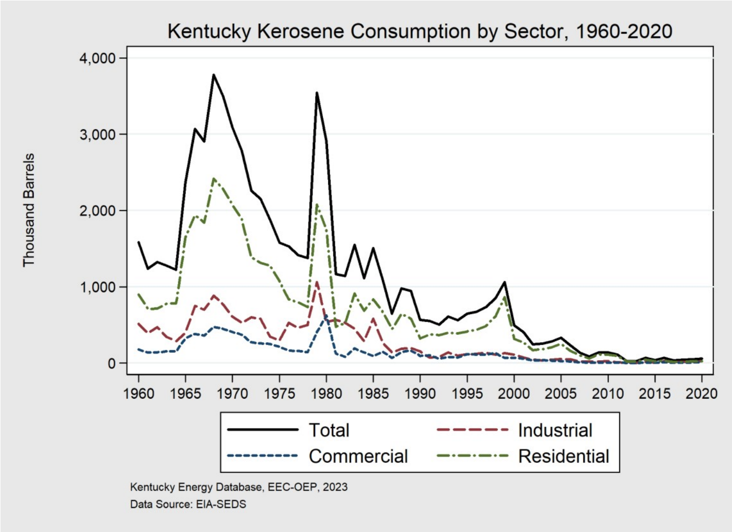




Sector	Thousand Barrels	1 Year Change
Total	2,583	-26.0%
Industrial	520	+5.1%
Residential	1,557	-31.2%
Commercial	501	-35.3%
Transportation	5	-50.0%

Sector	Thousand Barrels	1 Year Change
Total	57	+14.0%
Residential	23	-11.5%
Industrial	24	+50.0%
Commercial	9	+12.5%



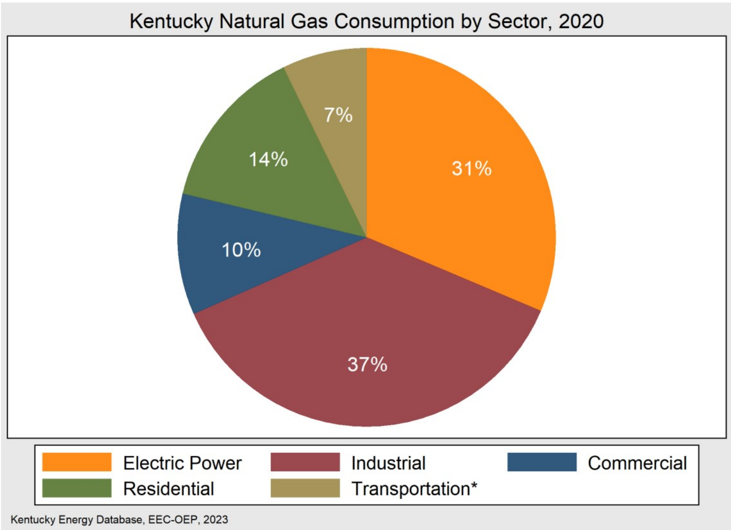


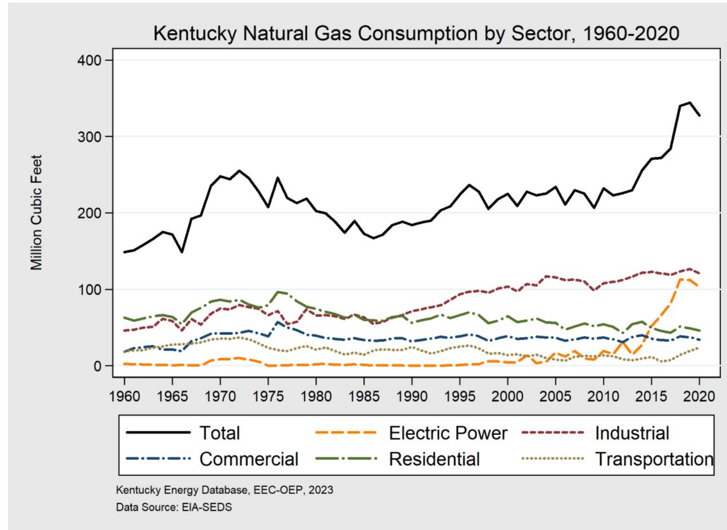
In 2020, more than 2.5 million barrels of liquid petroleum gas (LPG), which is mostly propane, but also includes ethane and butane, was consumed in Kentucky. Since 2019, consumption decreased by 26%. With 60% of total consumption, the residential sector was the largest end-user of LPG, followed by the industrial sector with 20%. The commercial and transportation sectors comprised the remaining 20% of LPG consumption in 2020.

In 2020, Kentucky consumed 57,000 barrels of kerosene. The industrial and residential sectors were the largest consumers of kerosene, consuming 43% and 41%, respectively, of the total for home heating. The industrial sector was the smallest consumer with 16% of consumption. Compared with 2019, Kentucky kerosene consumption increased by 14 percent.

*These quantities exclude kerosene-type jet fuel, which is itemized in transportation energy consumption.

Kentucky Natural Gas Consumption





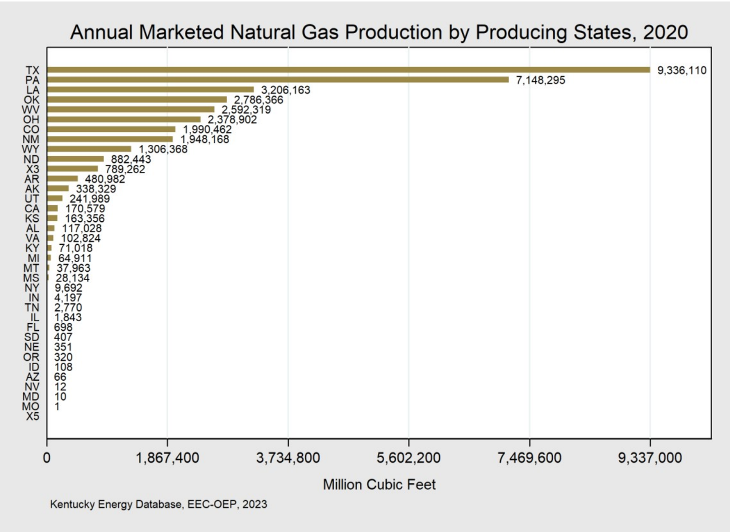
Sector	Million Cubic Feet	1 Year Change
Total	327,731	-4.8%
Industrial	121,272	-4.2%
Residential	45,961	-5.8%
Commercial	33,950	-9.2%
Electric Power	102,809	-8.5%
Transportation*	23,739	+23.5%

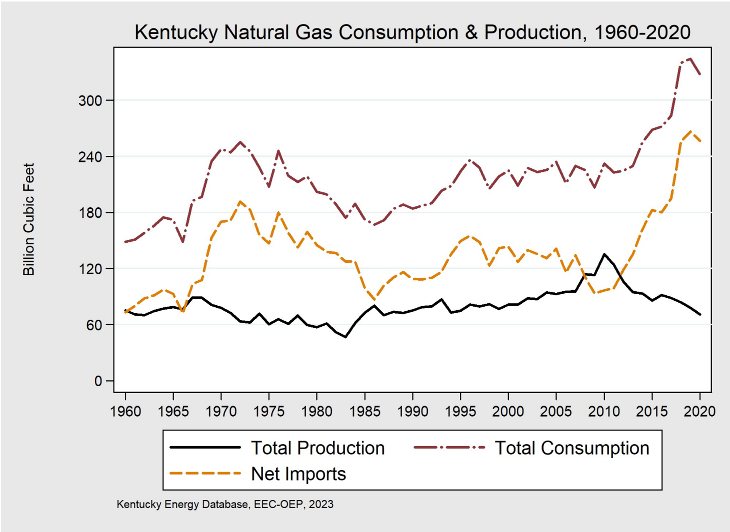
*Natural gas consumption by the transportation sector is the summation of vehicle fuel usage and natural gas used in the movement of natural gas resources through transmission and distribution pipelines.

Kentucky's consumption of natural gas fell by 4.8% in 2020 to consume a total of 327,731 million cubic feet, approximately 1% of United States total consumption. The industrial sector was the largest consumer of natural gas, using 37% of the state total. The electric power sector was the second largest sector consumer with 31% of total natural gas consumption. The residential sector accounted for 14% of consumption. Natural gas combined cycle (NGCC) plants have replaced coal-fired boilers at the Cane Run, Big Sandy, Paradise, and Robert Reid power plants. Both, the commercial and transportation sectors, consumed 17% of statewide consumption.

The commercial and residential sectors consume natural gas to generate heat while industrial consumers, which include agriculture, primarily use natural gas as a process feedstock in manufacturing operations. As a result, residential and commercial consumption follows a seasonal pattern, with notable fluctuation due to weather while industrial consumption is more consistent throughout the year. The sizeable consumption by the industrial sector is reflective of the large presence of industrial firms within Kentucky.

Kentucky Natural Gas Production





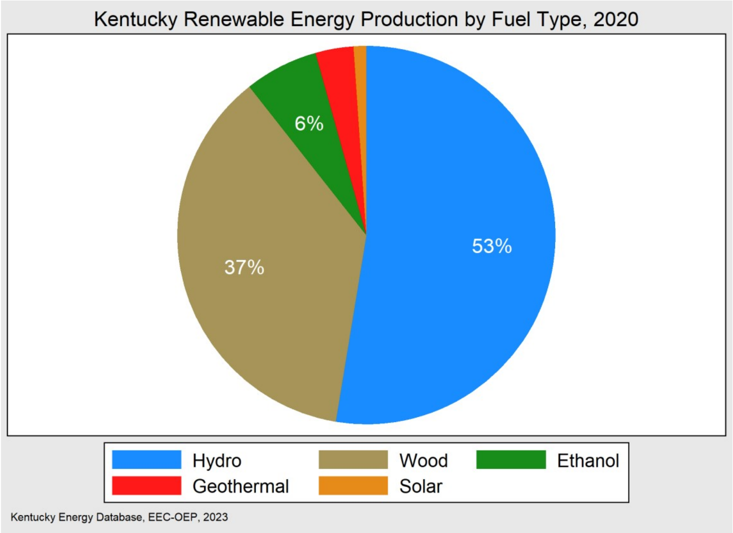
State	2020 Production	Rank
Texas	9,336	1st
Kentucky	71	18th

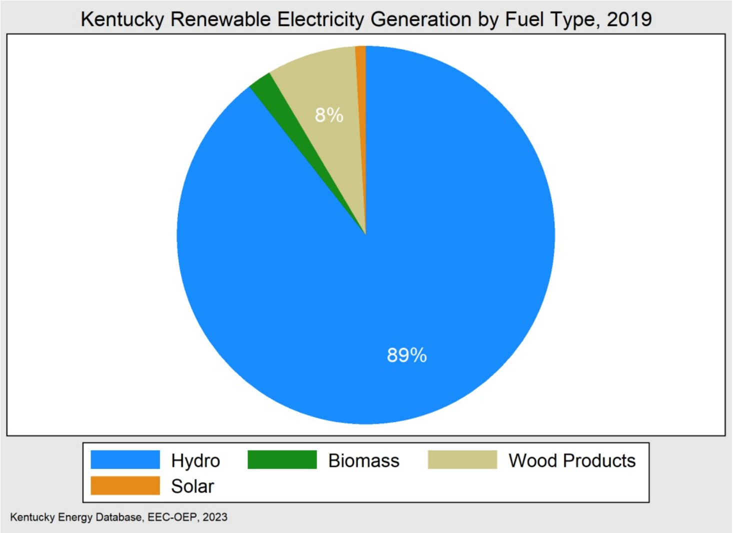
Kentucky produced 71 billion cubic feet (Bcf) of natural gas in 2020, a 9.2% decrease in natural gas production from 2019. Given a favorable price of natural gas, statewide production has the capacity to increase substantially, but production is expected to remain less than other states.

Kentucky has 2 natural gas processing plants located in eastern Kentucky and 22 underground storage locations, mostly located in western Kentucky. Additional information on the location of natural gas fields and wells is available from the Kentucky Geological Survey Geologic Map Information Service at: http://kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp

Aerial view of E.W. Brown Solar Facility. Photo courtesy of LG&E-KU.

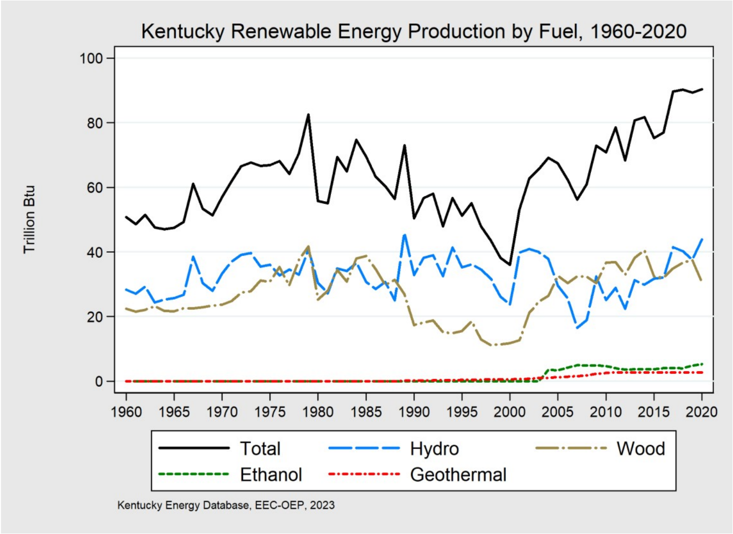
Kentucky Renewable Energy

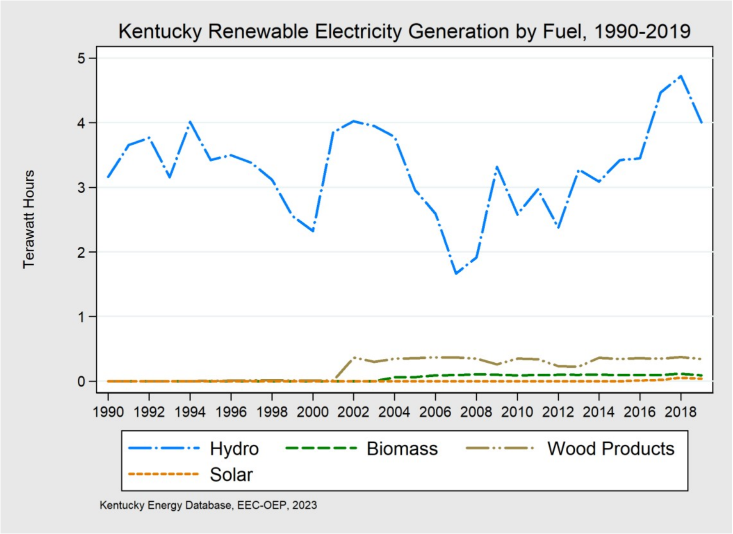




Fuel Type	Billion Btu	1 Year Change
Total	83,487	+1.2%
Wood & Biomass	30,698	-18.0%
Hydroelectric*	43,913	+16.5%
Ethanol†	5,270	+9.6%
Geothermal	2,712	+0.0%
Solar	894	+8.1%

Fuel Type	Gigawatt Hours	1 Year Change
Total	4,480,456	-17.5%
Hydroelectric*	4,006,900	-15.2%
Woody Biomass	342,698	-8.6%
Biomass	91,456	-19.6%
Solar	39,402	-26.5%





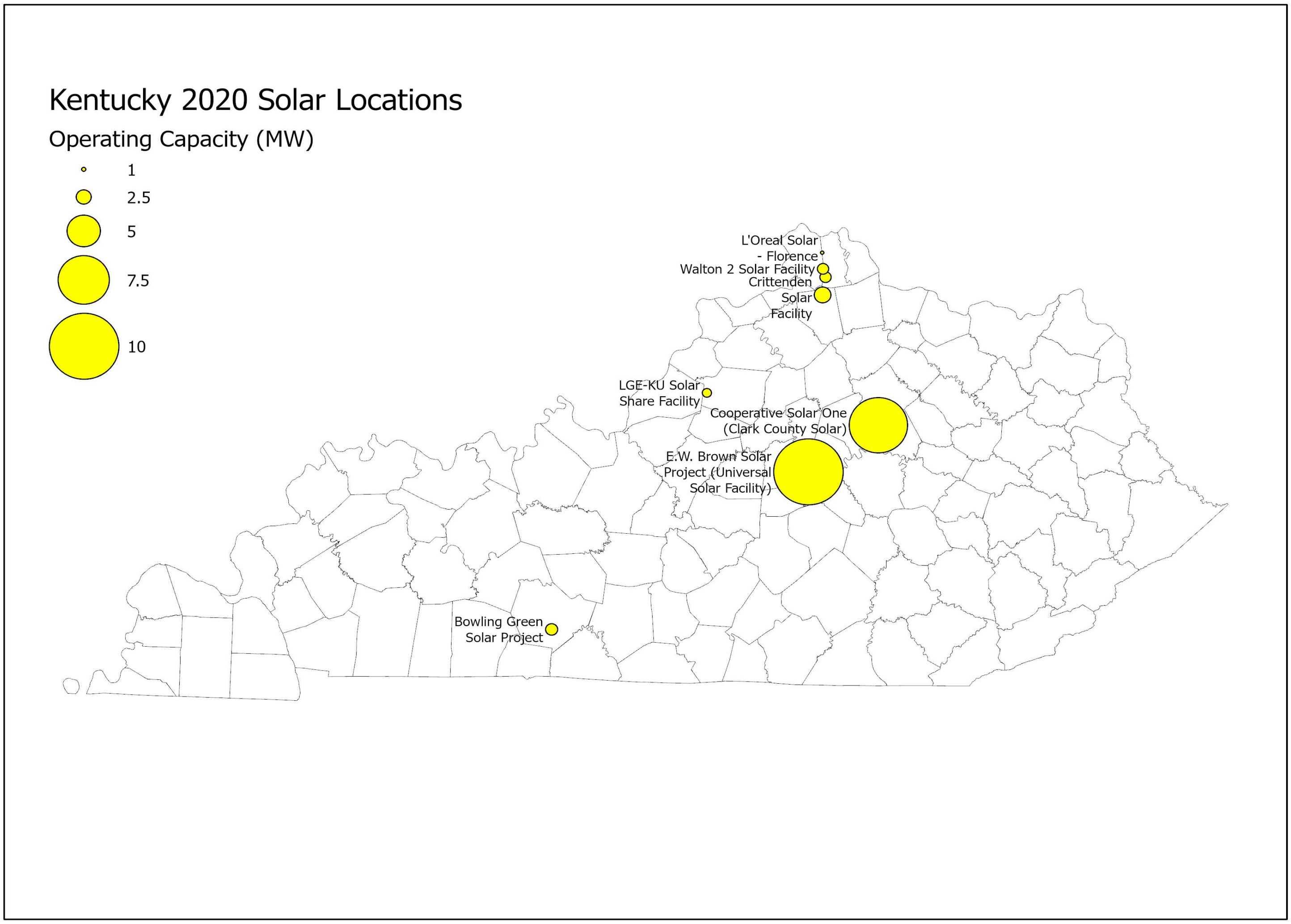
In 2020, Kentucky produced 83.5 trillion Btu of energy from renewable resources, a 1.2% increase compared with 2019. Year-to-year fluctuations are mostly due to variations in hydroelectric power, which itself is a reflection of rainfall. Hydroelectric, Wood and biomass waste was 90% of all renewable energy produced in Kentucky in 2020.

†Ethanol includes the biomass inputs used in the production of ethanol. These data exclude the energy losses associated with making ethanol and the co-products gleaned during production and thereafter sold.

Hydroelectric power generated 89% of renewable electricity in Kentucky in 2019. Total renewable electricity generation decreased by 17.5% compared with 2018.

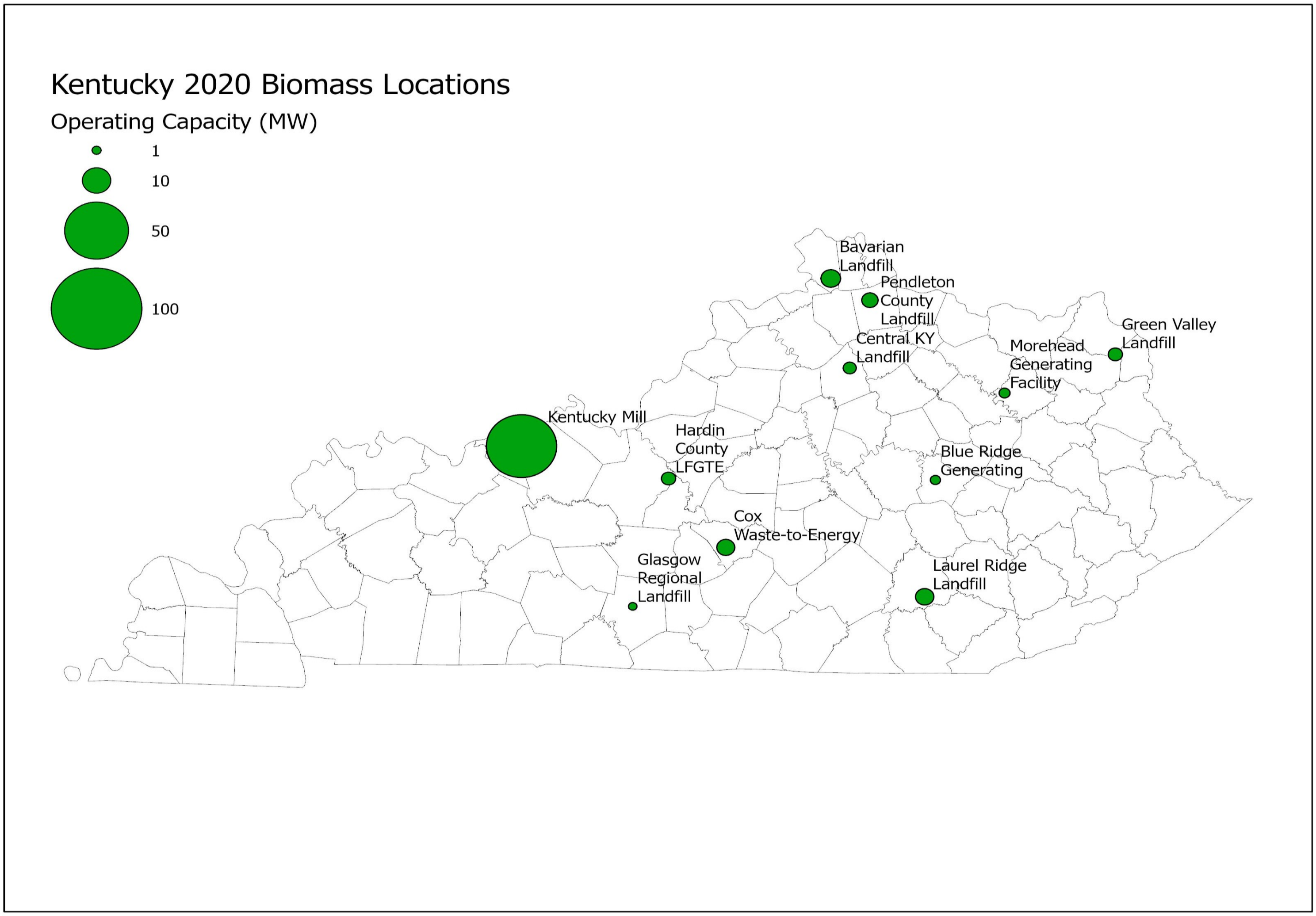
*Hydroelectric generation is directly accounted through gigawatt-hour consumption, whereas hydroelectric production (billion Btu) is a calculated fossil fuel displacement conversion, or the amount of fossil fuel energy required to generate an equal amount of electricity.

Kentucky Solar Generation



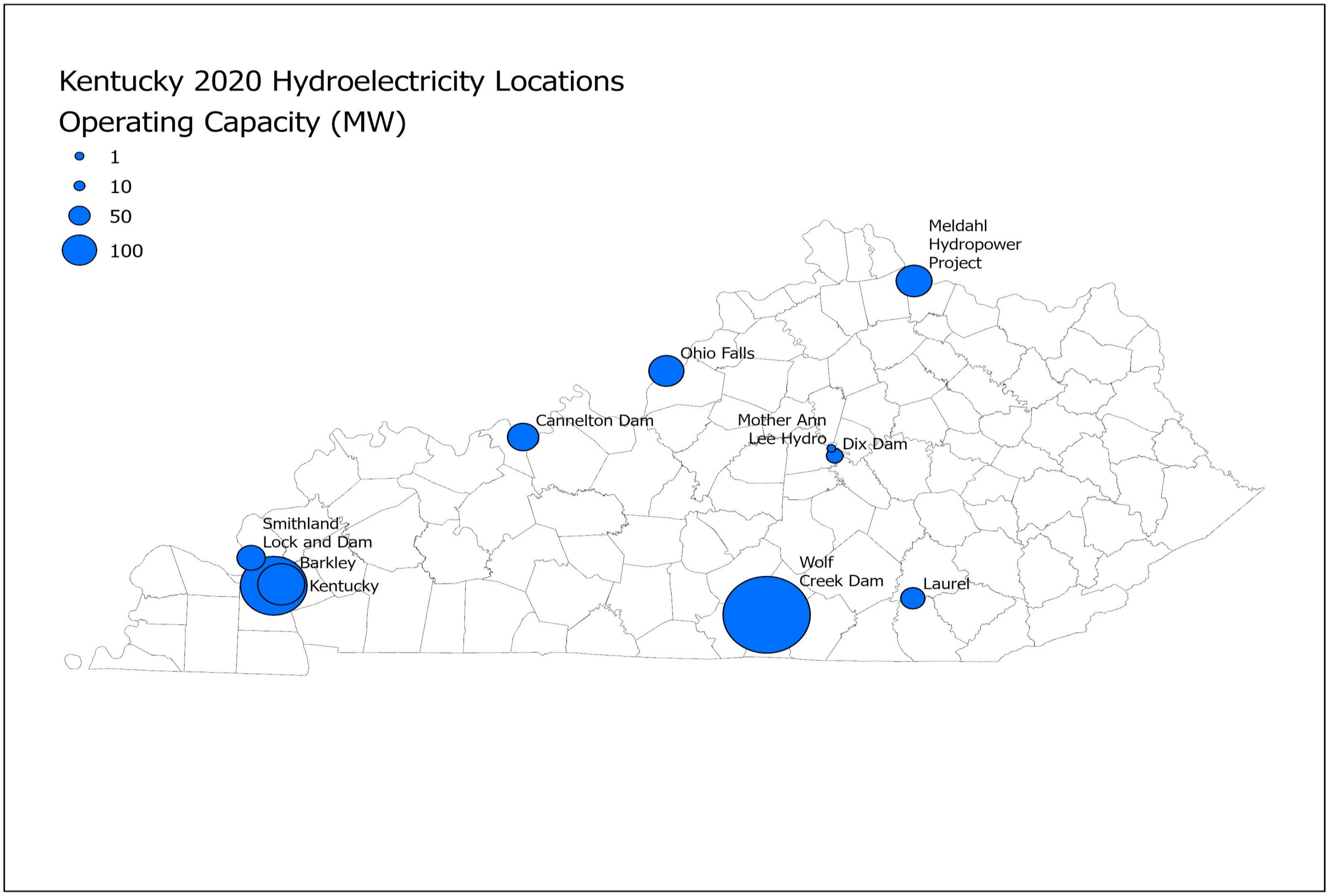
Name	Capacity (MW)
Bowling Green Solar Project	**2.1**
LGE-KU Solar Share Facility	**1.7**
Cooperative Solar One (Clark County Solar)	**8.5**
Crittenden Solar Facility	**2.7**
E.W. Brown Solar Project (Universal Solar Facility)	**10**
L'Oreal Solar - Florence	**1.1**
Walton 1 Solar Facility	**2**
Walton 2 Solar Facility	**2**

Kentucky Biomass Generation



Name	Capacity (MW)
Bavarian Landfill	**4.7**
Blue Ridge Generating	**1.2**
Central KY Landfill	**2**
Cox Waste-to-Energy	**3.9**
Glasgow Regional Landfill	**1**
Green Valley Landfill	**2.4**
Kentucky Mill	**60**
Laurel Ridge Landfill	**4**
Hardin County LFGTE	**2.4**
Pendleton County Landfill	**3.2**
Morehead Generating Facility	**1.4**

Hydroelectricity Generation



Name	Capacity (MW)
Barkley	**148**
Cannelton Dam	**87.9**
Dix Dam	**31.5**
Kentucky	**222.5**
Laurel	**61**
Meldahl Hydropower Project	**105**
Mother Ann Lee Hydro	**2.3**
Ohio Falls	**100.8**
Smithland Lock and Dam	**75.9**
Wolf Creek Dam	**312**

Distributed Renewable Generation

Distributed Renewable Generation (DG) refers to those distributed renewable energy systems that generate or store electricity for delivery to the electrical grid and includes the eligible electric generating facilities under KRS 278.465 and those connected under utility tariffs filed under the regulation for Small Power Production and Cogeneration.

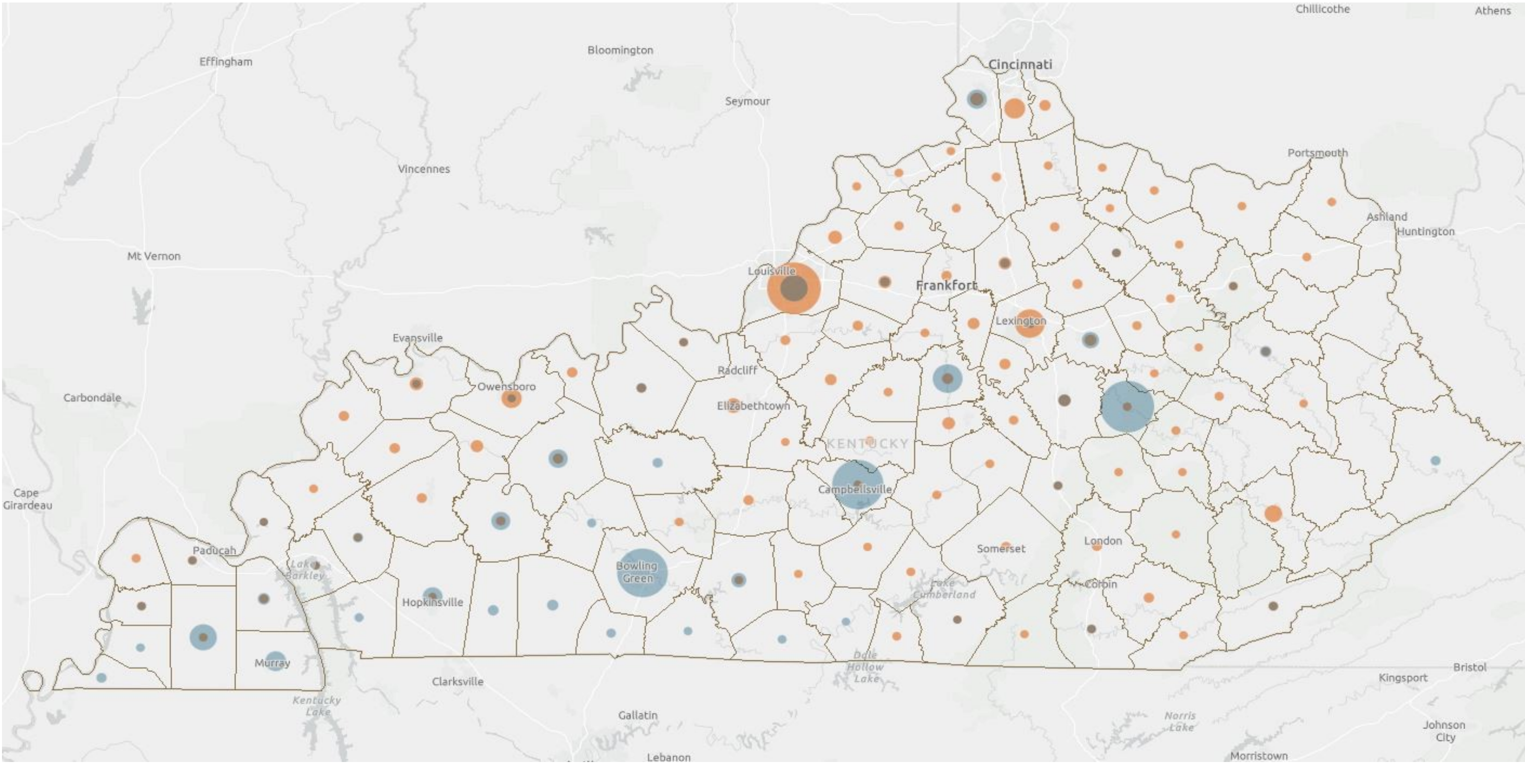
Net Energy Metering or Net Metering refers to a compensation mechanism established in KRS 278.465-468 which allows small renewable generation systems to interconnect to the electric distribution grid.

Distributed renewable generation systems located in areas of Kentucky served by TVA local power companies do not interconnect via net metering.

In addition to Net Metering, larger power generation systems interconnect to the electric grid via tariffs established by utilities under the Public Utility Regulatory Policies Act.

For more information on accessing alternative energy in Kentucky, visit the Consumer Energy Management and Access Guide located at eec.ky.gov/energy.

Distributed Renewable Generation — 2020



2020 Renewable Net Metering Summary

Sum of Cumulative Installed Net Metered Capacity through December 2020 (kW)

> 4,774

3,500

2,500

1,000

< 0

2020 Renewable Non-Net Metering Summary

Sum of Cumulative Installed Non-Net Metered Renewable Capacity through December 2020 (kW)

> 4,240

3,000

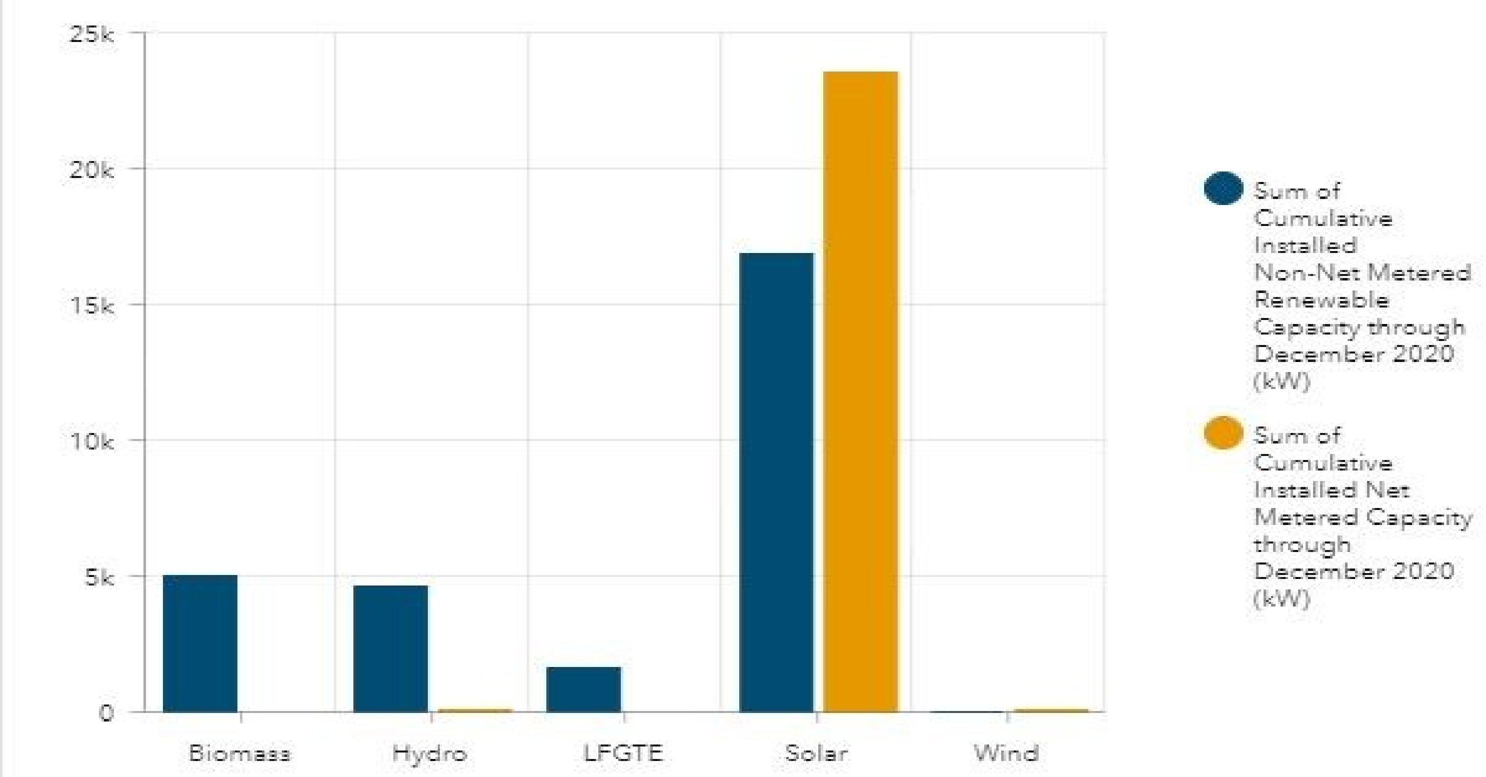
2,000

1,000

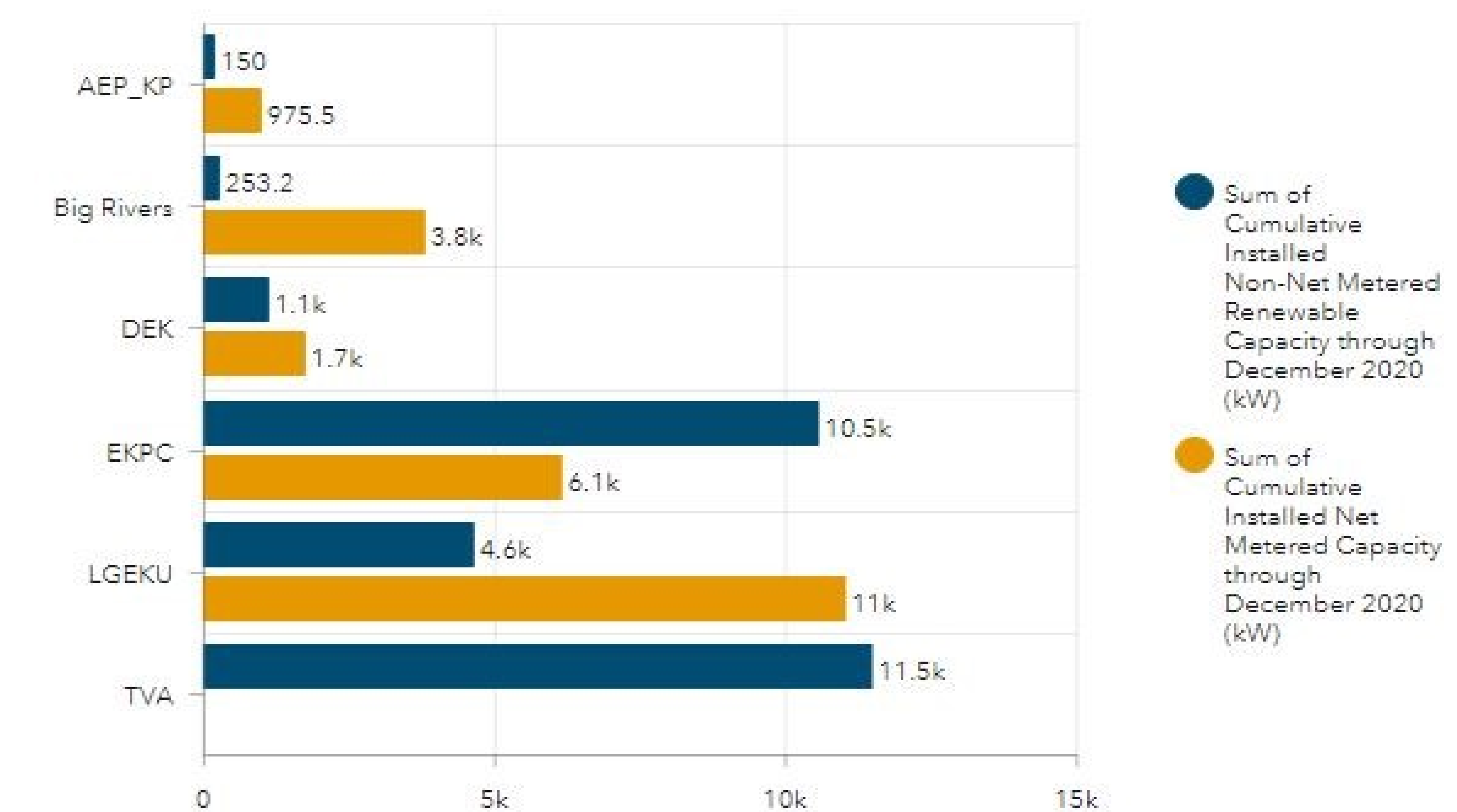
< 0

Distributed Renewable Generation — 2020

Renewable Intereconnection Data Summary By Resource



Renewable Interconnection Summary By Utility (kW)



Trimble County Power Plant, Kentucky's youngest coal-fired power plant. Owned jointly by Louisville Gas & Electric, Illinois Municipal Electric Agency, and Indiana Municipal Power Agency.

Coal-Fired Power Plant Profiles

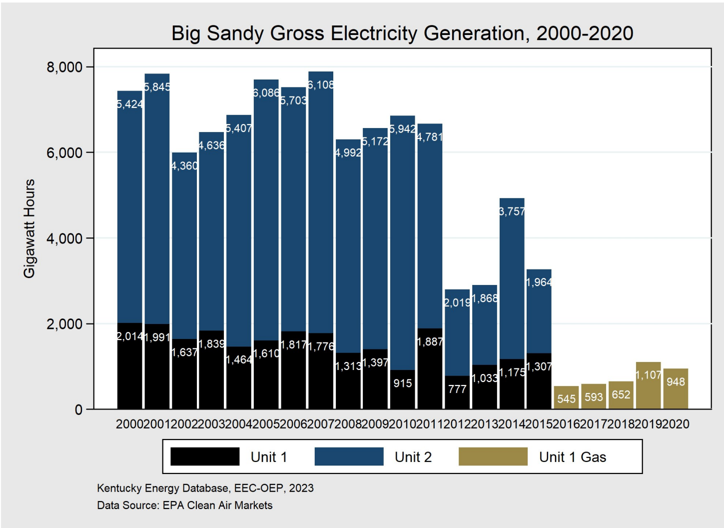
The following pages detail generation and emission statistics for Kentucky's coal fired generating plants. The plants that are profiled represent those that are currently coal fired or were once coal fired and have been converted to another source.

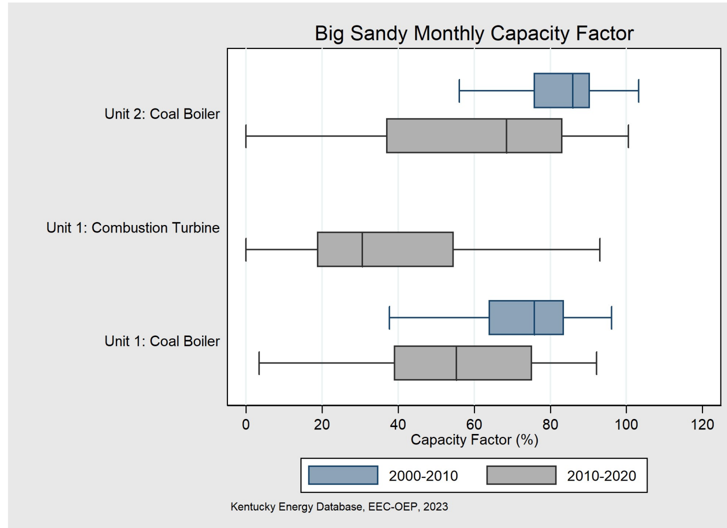
Edits from the previous edition:

The Green River Generation Station[1], Henderson Station[1], and Kenneth C. Coleman[2] have been removed from the 2023 edition due to retirements[1] or being idle[2] during the 2019-2020 reporting period.

The reader will note that some power plants are not operational or have significantly reduced generation. Those power plants remain in this edition until they are no longer able to resume operations.

Big Sandy Power Plant



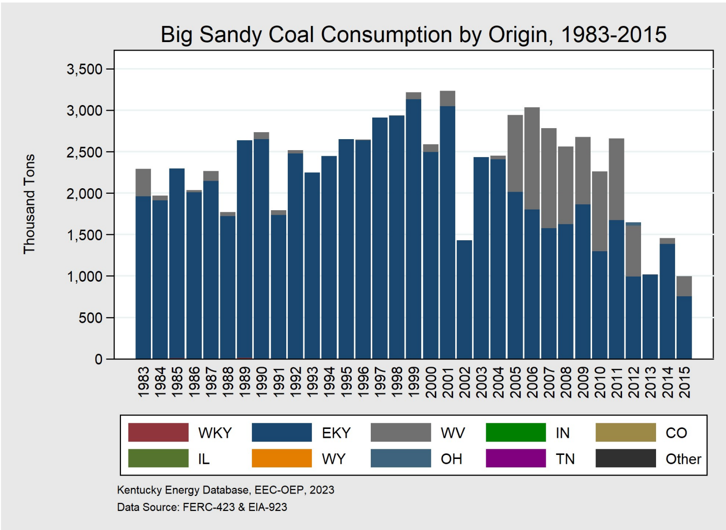


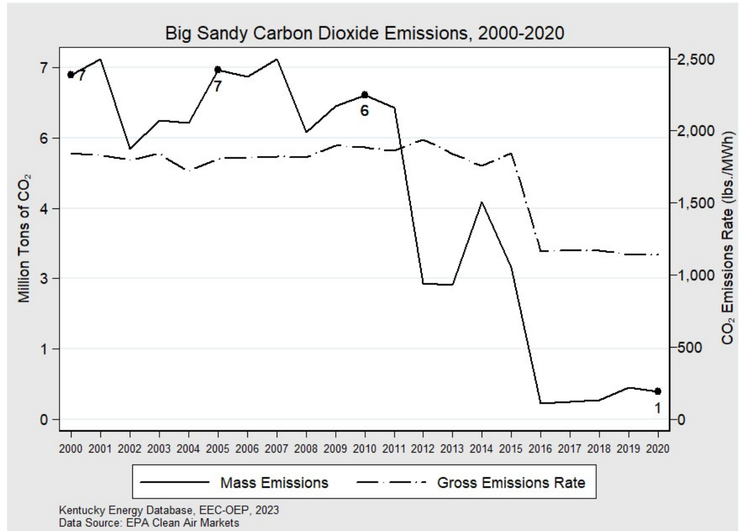
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1963**		**Natural Gas**	**281**	**39%**	**948**	**913**	**1,138**	**0.05**	**1.6**
1	1963		Natural Gas	281	39%	948	913	1,138	0.05	1.6
2	1969	2016	Coal	816		0	0			

The Big Sandy Power Plant, near Louisa in Lawrence County, is 60 years old and consisted of two coal-fired electricity generating units, which came online in 1963 and 1969, respectively. The plant has a total nameplate capacity of 281 MW and is owned by Kentucky Power, a subsidiary of American Electric Power Co.. In 2020, the plant generated 948 GWh of electricity, up from 652 GWh in 2018. Big Sandy's two coal-fired units were retired in 2016 and Unit 1 was converted to a natural gas combined cycle unit in 2016. Big Sandy's plant-wide capacity factor was 39% in 2020.

*2020

Big Sandy Power Plant

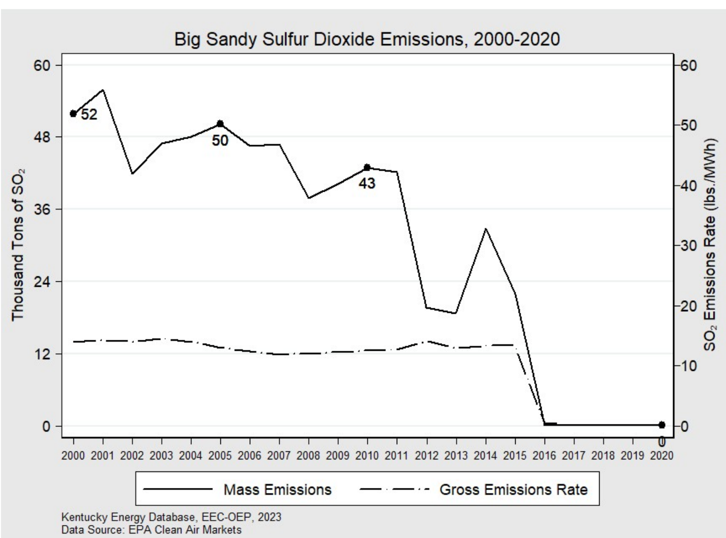


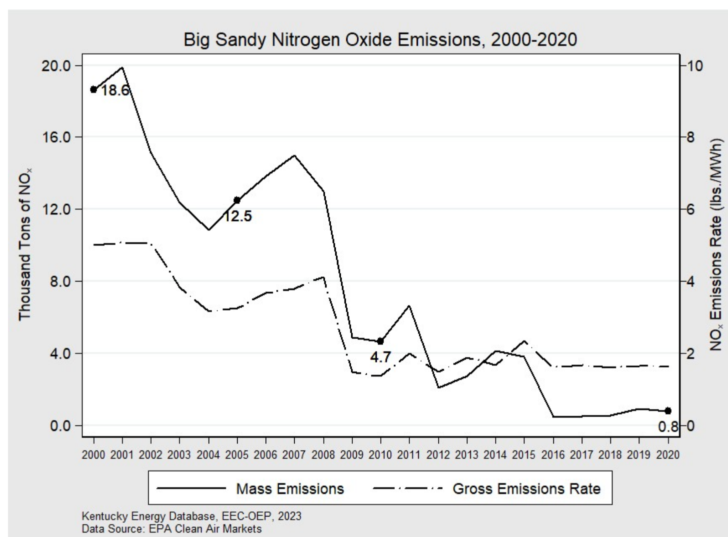


State	2015 Tons	Percentage
Total	1,457,580	100%
Eastern Kentucky	1,387,116	95%
West Virginia	70,464	5%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	539,187	-91.7%
Rate (lbs./MWh)	1,138	-39.6%

The Big Sandy Power Plant emitted 539 thousand tons of CO_2 in 2020, a decrease of 92% since 2010. The rate of CO_2 emissions has decreased by 40% during that time.





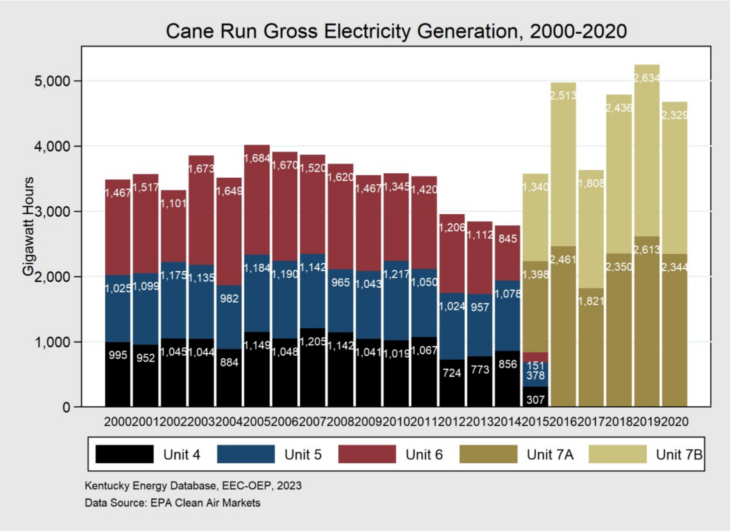
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	23	-99.9%
Rate (lbs./MWh)	0.05	-99.9%

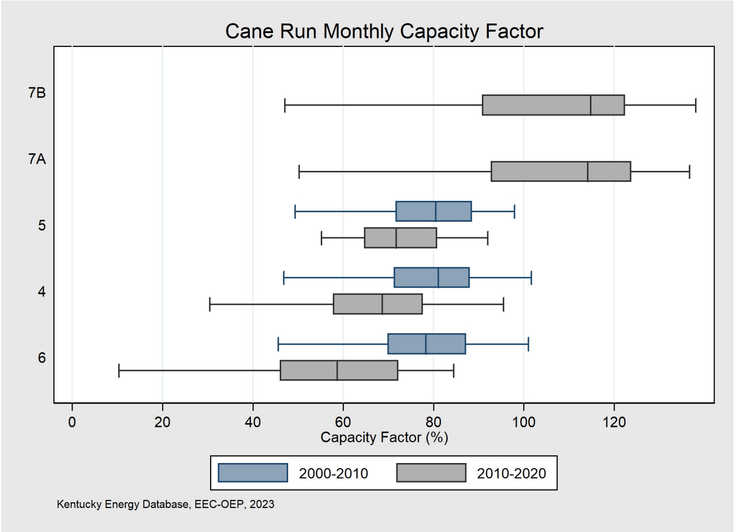
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	772	-83%
Rate (lbs./MWh)	1.6	-66.0%

The Big Sandy Power Plant emitted 23 tons of SO_2 in 2020. The SO_2 emissions rate has decreased at the plant by almost 100% after the closure of the plant's coal units in 2016.

The Big Sandy Power Plant emitted 772 tons of NO_x in 2020, a reduction of 83% since 2010. The rate of NO_x emissions decreased by 66% during that period.

Cane Run Station





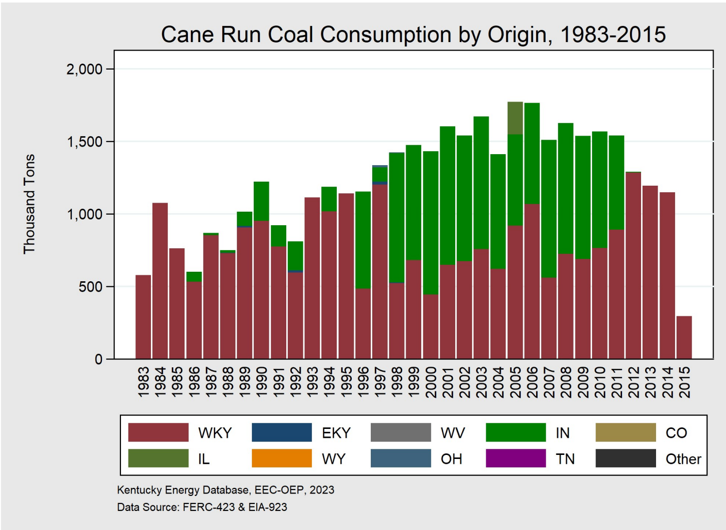
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1954**		**Natural Gas**	**807**	**79%**	**4,673**	**4,590**	**804**	**0.004**	**0.18**
4	1962	2015	Coal	155	-	-	-	-	-	-
5	1966	2015	Coal	168	-	-	-	-	-	-
6	1969	2015	Coal	240	-	-	-	-	-	-
7A	2015		Natural Gas	260	77%	2,344	1,477	806	0.004	0.18
7B	2015		Natural Gas	260	79%	2,329	1,470	802	0.004	0.17
7S	2015		Natural Gas	287	-	-	1,643	-	-	-

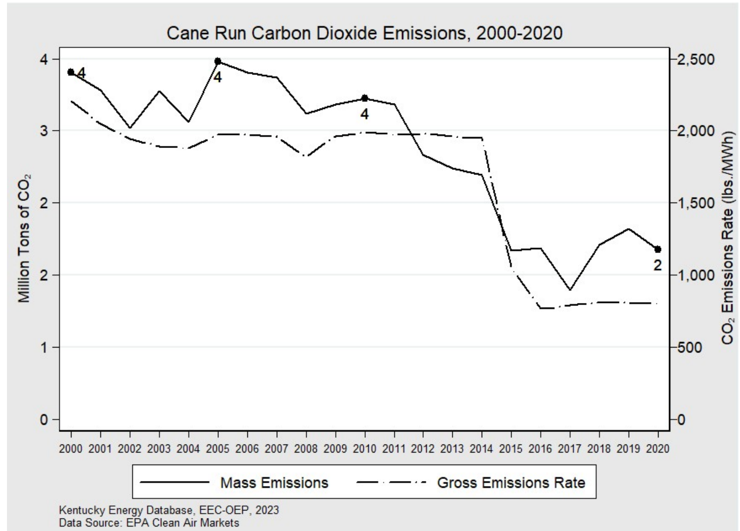
Cane Run Station, located southwest of Louisville in Jefferson County, began operation in 1954. The plant had six units at one time, but the three oldest coal units were retired by 1987. Units 4, 5, and 6 came online in 1962, 1966, and 1969, respectively. Units 4, 5, and 6 were retired in 2015 and replaced by 807 MW of natural gas combined cycle generation. In 2020, the plant generated 4.7 TWh of electricity, up from 3.5 TWh in 2015.

In their last full year of operation, Cane Run's coal units generated 2.7 TWh of electricity with an average capacity factor of 56%. Units 4, 5, and 6 generated 71.1 GWh for the Commonwealth over their lifetime with an average capacity factor of 59%. The coal units were demolished in June 2019.

*2020

Cane Run Station

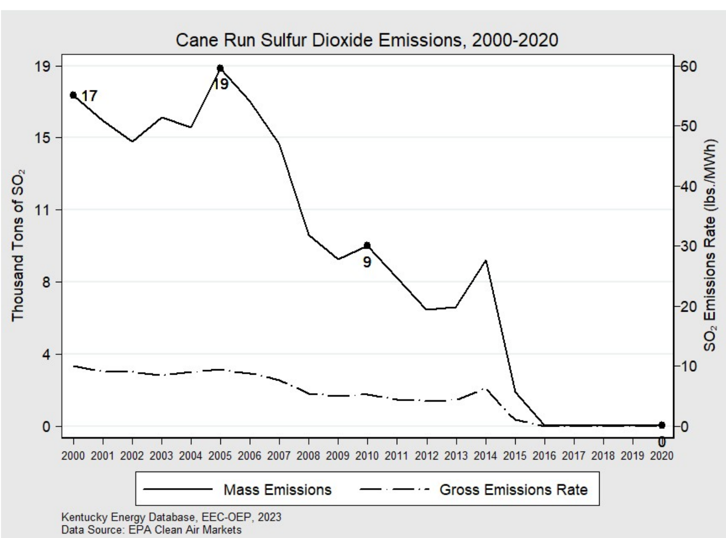


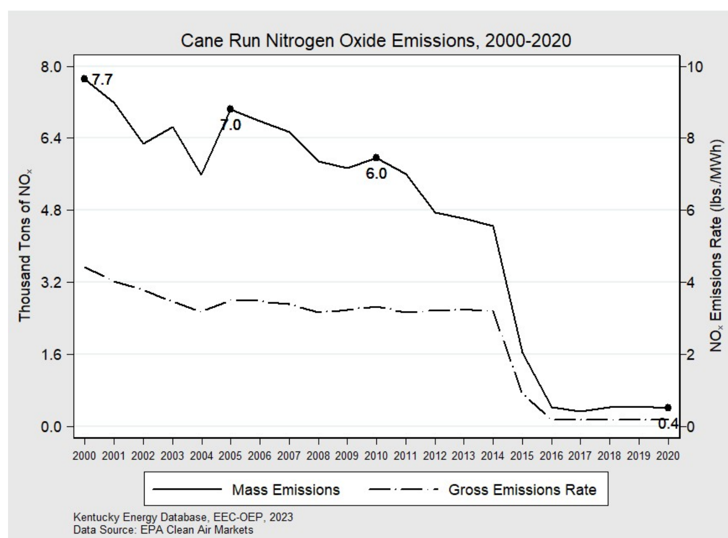


State	2015 Tons	Percentage
Total	1,147,537	100%
Western Kentucky	1,147,537	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,878,988	-47%
Rate (lbs./MWh)	804	-60%

Cane Rune Station emitted 1.9 million tons of CO_2 in 2020, a decrease of 47% from 2010 levels. The rate of CO_2 emissions decreased by 60% over the same period.





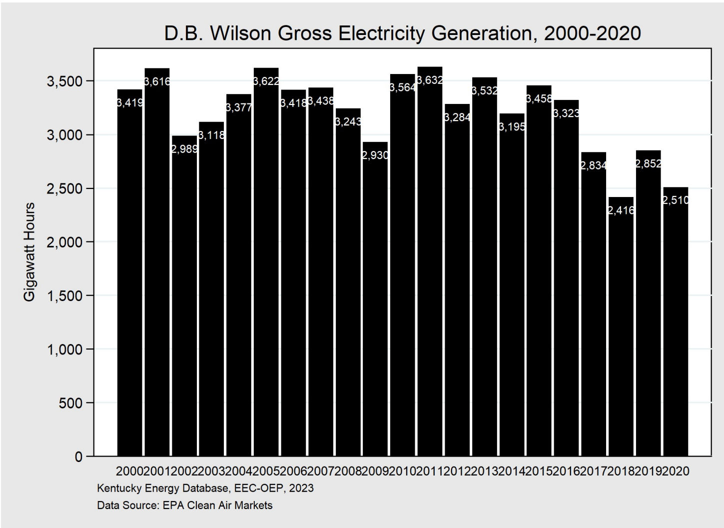
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	10	-99%
Rate (lbs./MWh)	0.004	-99%

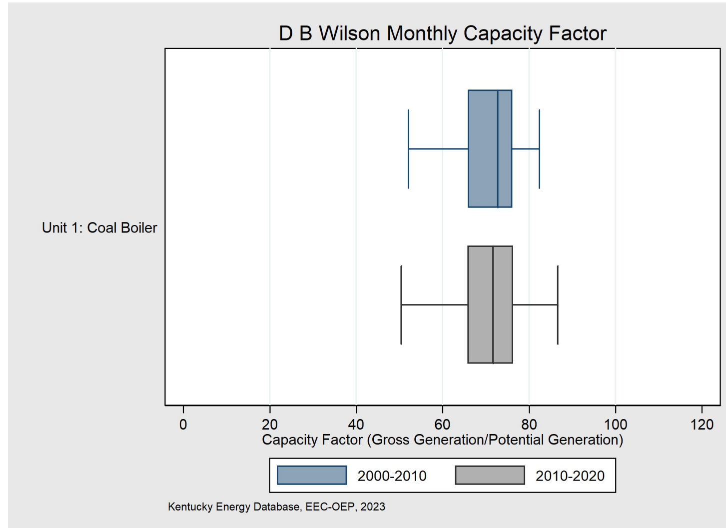
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	412	-93%
Rate (lbs./MWh)	0.18	-95%

Cane Rune Station emitted 10 tons of SO_2 in 2020, a decrease of 99.8% since 2010. The rate of SO_2 emissions decreased by the same amount during that period.

Cane Rune Station emitted 412 tons of NO_x in 2020, a reduction of 93% since 2010. The rate of NO_x emissions decreased by nearly 95% during that period.

D. B. Wilson Station



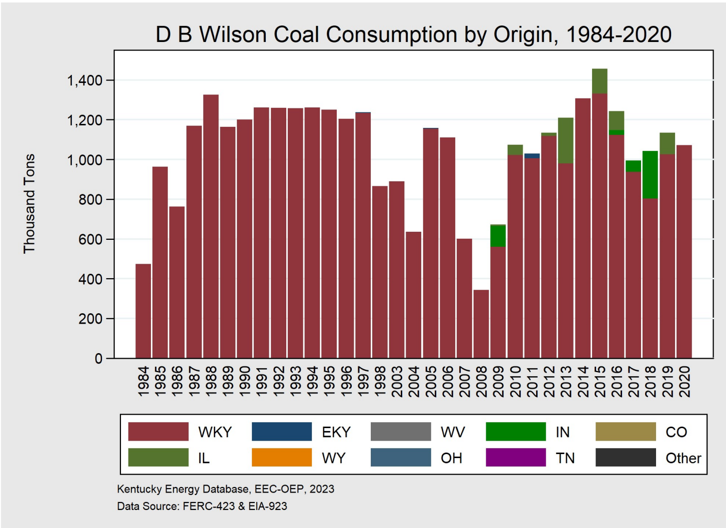


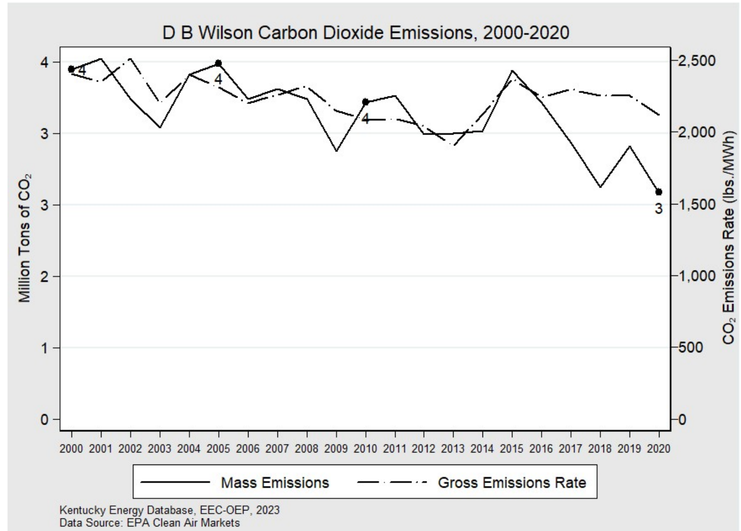
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1984**		**Coal**	**510**	**72%**	**2,510**	**2,317**	**2,118**	**3.57**	**0.93**
1	1984		Coal	510	72%	2,510	2,317	2,118	3.57	0.93

D. B. Wilson Station, located in Ohio County, is 39 years old and consists of one coal-fired electricity generating unit. The unit came online in 1984 and has a nameplate capacity of 510 MW. In 2020, the plant generated 2.4 TWh of electricity and had a plant-wide capacity factor of 72%. Wilson only burned western Kentucky coal in 2020. Wilson Station is owned by Big Rivers Electric Corporation.

*2020

D. B. Wilson Station

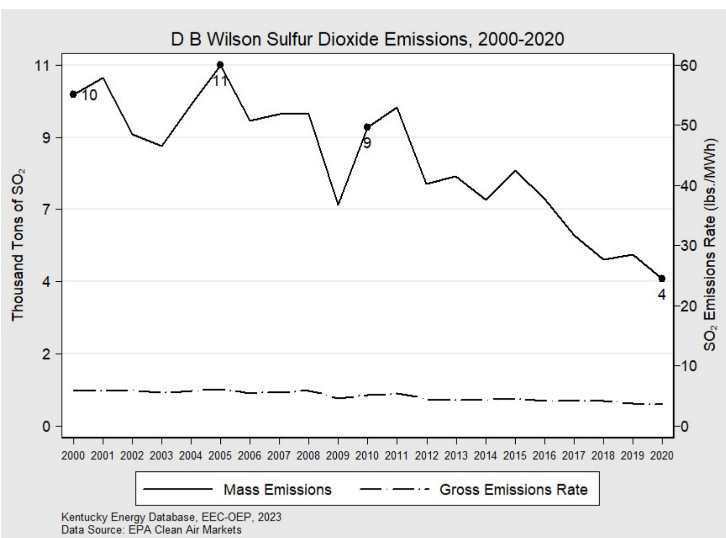


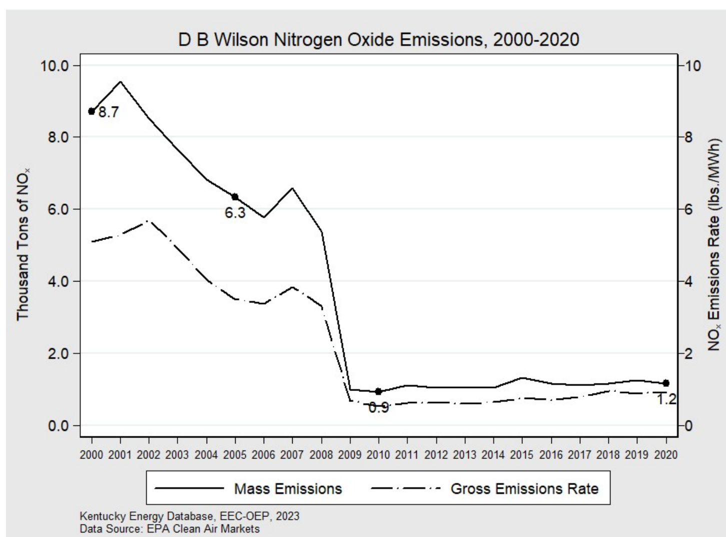


State	2020 Tons	Percentage
Total	1,071,141	100%
Western Kentucky	1,071,141	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,657,885	-29%
Rate (lbs./MWh)	2,118	+2%

The D. B. Wilson Station emitted 2.7 million tons of CO_2 in 2020, a decrease of 29% from 2010 levels. The rate of CO_2 emissions increased by 2% during that period.





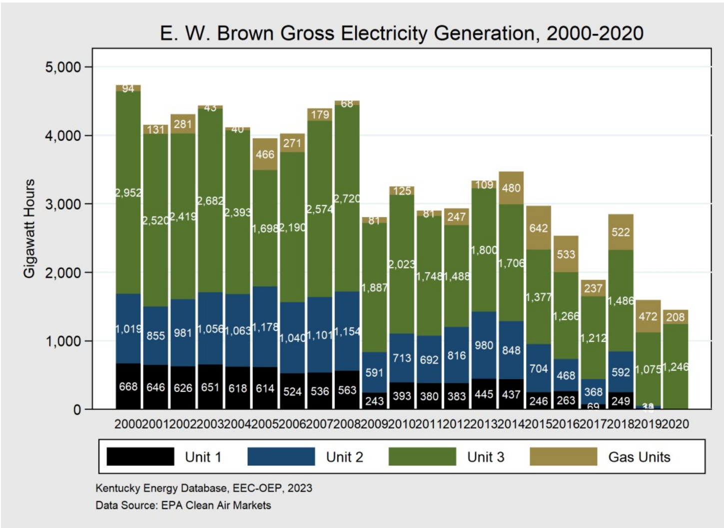
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	4,481	-51%
Rate (lbs./MWh)	3.57	-30%

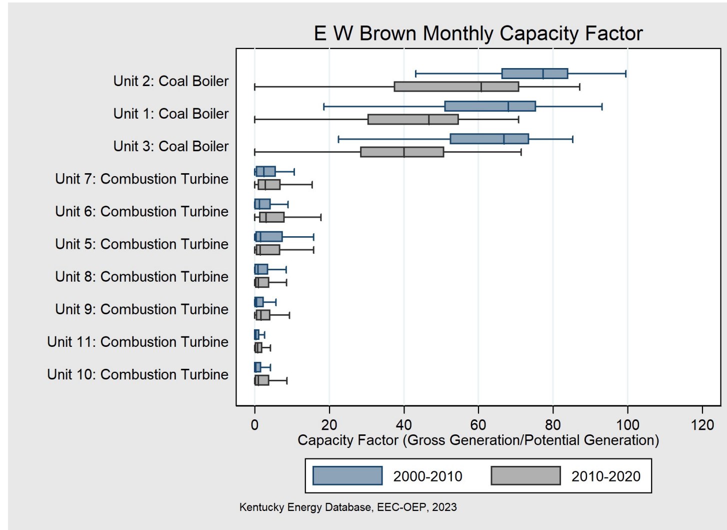
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,162	+24%
Rate (lbs./MWh)	0.93	+79%

The D. B. Wilson Station emitted 4,481 tons of SO_2 in 2020, a decrease of 51% since 2010. The rate of SO_2 emissions reduced by 30% during that period.

The D. B. Wilson Station emitted 1,162 tons of NO_x in 2020, an increase of 24% since 2010. The rate of NO_x emissions increased by 79% during that period.

E. W. Brown Generating Station



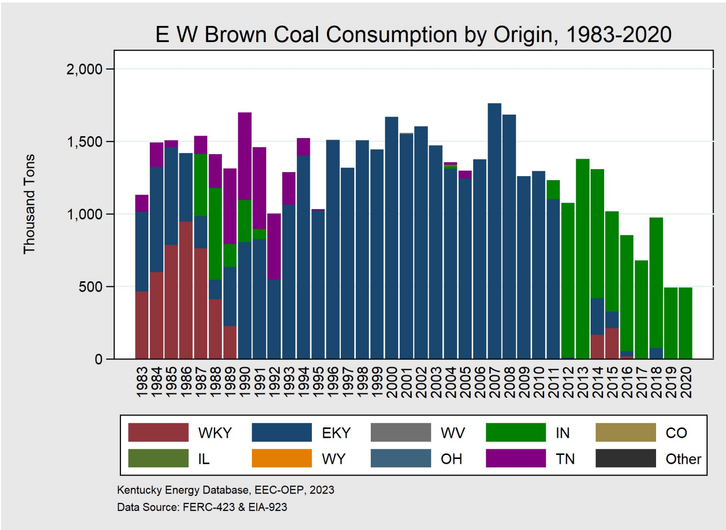


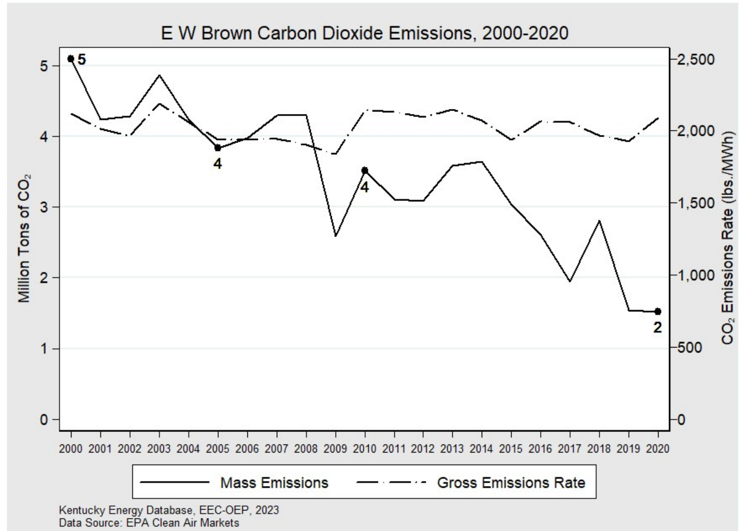
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1957**		**Coal & NG**	**1,420**	**8%**	**1,453**	**1,307**	**2,087**	**0.32**	**0.51**
1	1957	2019	Coal	106	-	-	-	-	-	-
2	1963	2019	Coal	166	-	-	-	-	-	-
3	1971		Coal	464	54%	1,246	1,307	2,203	0.37	0.45
5	2001		Natural Gas	123	2%	27		1,539	0.008	0.9
6	1999		Natural Gas	177	2%	74		1,263	0.006	0.5
7	1999		Natural Gas	177	3%	50		1,300	0.007	0.78
8	1995		Natural Gas	126	1%	11		1,513	0.02	1.43
9	1994		Natural Gas	126	1%	21		1,506	0.02	1.50
10	1995		Natural Gas	126	1%	16		1,761	0.45	1.76
11	1996		Natural Gas	126	1%	8		1,523	0.02	1.63

The E. W. Brown Generating Station, owned and operated by Kentucky Utilities Co., is located in Mercer County. The plant now consists of three coal-fired electricity generating units as well as seven natural gas combustion turbines used to meet peak demand. The plant is 66 years old, and the coal units came online in 1957, 1963, and 1971, respectively. Units 1 and 2 were retired in 2019; unit 3 has an operating capacity of 464 MW. In 2020, the plant generated 1.5 TWh of electricity and its coal-unit had a capacity factor of 54% while the average capacity factor for the natural gas units was 2%. The plant wide capacity factor was 8%.

*2020

E. W. Brown Generating Station

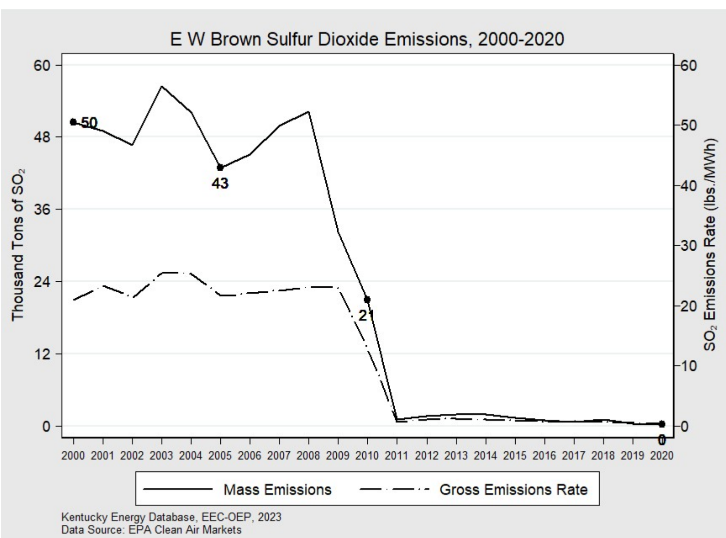


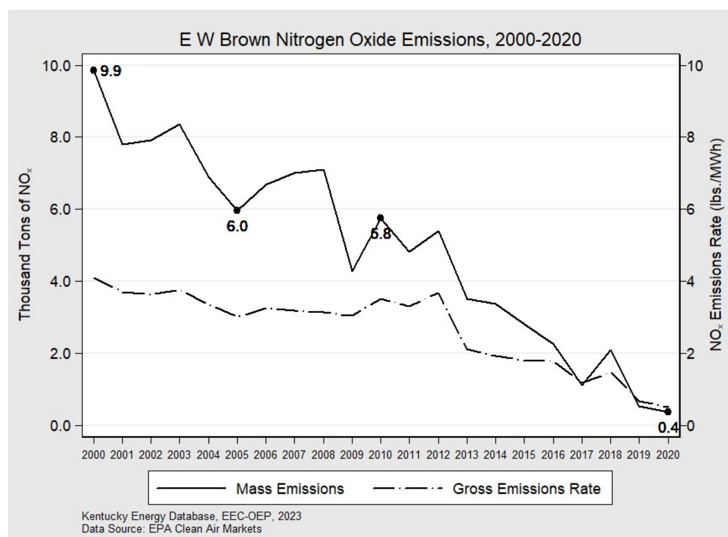


State	2020 Tons	Percentage
Total	492,787	100%
Indiana	492,787	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,516,835	-57%
Rate (lbs./MWh)	2,087	-3%

The E. W. Brown Generating Station emitted 1.5 million tons of CO_2 in 2020, a decrease of 57% since 2010. The rate of CO_2 emissions has remained relatively unchanged during that period and is the second highest of Kentucky coal plants.





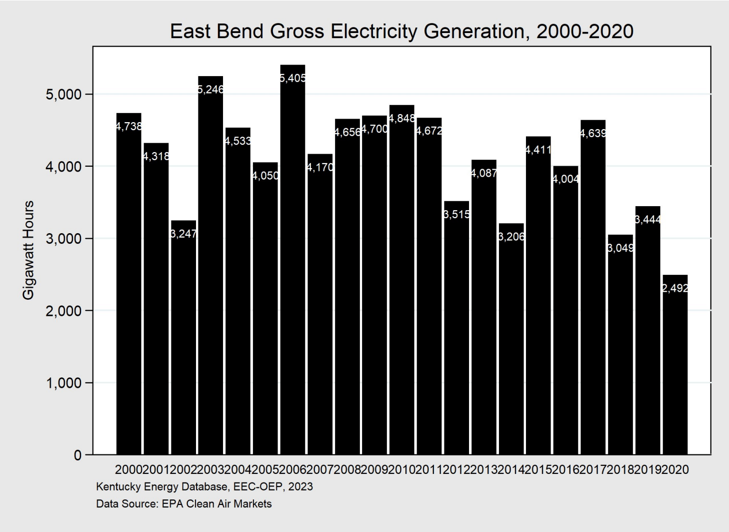
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	233	-99%
Rate (lbs./MWh)	0.32	-98%

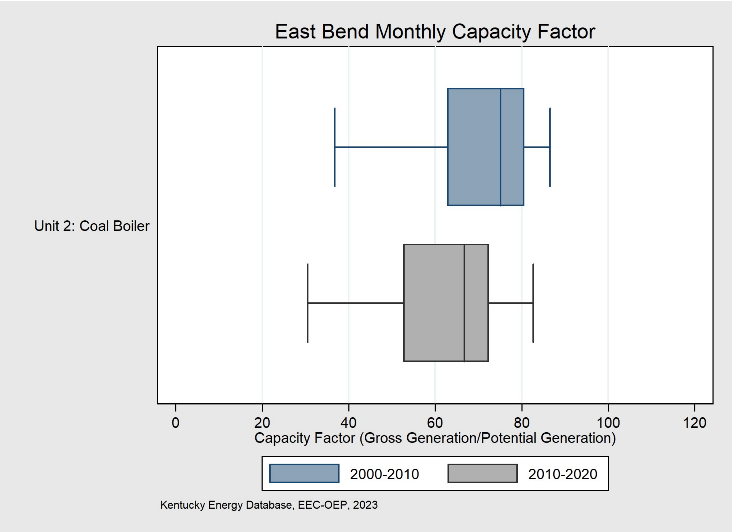
The E. W. Brown Generating Station emitted 465 tons of SO_2 in 2020, a decrease of 98% since 2010. The rate of SO_2 emissions decreased by 98% during that period.

Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	373	-94%
Rate (lbs./MWh)	0.51	-86%

The E. W. Brown Generating Station emitted 373 tons of NO_x in 2020, a reduction of 94% since 2010. The rate of NO_x emissions decreased by 86% during that period.

East Bend Generating Station



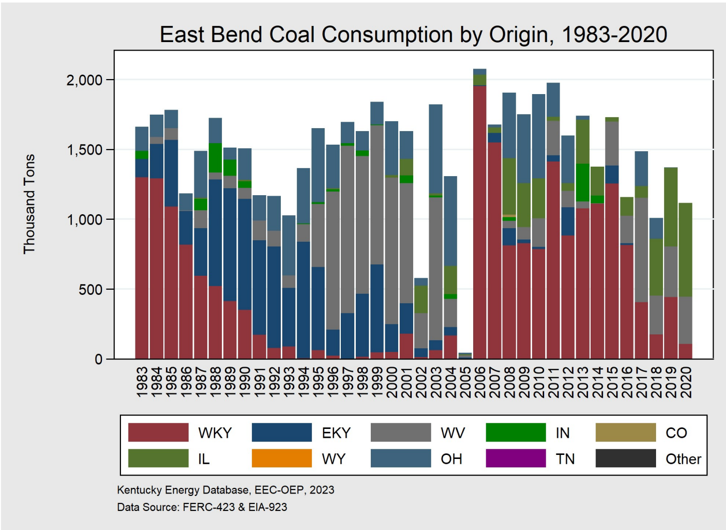


Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1981**		**Coal**	**600**	**70%**	**2,492**	**2,274**	**2,191**	**1.55**	**1.06**
2	1981		Coal	600	70%	2,492	2,274	2,191	1.55	1.06

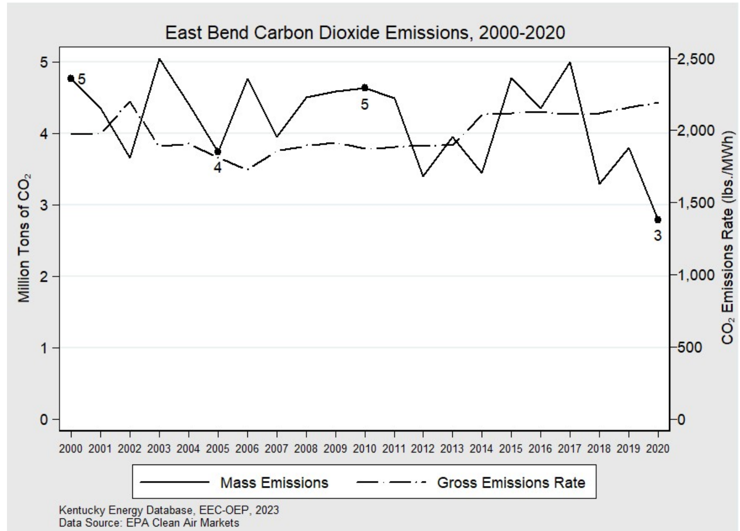
The East Bend Generating Station, located in Boone County, is 42 years old and consists of one coal-fired electricity generating unit. The unit came online in 1981 and has a nameplate capacity of 600 MW. The coal plant is owned by Duke Energy, but was originally constructed and owned jointly by Cincinnati Gas & Electric and Dayton Power & Light. In 2020, the plant generated 2.5 TWh of electricity and had a capacity factor of 70%. After the installation of sulfur dioxide scrubbers in 2005, East Bend began shifting its consumption of low-sulfur coal from West Virginia to that of western Kentucky, which has relatively higher sulfur content but a lower cost. In 2020, East Bend used a mix of coal from western Kentucky, Illinois, and West Virginia.

*2020

East Bend Generating Station

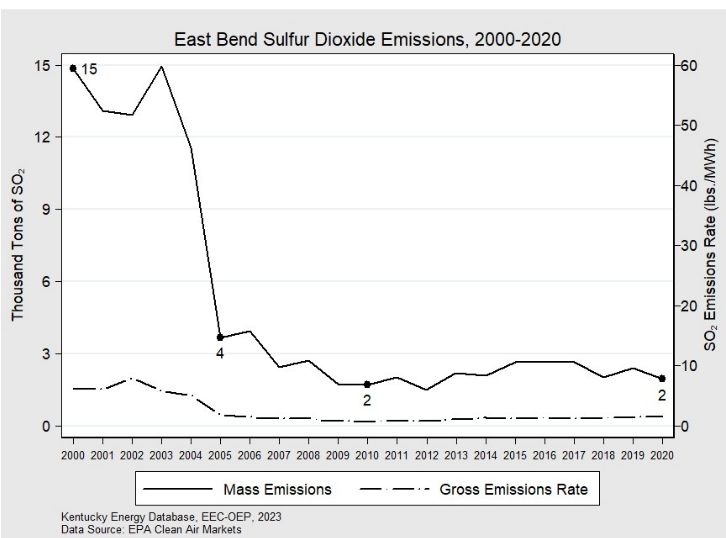


State	2020 Tons	Percentage
Total	1,115,715	100%
Western Kentucky	107,839	9.7%
Illinois	670,821	60.1%
West Virginia	337,055	30.2%



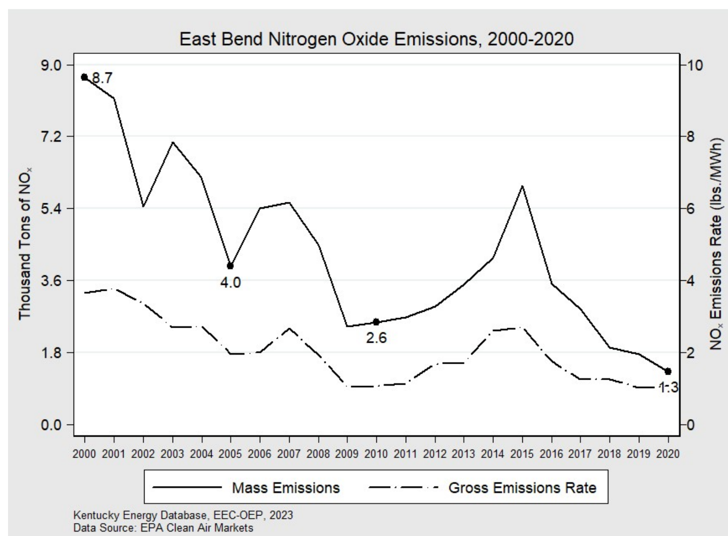
Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,730,063	+40%
Rate (lbs./MWh)	2,191	+17%

The East Bend Generating Station emitted 2.7 million tons of CO_2 in 2020, an increase of 40% from 2010 levels. The rate of CO_2 emissions increased by 17% during that period.



Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,932	+13%
Rate (lbs./MWh)	1.55	+118%

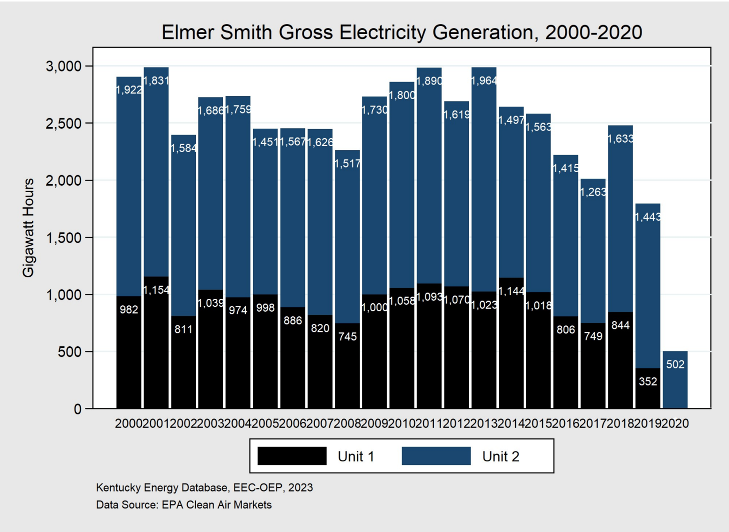
The East Bend Generating Station emitted 1,932 tons of SO_2 in 2020, an increase of 13% since 2010. The rate of SO_2 emissions increased by 118% during that period.

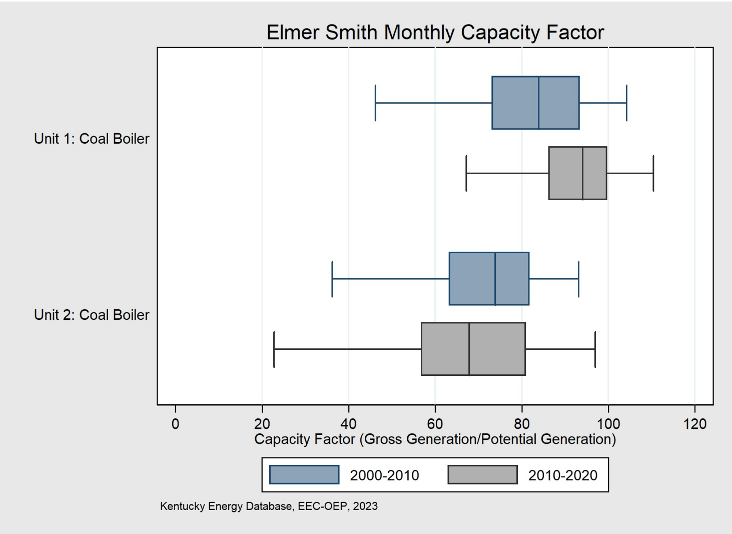


Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,320	-49%
Rate (lbs./MWh)	1.06	0%

The East Bend Generating Station emitted 1,320 tons of NO_x in 2020, a decrease of 49% since 2010. The rate of NO_x emissions returned to the same rate as 2010.

Elmer Smith Station



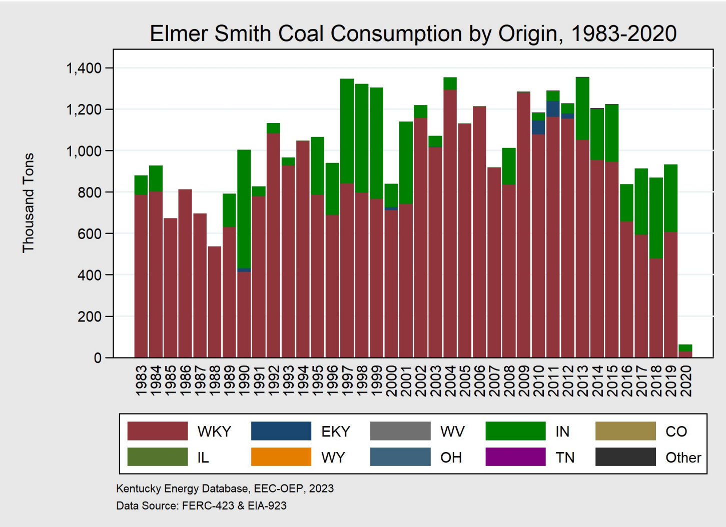


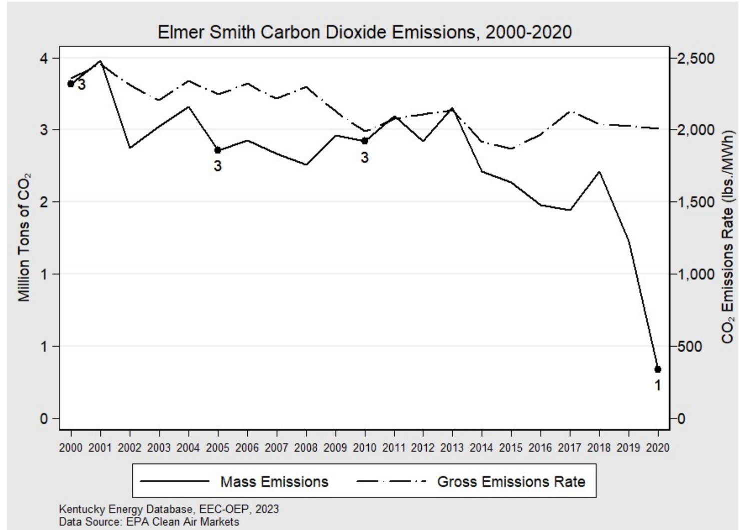
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1964**		**Coal**	**263**	**74%**	**502**	**451**	**2,010**	**2.34**	**2.83**
1	1964	2019	Coal	139	-	-	-	-	-	-
2	1974	2020	Coal	263	74%	502	451	2,010	2.34	2.83

Elmer Smith Station, located in Henderson County, is 59 years old and consists of two coal-fired electricity generating units, which began operating in 1964 and 1974, respectively. The plant has a total nameplate capacity of 401 MW. In 2020, the plant generated 502 GWh of electricity and had a plant-wide capacity factor of 74%. The coal used at Elmer Smith in 2020 was trucked from western Kentucky and Indiana. Both units have been retired, Unit 1 in 2019 and Unit 2 in 2020. Elmer Smith Station is owned and operated by Owensboro Municipal Utilities.

*2020

Elmer Smith Station

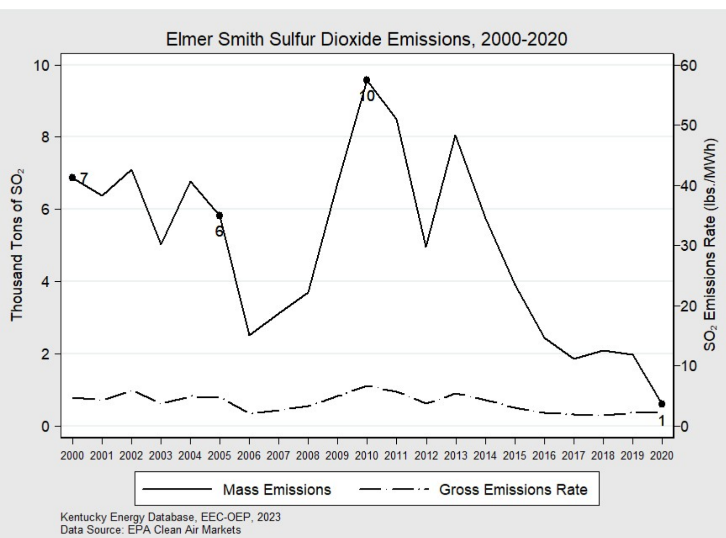


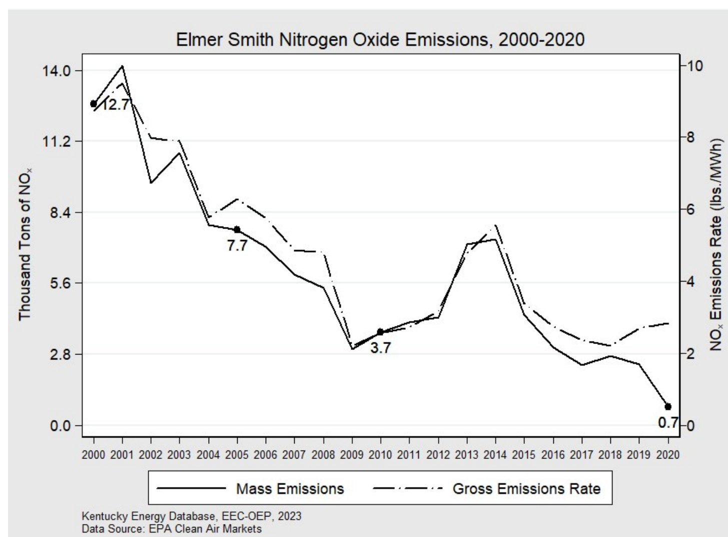


State	2020 Tons	Percentage
Total	63,120	100%
Western Kentucky	29,056	46%
Indiana	34,064	54%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	504,217	-82%
Rate (lbs./MWh)	2,010	+1%

Elmer Smith Station emitted 0.5 million tons of CO_2 in 2020, a decrease of 82% from 2010 levels. The rate of CO_2 emissions increased by 1% during that period.





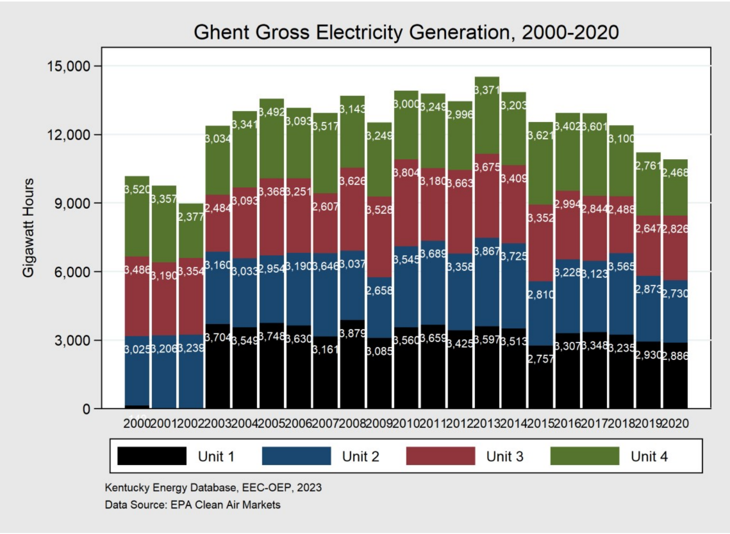
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	587	-94%
Rate (lbs./MWh)	2.34	-65%

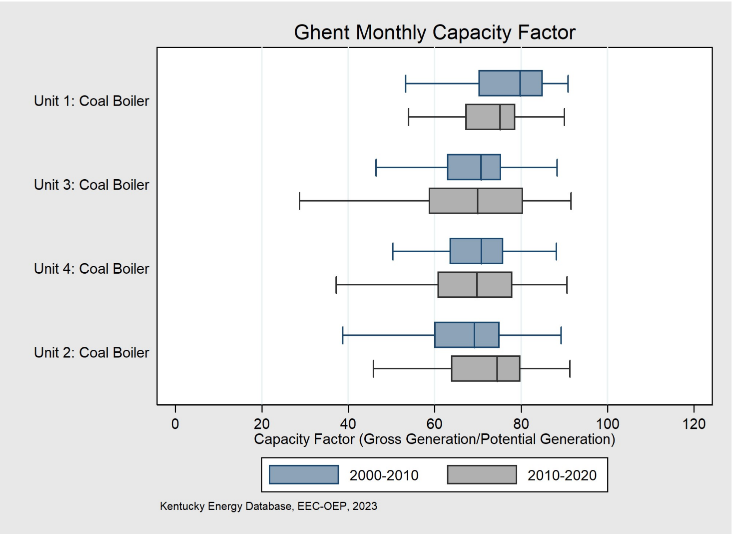
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	710	-81%
Rate (lbs./MWh)	2.83	-5%

Elmer Smith Station emitted 587 tons of SO_2 in 2020, a decrease of 94% since 2010. The rate of SO_2 emissions reduced by 65% during that period.

Elmer Smith Station emitted 710 tons of NO_x in 2020, a reduction of 81% since 2010. The rate of NO_x emissions decreased by 5% during the same period.

Ghent Generating Station



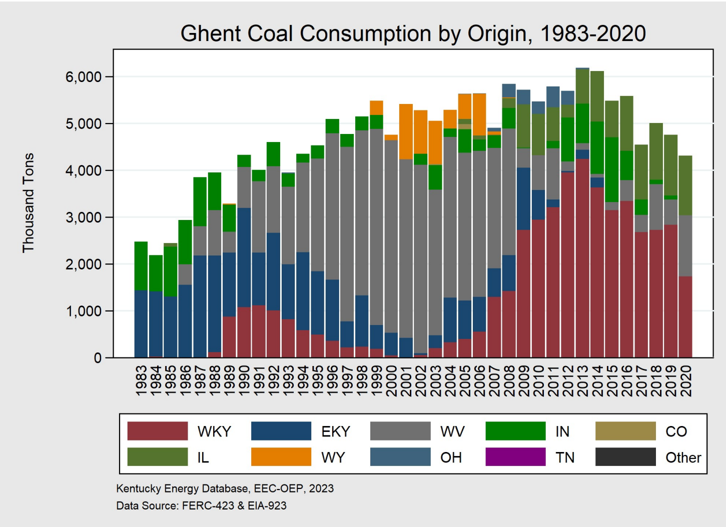


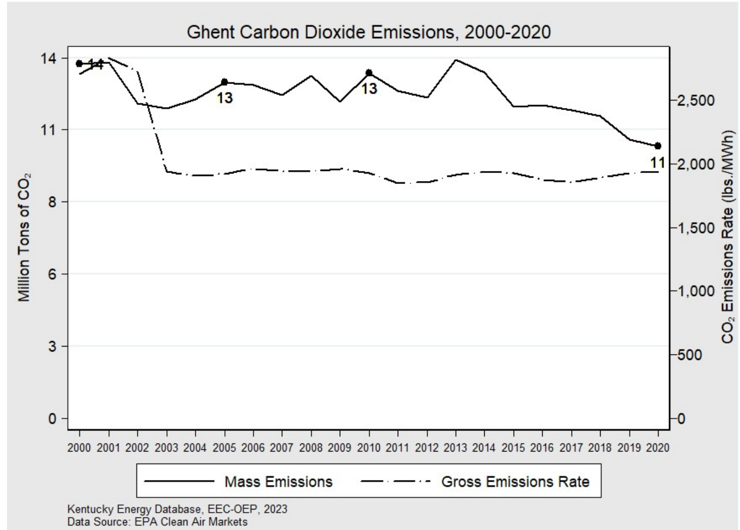
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1973**		**Coal**	**1,943**	**72%**	**10,910**	**9,910**	**1,933**	**1.57**	**0.98**
1	1974		Coal	479	75%	2,886	2,652	1,984	0.91	0.57
2	1977		Coal	495	70%	2,730	2,498	1,874	2.59	1.51
3	1981		Coal	489	71%	2,826	2,533	1,879	2.10	1.26
4	1984		Coal	469	70%	2,468	2,227	2,002	0.64	0.54

The Ghent Generating Station, located in Carroll County, began operation in 1973 and consists of four coal-fired electricity generating units. The units came online in 1974, 1977, 1981, and 1984, respectively. The plant is owned by Kentucky Utilities Co. and has a total nameplate capacity of 1,943 MW, making it the largest of Kentucky Utilities' electricity plants. In 2020, the plant had a plant-wide capacity factor of 72% and generated 10.9 TWh of electricity. All four units at Ghent underwent retrofits to control for sulfur dioxide emissions from 2007 to 2009. The majority of coal consumed by Ghent in 2018 was transported by river barge from western Kentucky, Illinois, and West Virginia. The plant burned smaller amounts of coal from Indiana, Illinois, West Virginia, and Perry County, in eastern Kentucky. This is a significant change from the 2000s, when it used mostly coal from West Virginia.

*2020

Ghent Generating Station

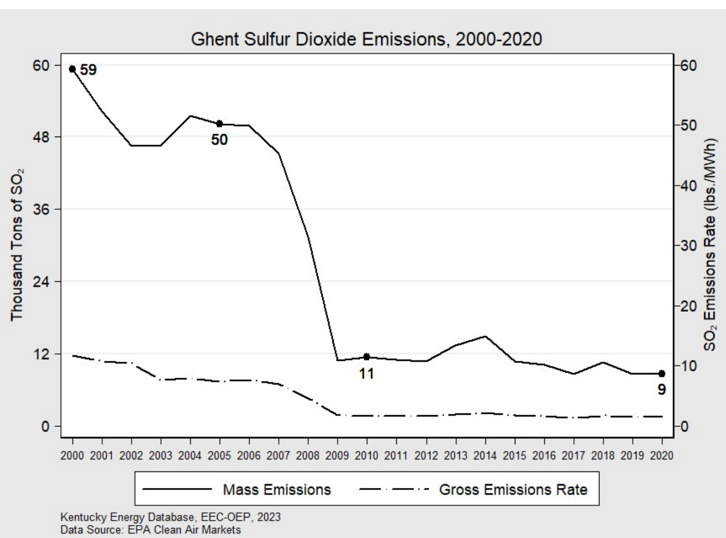


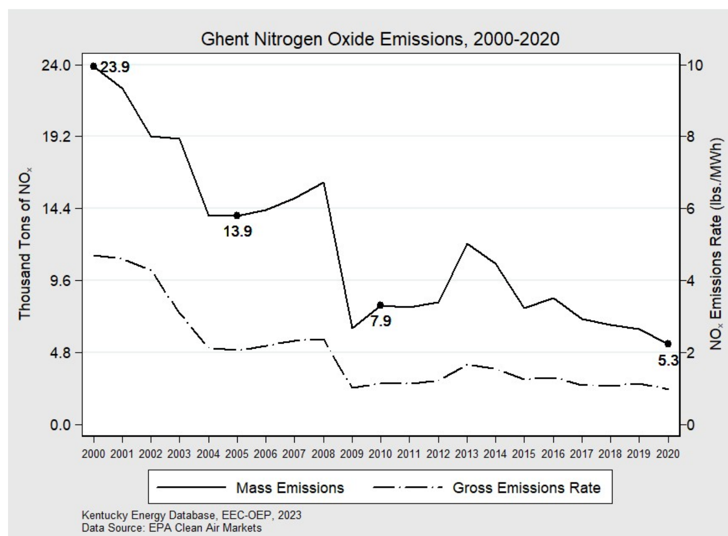


State	2020 Tons	Percentage
Total	4,313,047	100%
Western Kentucky	1,727,871	40.1%
Illinois	1,274,615	29.6%
West Virginia	1,310,561	30.3%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	10,547,019	-21%
Rate (lbs./MWh)	1,933	0%

The Ghent Generating Station emitted 11 million tons of CO_2 in 2020, a decrease of 21% from 2010 levels. The rate of CO_2 emissions has remained relatively constant during that time.





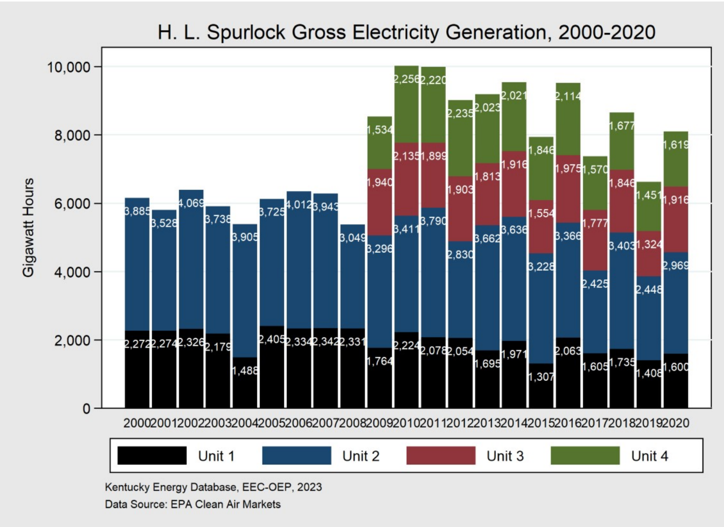
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	8,601	-24%
Rate (lbs./MWh)	1.57	-4%

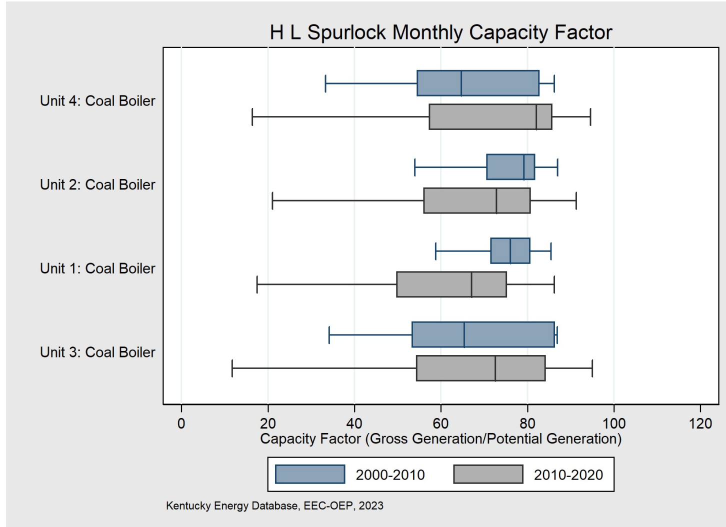
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	5,337	-33%
Rate (lbs./MWh)	0.98	-14%

The Ghent Generating Station emitted 8,601 tons of SO_2 in 2020, a decrease of 24% since 2010. The rate of SO_2 emissions decreased by 4% during that period.

The Ghent Generating Station emitted 5,337 tons of NO_x in 2020, a decrease of 33% since 2010. The rate of NO_x emissions decreased by 14% since 2010.

H. L. Spurlock Power Station



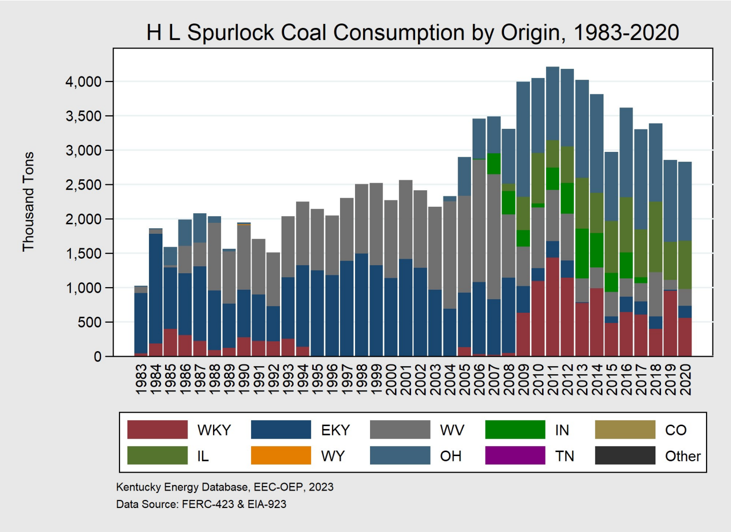


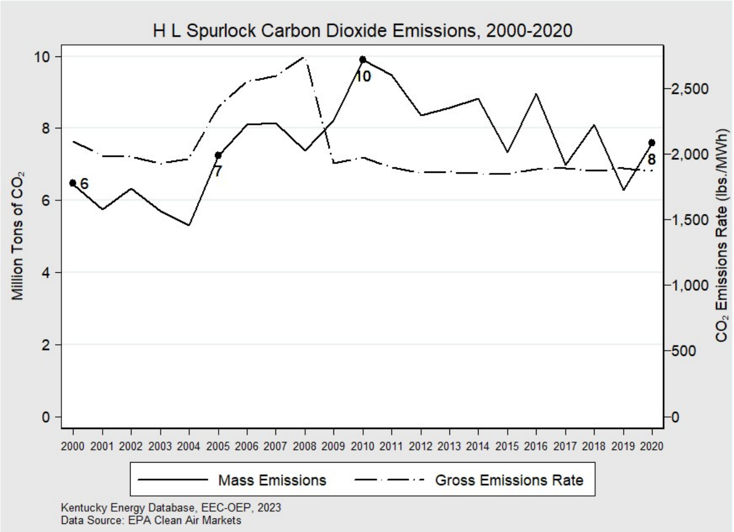
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1977**		**Coal**	**1,346**	**76%**	**8,104**	**7,294**	**1,869**	**0.95**	**0.71**
1	1977		Coal	300	74%	1,600	1,448	1,918	0.69	0.84
2	1981		Coal	510	77%	2,969	2,721	1,948	1.00	0.85
3	2005		Coal	268	71%	1,916	1,701	1,808	1.19	0.56
4	2008		Coal	268	82%	1,619	1,424	1,752	0.81	0.52

The H. L. Spurlock Power Station, located in Mason County, is 46 years old and consists of four coal-fired electricity generating units. The units came online in 1977, 1981, 2005, and 2009, respectively. Spurlock has a total nameplate capacity of 1,346 MW. In 2020, the plant generated 8.1 TWh of electricity and had a plant-wide capacity factor of 76%. To lower sulfur dioxide emissions, desulfurization scrubbers were installed on Unit 3 in 2004, on Unit 2 in 2008, and on Units 1 and 4 in 2009. Spurlock used a mix of coal from Ohio and Union counties in western Kentucky, and from the states of Illinois, Eastern Kentucky and West Virginia in 2020. From the 1990s through the mid-2000s, Spurlock used a mix of mostly eastern Kentucky and West Virginia coal. Spurlock Power Station is owned and operated by East Kentucky Power Cooperative.

*2020

H. L. Spurlock Power Station

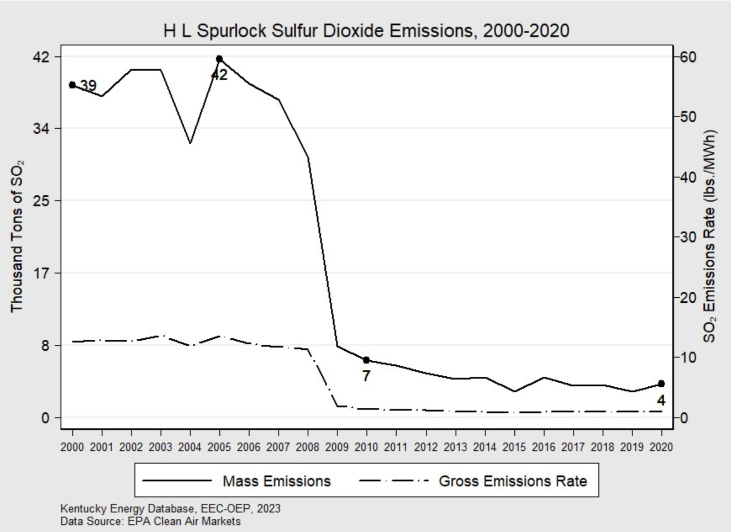


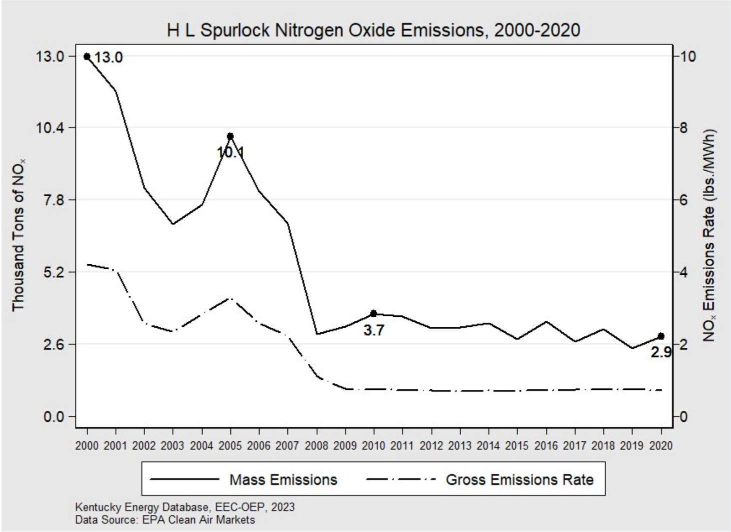


State	2020 Tons	Percentage
Total	2,829,772	100%
Ohio	1,149,563	40.5%
Western Kentucky	558,970	19.8%
Illinois	703,878	24.9%
Eastern Kentucky	171,475	6.1%
West Virginia	245,886	8.7%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	7,577,185	-23%
Rate (lbs./MWh)	1,869	-5%

The H. L. Spurlock Power Station emitted 7.6 million tons of CO_2 in 2020, a decrease of 23% from 2010 levels. The rate of CO_2 emissions decreased by 5% during that period.





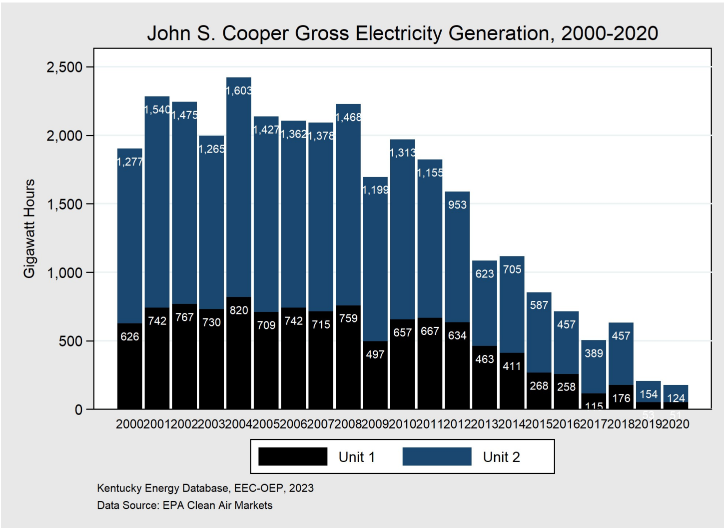
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	3,831	-42%
Rate (lbs./MWh)	0.95	-28%

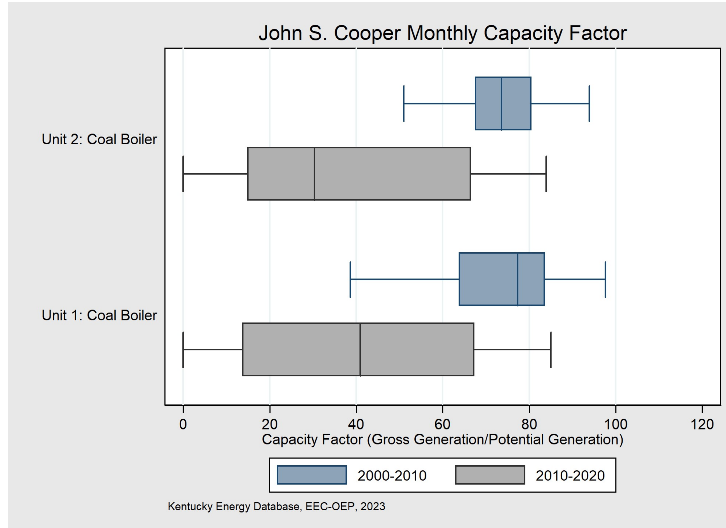
The H. L. Spurlock Power Station emitted 3,831 tons of SO_2 in 2020, a decrease of 42% since 2010. The rate of SO_2 emissions reduced by 28% during that period.

Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,884	-22%
Rate (lbs./MWh)	0.71	-3%

The H. L. Spurlock Power Station emitted 2,884 tons of NO_x in 2020, a decrease of 22% since 2010. The rate of NO_x emissions decreased by 3% during that period.

John S. Cooper Power Station



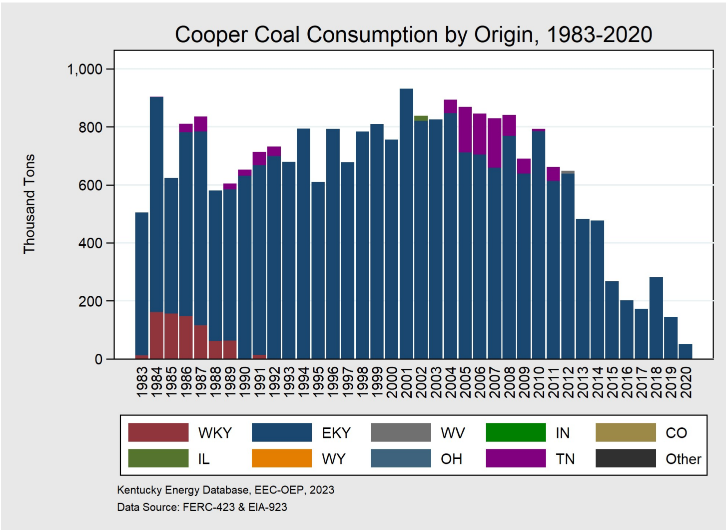


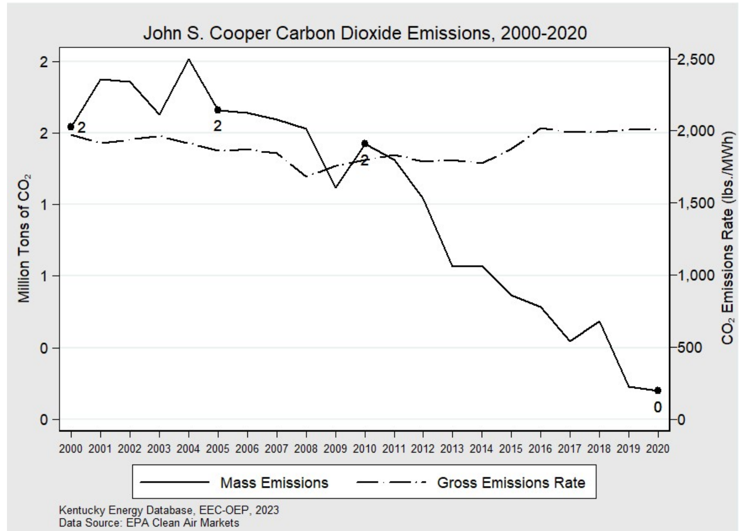
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1965**		**Coal**	**341**	**36%**	**175**	**142**	**2,009**	**0.53**	**1.36**
1	1965		Coal	116	42%	51	41	2,036	0.96	1.95
2	1969		Coal	225	31%	124	101	1,998	0.36	1.12

The John Sherman Cooper Power Station, located in Pulaski County, is 58 years old and consists of two coal-fired electricity generating units. The units came online in 1965 and 1969, respectively. The plant has a total nameplate capacity of 341 MW. In 2020, the plant generated 175 GWh of electricity and had a plant-wide capacity factor of 36%. A scrubber was installed on Unit 2 in 2012 to lower sulfur dioxide emissions and a baghouse. Cooper sourced all of its coal from eastern Kentucky in 2020. John S. Cooper Power Station is owned and operated by East Kentucky Power Cooperative.

*2020

John S. Cooper Power Station

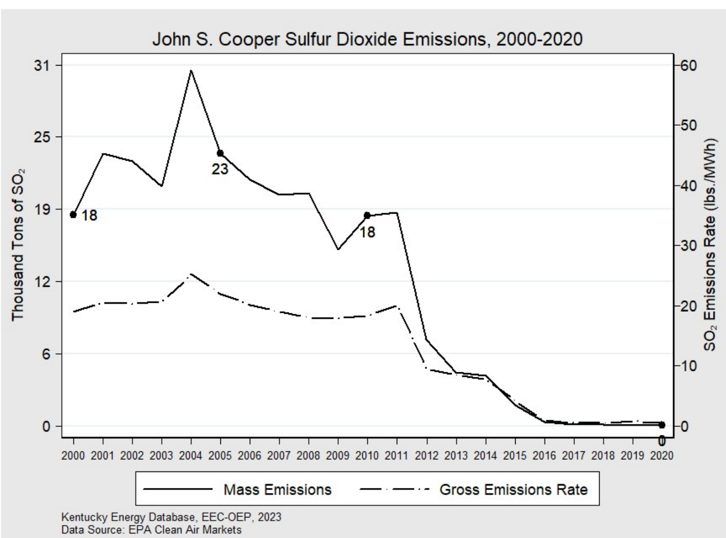


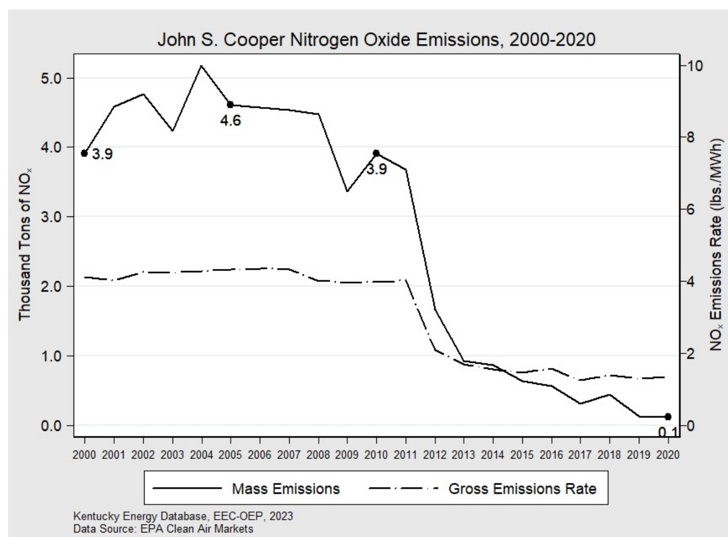


State	2020 Tons	Percentage
Total	51,772	100%
Eastern Kentucky	51,772	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	176,679	-90%
Rate (lbs./MWh)	2,009	+12%

The John S. Cooper Power Station emitted 177 thousand tons of CO_2 in 2020, a decrease of 90% from 2010 levels. The rate of CO_2 emissions increased by 12% during that period.





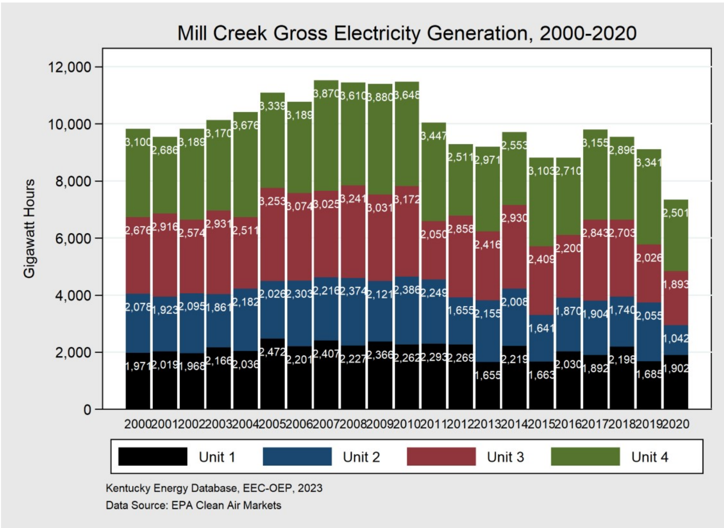
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	47	-99%
Rate (lbs./MWh)	0.53	-97%

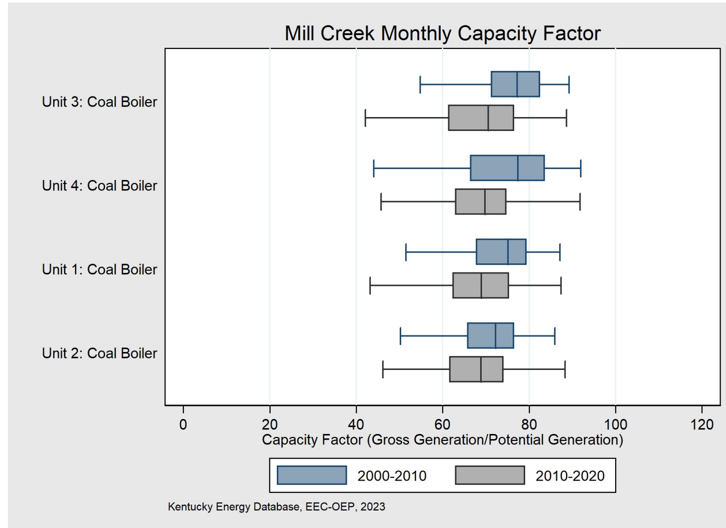
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	120	-97%
Rate (lbs./MWh)	1.36	-66%

The John S. Cooper Power Station emitted 47 tons of SO_2 in 2020, a decrease of 99% since 2010. The rate of SO_2 emissions reduced by 97% during that period.

The John S. Cooper Power Station emitted 120 tons of NO_x in 2020, a reduction of 97% since 2010. The rate of NO_x emissions decreased by 66% during that period.

Mill Creek Generating Station



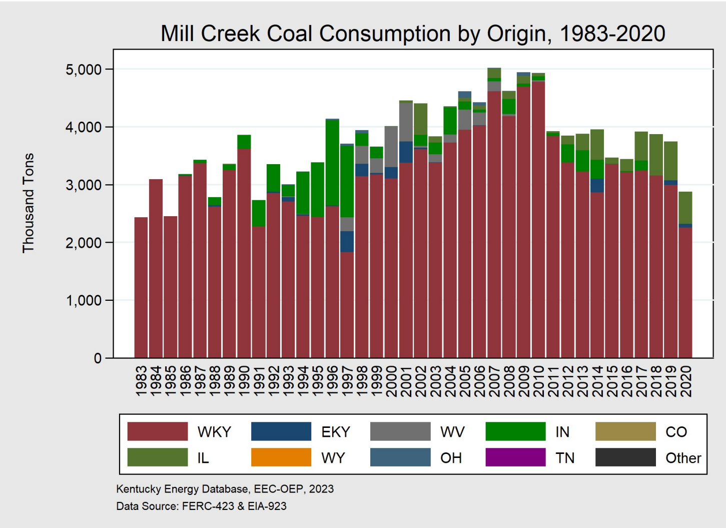


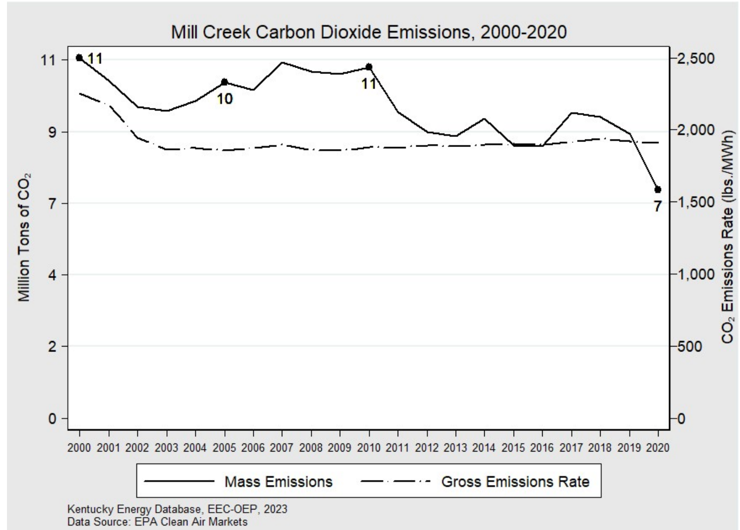
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1972**		**Coal**	**1,477**	**72%**	**7,338**	**8,640**	**1,906**	**0.79**	**1.43**
1	1972		Coal	300	71%	1,902	1,691	1,810	0.61	2.46
2	1974		Coal	297	69%	1,042	9,21	1,806	0.73	2.58
3	1978		Coal	391	74%	1,893	1,731	1,975	0.50	0.74
4	1982		Coal	477	72%	2,501	2,305	1,970	1.16	0.70

The Mill Creek Generating Station, located in Jefferson County, is 51 years old and consists of four coal-fired electricity generating units. The units came online in 1972, 1974, 1978, and 1982, respectively and are owned by Louisville Gas & Electric. The plant has a total nameplate capacity of 1,477 MW and is the third-largest power plant in Kentucky by capacity. In 2020, Mill Creek had a plant-wide capacity factor of 72% and generated 7.3 TWh of electricity. The majority of Mill Creek's coal came from western Kentucky in 2020.

*2020

Mill Creek Generating Station

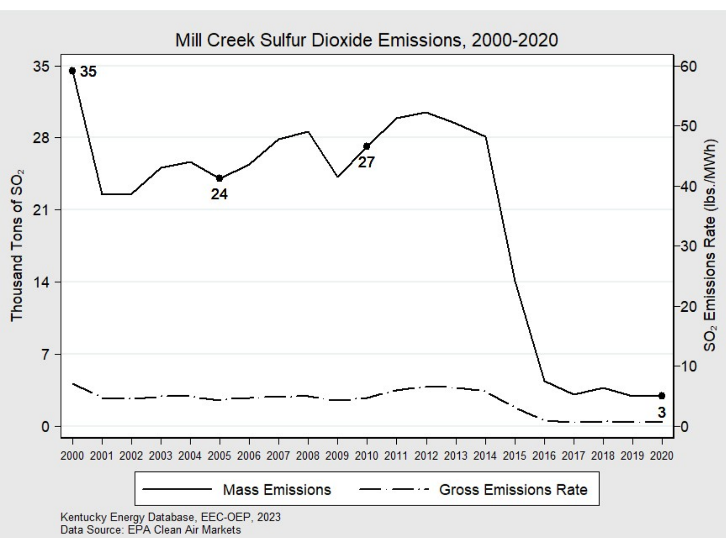


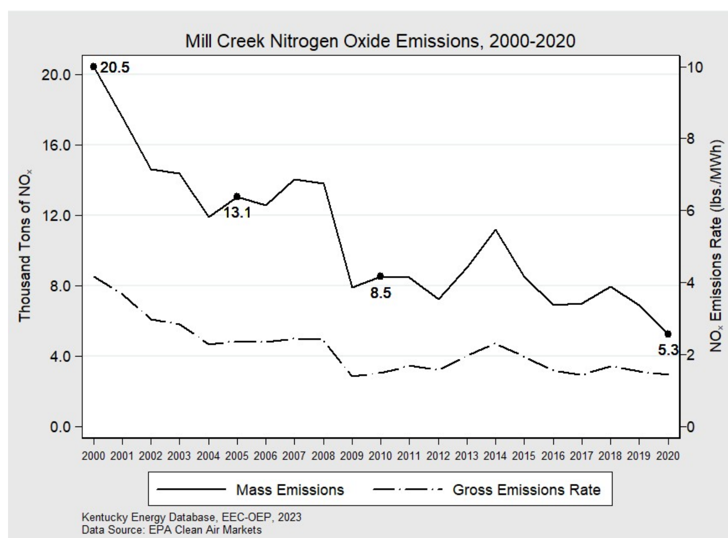


State	2020 Tons	Percentage
Total	2,875,945	100%
Western Kentucky	2,257,435	78.5%
Illinois	555,240	19.3%
Eastern Kentucky	63,270	2.2%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	6,995,651	-35%
Rate (lbs./MWh)	1,906	+2%

The Mill Creek Generating Station emitted 7 million tons of CO_2 in 2020, a decrease of 35% from 2010 levels. The rate of CO_2 emissions increased by 2% during that period.





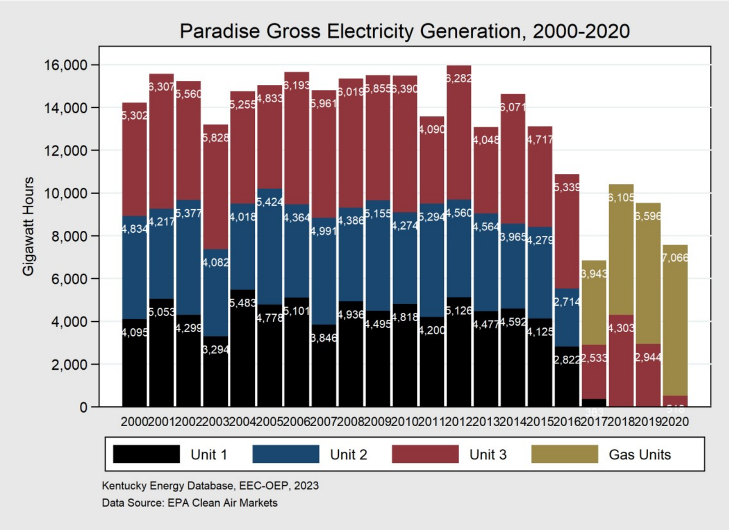
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,889	-89%
Rate (lbs./MWh)	0.79	-83%

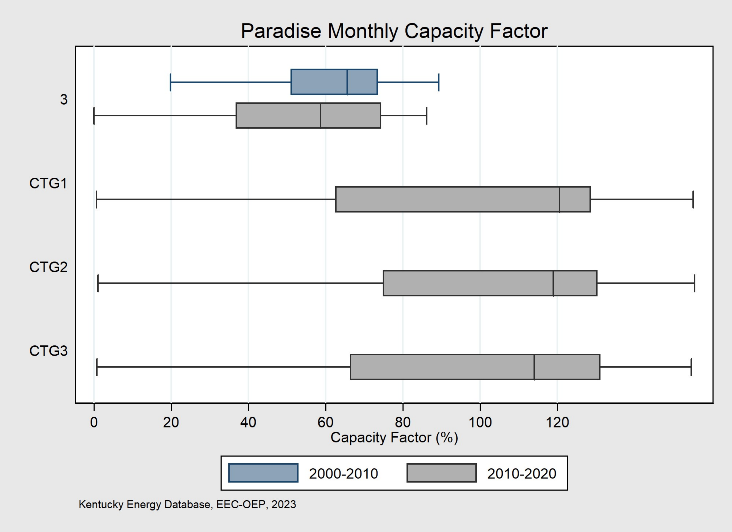
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	5,253	-38%
Rate (lbs./MWh)	1.43	-3.4%

The Mill Creek Generating Station emitted 2,889 tons of SO_2 in 2020, a decrease of 89% since 2010. The rate of SO_2 emissions reduced by 83% during that period.

The Mill Creek Generating Station emitted 5,253 tons of NO_x in 2020, a reduction of 38% since 2010. The rate of NO_x emissions decreased by 3.4% during that period.

Paradise Fossil Plant



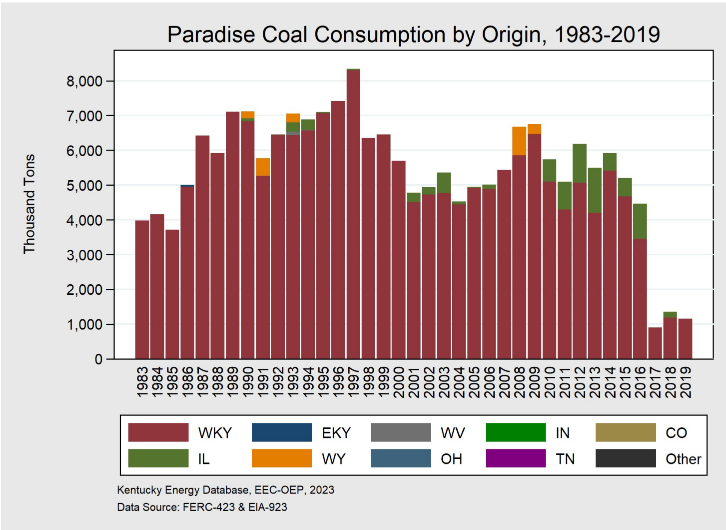


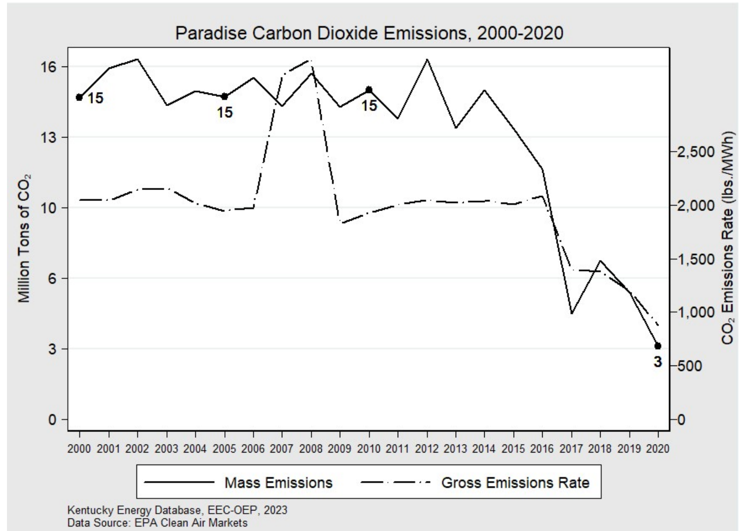
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1963**		**Coal**	**1,160**	**105%**	**7,584**	**7,365**	**875**	**0.1**	**0.4**
1	1963	2017	Coal	628	-	-	-	-	-	-
2	1963	2017	Coal	602	-	-	-	-	-	-
3	1970	2020	Coal	971	36%	518	457	2,013	1.47	3.27
CTG1	2017		Natural Gas	211	120%	2,343	1,474	792	0.004	0.20
CTG2	2017		Natural Gas	211	119%	2,343	1,359	788	0.004	0.18
CTG3	2017		Natural Gas	211	114%	2,380	1,494	791	0.004	0.19
STG1	2017		Natural Gas	467	-	-	2,581	-	-	-

The Paradise Fossil Plant, located in Muhlenberg County on the former site of Paradise, Kentucky, is 60 years old and consisted of three coal-fired electricity generating units. The plant is owned by the Tennessee Valley Authority and its units came online in 1963, 1963, and 1970, respectively. The plant has a total nameplate capacity of 1,160 MW. Units 1 and 2 at Paradise were retired in 2017 and unit 3 was retired in 2020. In 2017, three natural gas combined cycle combustion turbine units and one combined cycle combustion steam unit began operating.

*2020

Paradise Fossil Plant

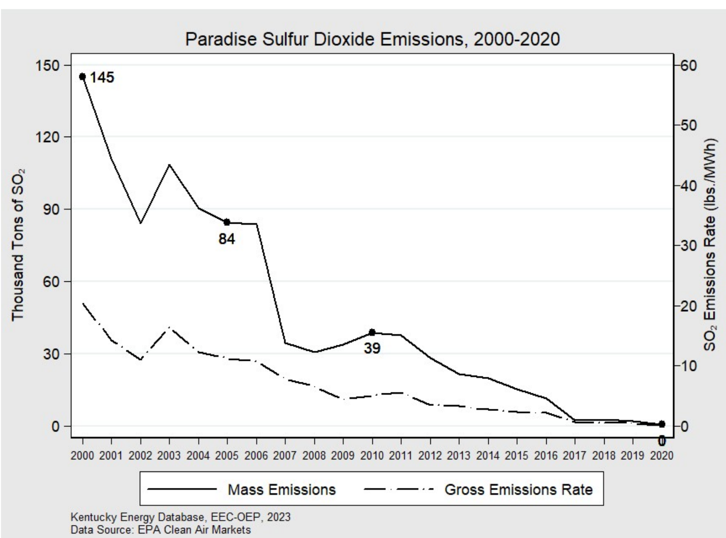


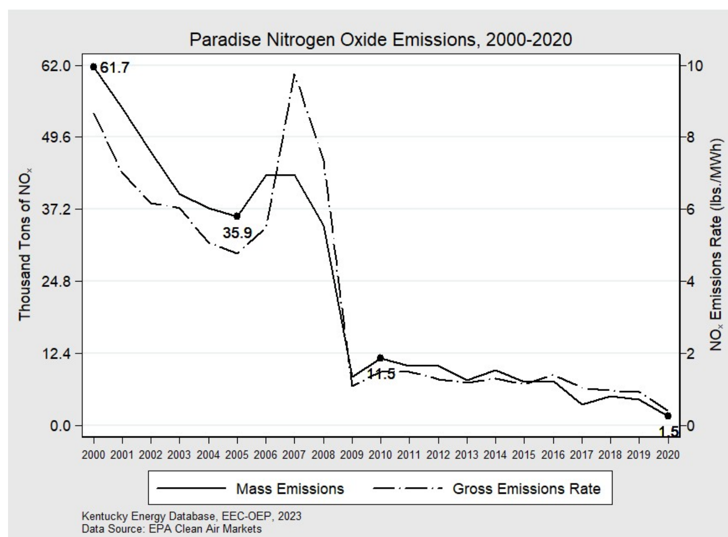


State	2019 Tons	Percentage
Total	1,158,863	100%
Western Kentucky	1,158,863	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	3,316,502	-78%
Rate (lbs./MWh)	875	-55%

The Paradise Fossil Plant emitted 3.3 million tons of CO_2 in 2020, a decrease of 78% from 2010 levels. The rate of CO_2 emissions decreased 55% from the year 2010.





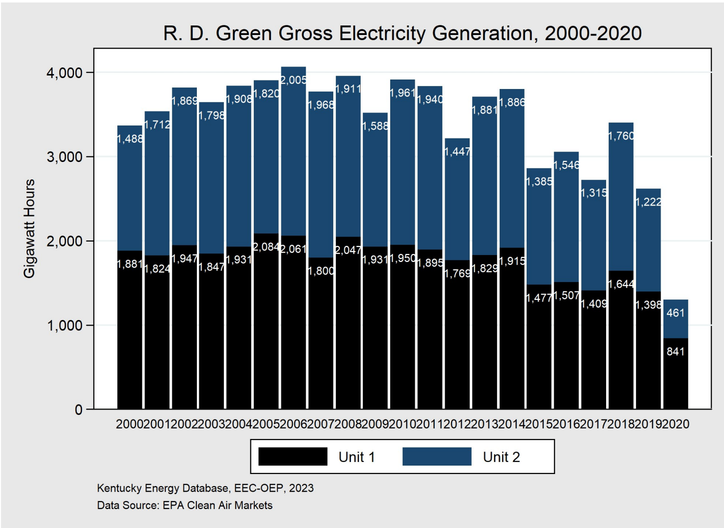
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	395	-99%
Rate (lbs./MWh)	0.1	-98%

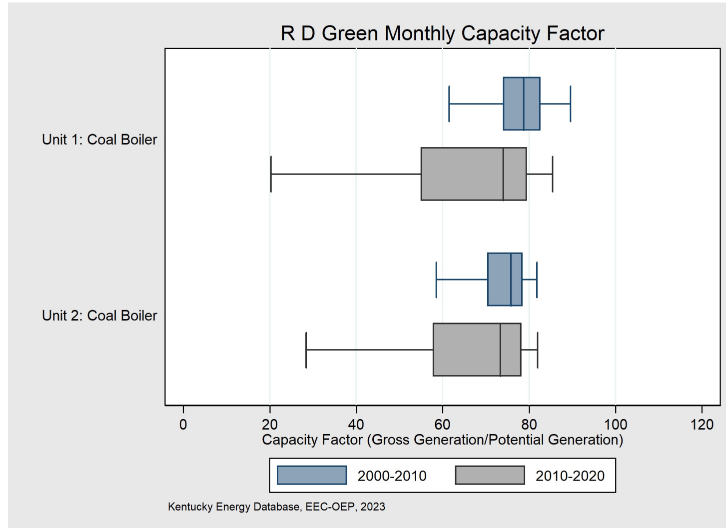
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,526	-87%
Rate (lbs./MWh)	0.4	-73%

The Paradise Fossil Plant emitted 395 tons of SO_2 in 2020, a decrease of 99% since 2010. The rate of SO_2 emissions reduced by 98% during that period.

The Paradise Fossil Plant emitted 1,526 tons of NO_x in 2020, a reduction of 87% since 2010. The rate of NO_x emissions decreased by 73% during that period.

R. D. Green Station



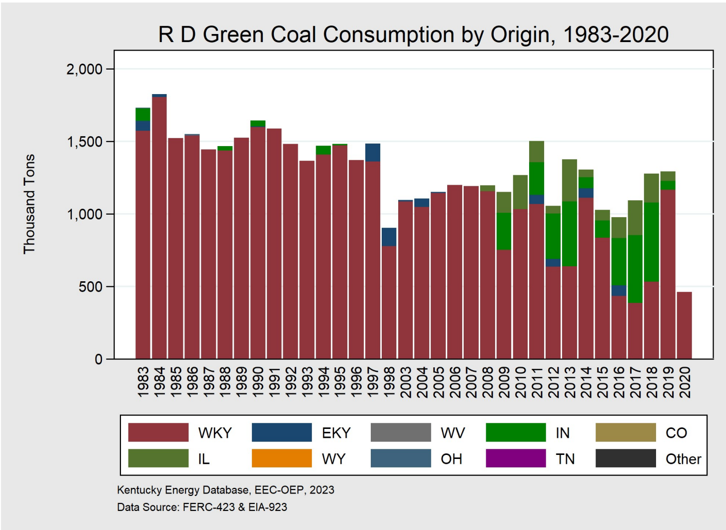


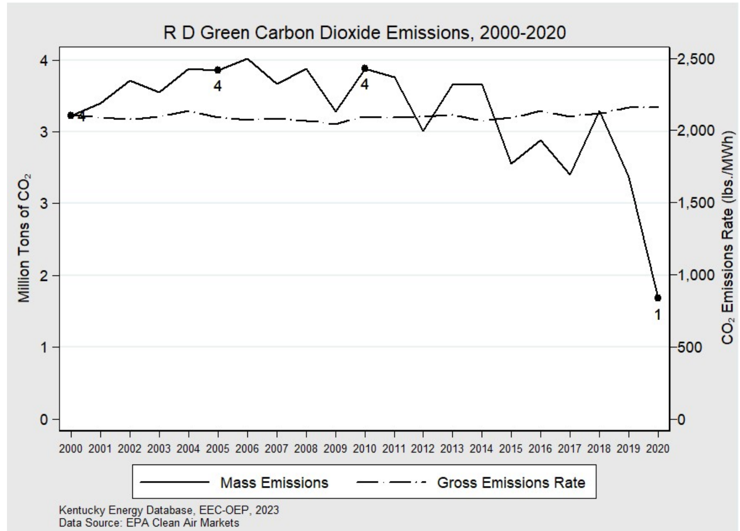
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1979**		**Coal**	**586**	**75%**	**1,302**	**1,113**	**2,162**	**3.34**	**2.36**
1	1979		Coal	293	76%	841	719	2,158	3.18	2.01
2	1981		Coal	293	73%	461	394	2,170	3.63	3.01

The R. D. Green Station, located in Webster County, is 44 years old and consists of two coal-fired electricity generating units. The units came online in 1979 and 1981, respectively. The plant is owned by Big Rivers Electric Corporation and has a total nameplate capacity of 586 MW. In 2020, the plant generated 1.3 TWh of electricity and had a plant-wide capacity factor of 75%. All of the plant's coal came from western Kentucky in 2020.

*2020

R. D. Green Station

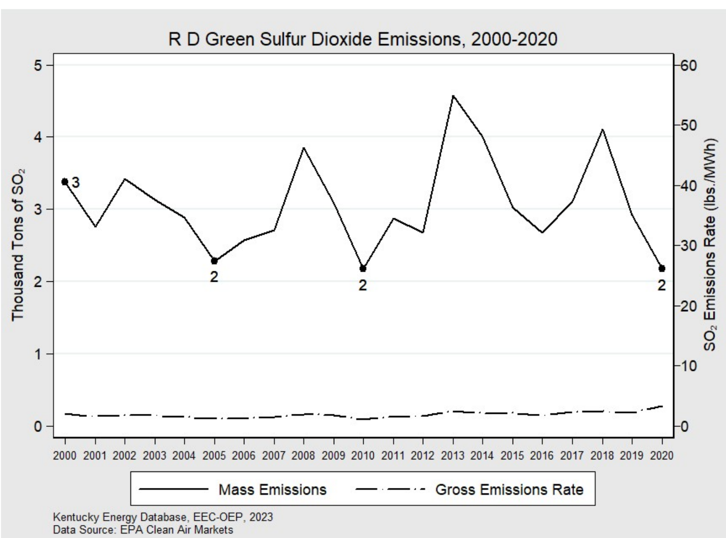


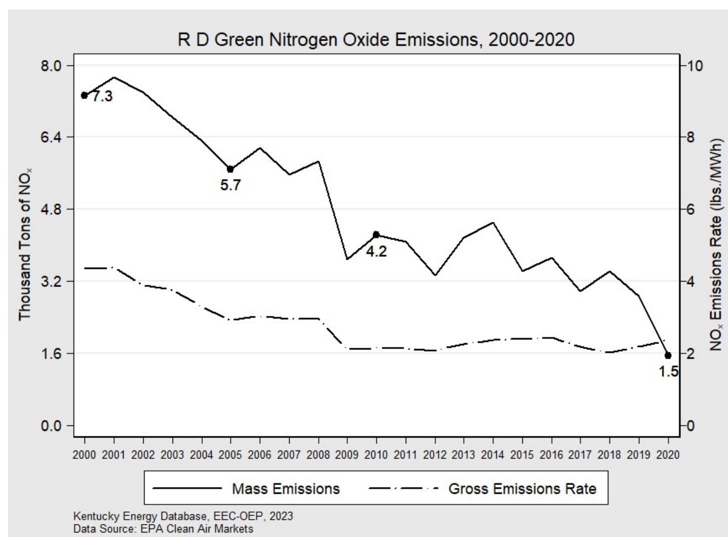


State	2020 Tons	Percentage
Total	460,383	100%
Western Kentucky	460,383	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,407,377	-66%
Rate (lbs./MWh)	2,162	+3%

The R.D. Green Station emitted 1.4 million tons of CO_2 in 2020, a decrease of 66% from 2010 levels. The rate of CO_2 emissions increased 3% during that period.





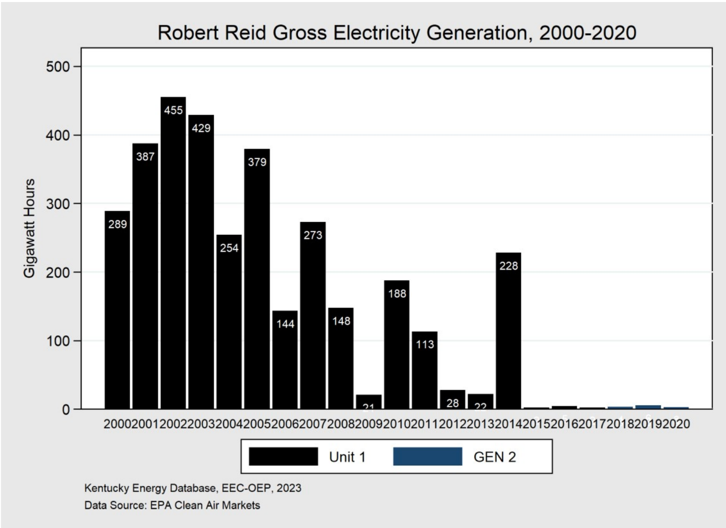
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,173	+0.3%
Rate (lbs./MWh)	3.34	+201%

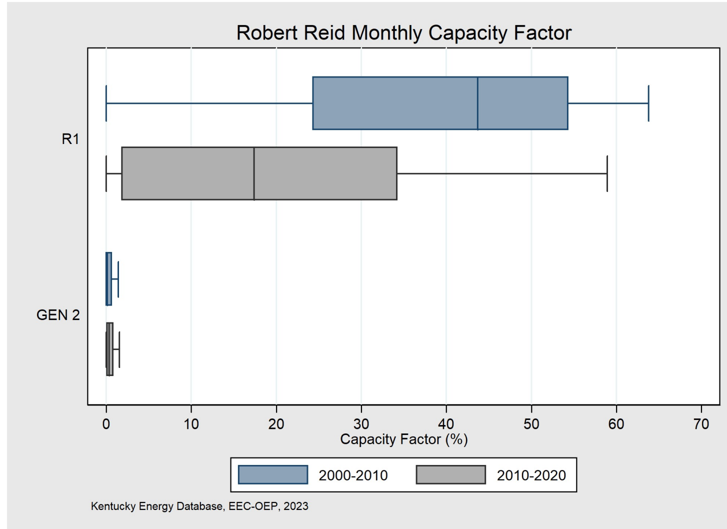
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1,539	-64%
Rate (lbs./MWh)	2.36	+9.3%

The R.D. Green Station emitted 2,173 tons of SO_2 in 2020, an increase of 0.3% since 2010. The rate of SO_2 emissions increased by 201% during that period.

The R.D. Green Station emitted 1,539 tons of NO_x in 2020, a reduction of 64% since 2010. The rate of NO_x emissions increased by 9% during that period.

Robert Reid Power Plant



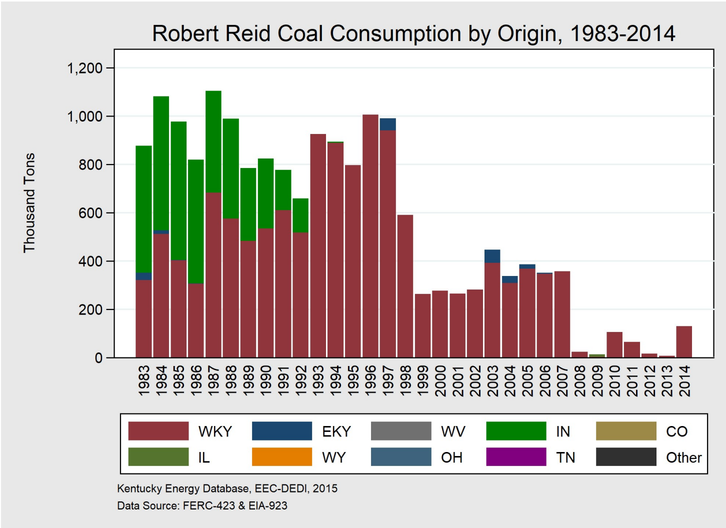


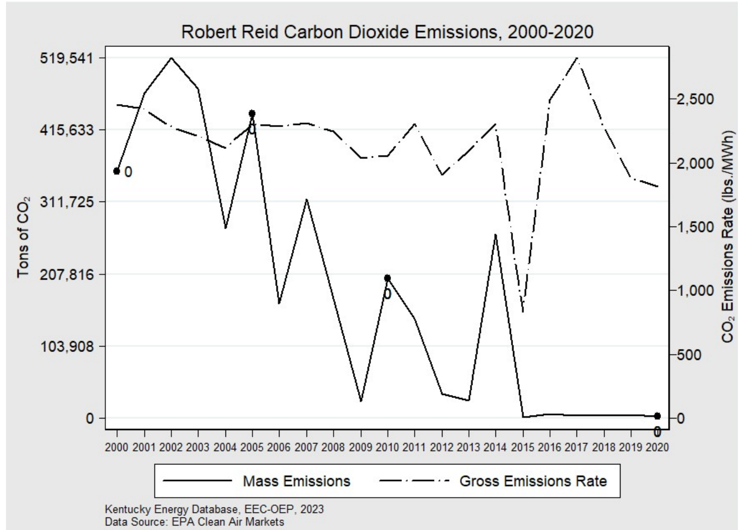
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation*	Net Generation*	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1966**	**2017**	**Coal**	**99**	**.27%**	**3.1**	**2.8**	**2,327**	**50.37**	**4.72**
1	1966	2017	Coal	-	-	-	-	-	-	-
GEN 2	2017		Natural Gas	99	.27%	3.1	2.8	1,817	0.06	11.25

The Robert Reid Power Plant, located in Webster County, is 57 years old and consisted of one coal-fired electricity generating unit up until 2017 when it was converted to a gas turbine natural gas unit . The plant has a nameplate capacity of 99 MW, and is the original generating unit for Big Rivers Electricity Corporation. In 2020, the plant generated 3.1 GWh of electricity, down from around 188 GWh in 2010. This decline in generation is consistent with announced retirement of the coal unit in 2017. Robert Reid's plant-wide capacity in 2020 was only .27%.

*2020

Robert Reid Power Plant

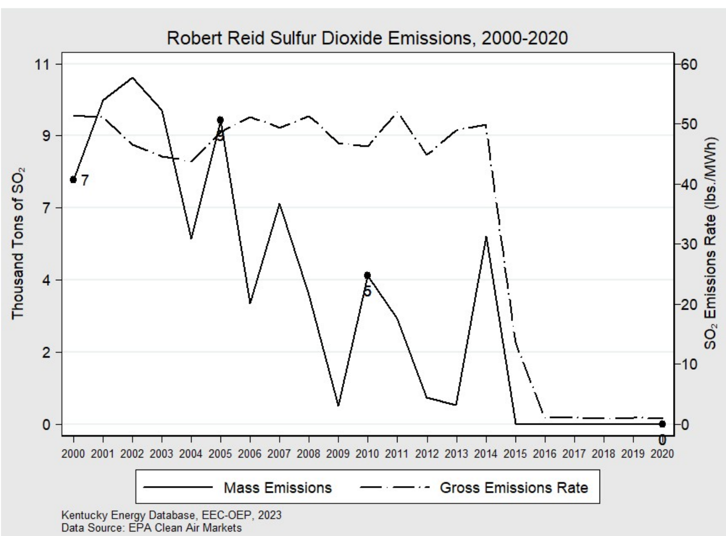


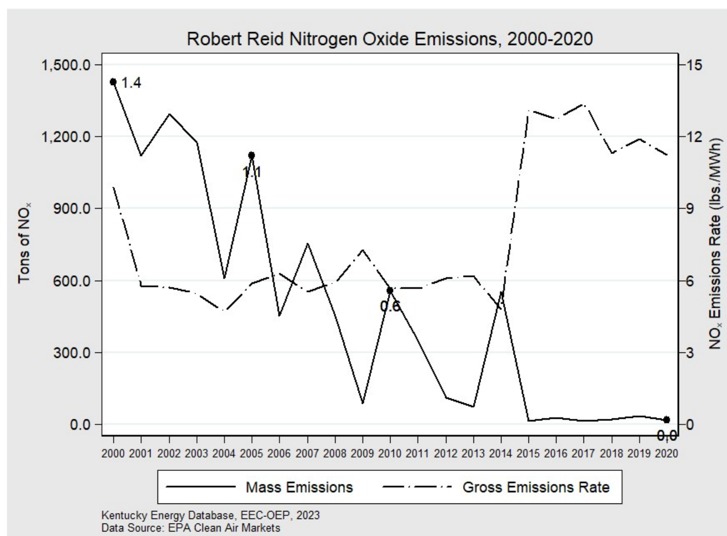


State	2014 Tons	Percentage
Total	12,643	100%
Illinois	9,664	76%
Western Kentucky	2,979	24%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,831	-99%
Rate (lbs./MWh)	1,817	-12%

The Robert Reid Power Plant emitted almost 3 thousand tons of CO_2 in 2020, a decrease of 99% from 2010 levels. The rate of CO_2 emissions decreased by 12% during that period, but remains the highest of operating Kentucky power plants.





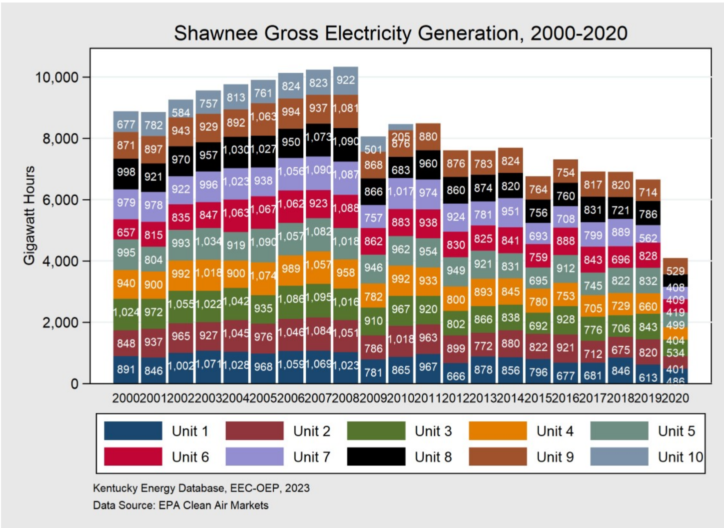
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	1	-99%
Rate (lbs./MWh)	0.06	-99%

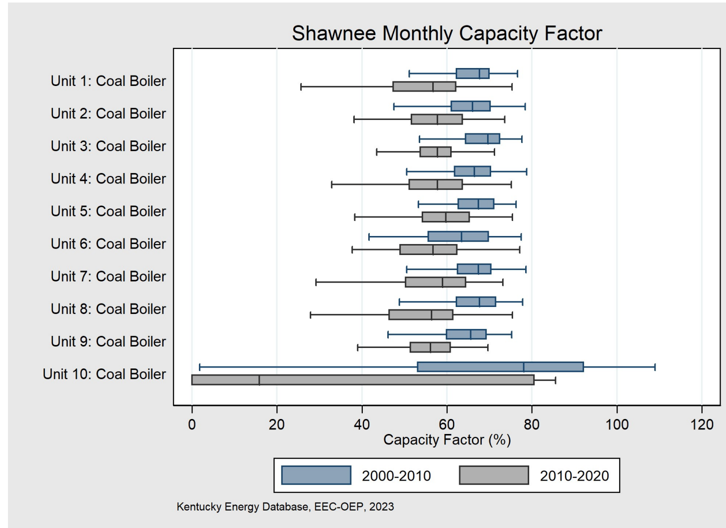
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	16	-97%
Rate (lbs./MWh)	11.25	+98%

The Robert Reid Power Plant emitted 1 tons of SO_2 in 2020, a decrease of 99% since 2010. The rate of SO_2 emissions reduced by 99% as well during that period.

The Robert Reid Power Plant emitted 16 tons of NO_x in 2020, a reduction of 97% since 2010. The rate of NO_x emissions increased by 98% during that period.

Shawnee Fossil Plant





Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1953**		**Coal**	**1,206**	**61%**	**4,089**	**3,660**	**2,302**	**4.41**	**2.25**
1	1953		Coal	134	61%	486	434	2,272	3.52	1.86
2	1956		Coal	134	63%	401	352	2,274	3.61	1.86
3	1953		Coal	134	62%	534	483	2,277	3.65	1.97
4	1953		Coal	134	62%	404	363	2,268	3.48	1.79
5	1954		Coal	134	64%	499	445	2,297	3.92	2.18
6	1954		Coal	134	58%	419	375	2,341	5.49	2.69
7	1954		Coal	134	63%	409	364	2,333	5.40	2.67
8	1954		Coal	134	62%	408	366	2,340	5.47	2.68
9	1955		Coal	134	61%	529	477	2,320	5.37	2.60
10	1955	2010	Coal	124	-	-	-	-	-	-

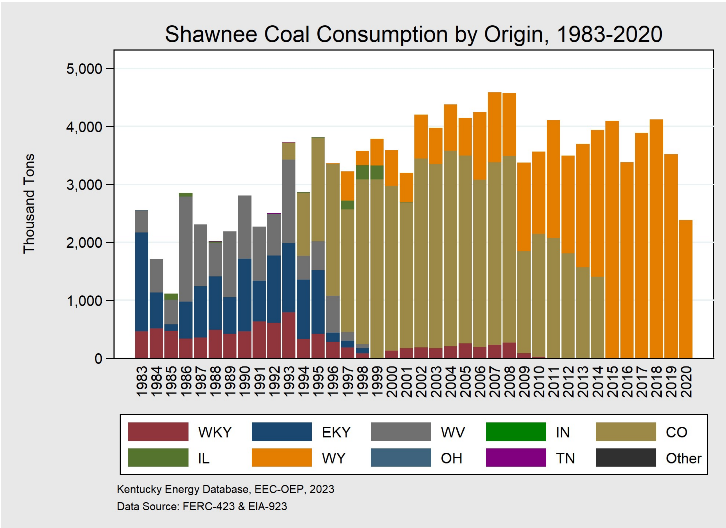
The Shawnee Fossil Plant, located in McCracken County, is 70 years old and consists of 10 coal-fired electricity generating units, though Unit 10 has not been used since August 2010. The plant is owned by the Tennessee Valley Authority and the units came online in 1953, 1954, 1955, and 1956. The plant has a total nameplate capacity of 1,206 MW from operable units. In 2020, the plant generated 4.1 TWh of electricity and had a plant-wide capacity factor of 61%.

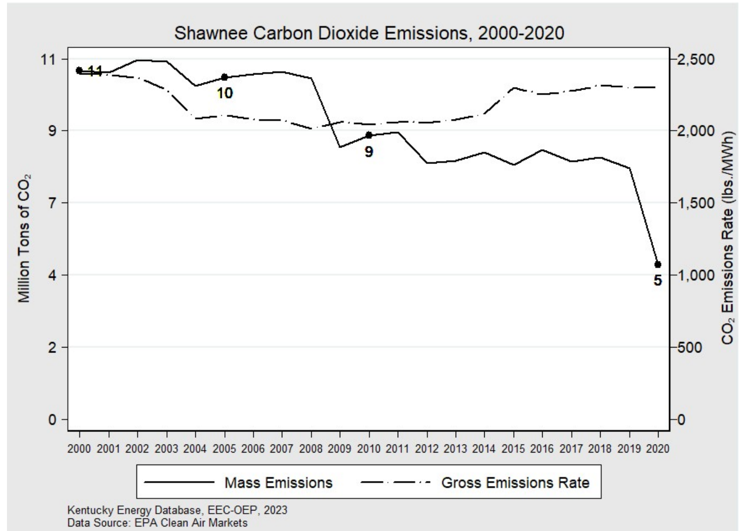
Shawnee burned coal solely from Wyoming in 2020. Shawnee had been utilized to generate electricity for the United States Enrichment Corporation Paducah Gaseous Diffusion Plant until its closure in 2013, but now largely serves Tennessee's electricity demand.

TVA has announced that they plan to retire eight of their steam turbine units with an estimated completion data of 2033.

*2020

Shawnee Fossil Plant

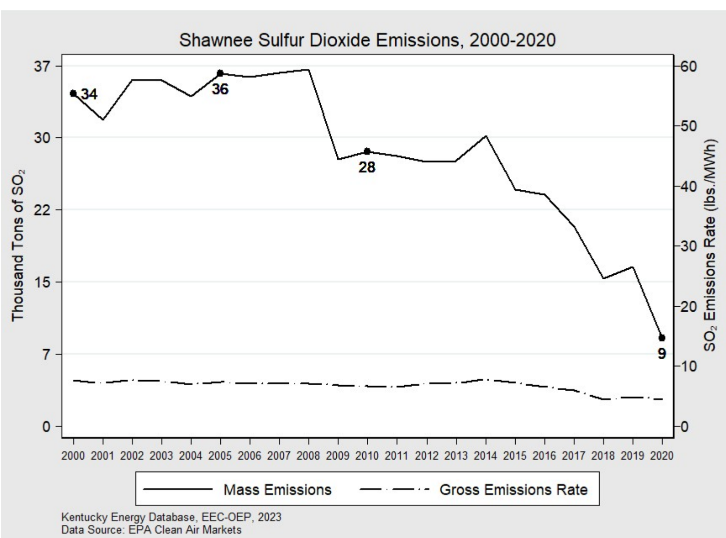


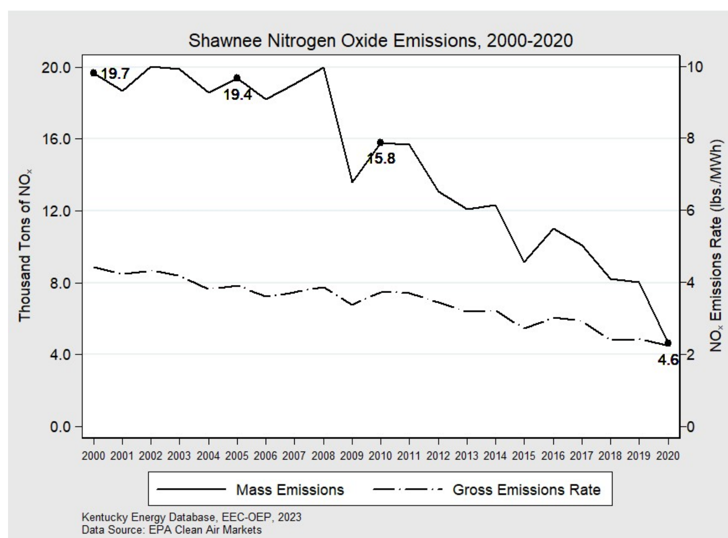


State	2020 Tons	Percentage
Total	2,382,441	100%
Wyoming	2,382,441	100%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	4,705,547	-46%
Rate (lbs./MWh)	2,302	+13%

The Shawnee Fossil Plant emitted 4.7 million tons of CO_2 in 2020, a decrease of 46% from 2010 levels. The rate of CO_2 emissions increased by 13% during that period.





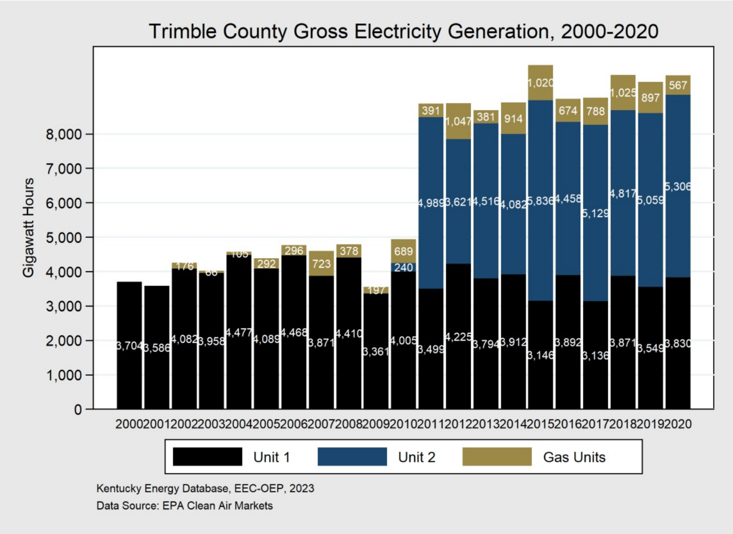
Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	9,024	-68%
Rate (lbs./MWh)	4.41	-34%

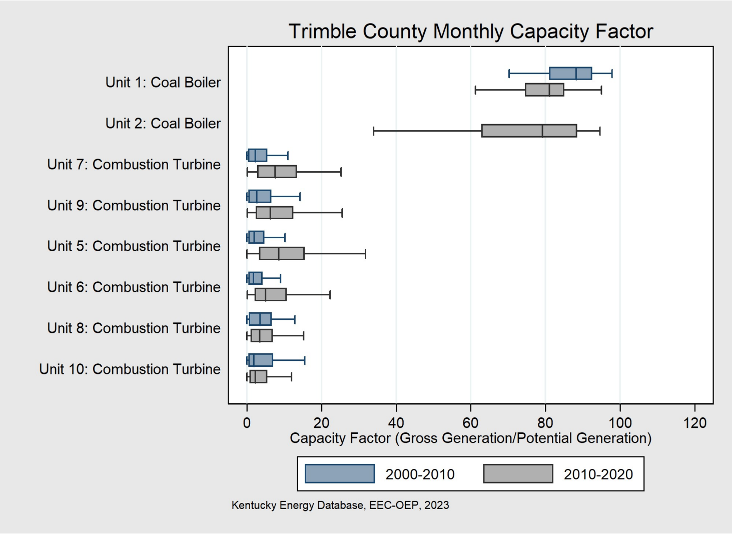
Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	4,600	-71%
Rate (lbs./MWh)	2.25	-40%

The Shawnee Fossil Plant emitted 9,024 tons of SO_2 in 2020, a decrease of 68% since 2010. The rate of SO_2 emissions has decreased by 34% since 2010.

The Shawnee Fossil Plant emitted 4,600 tons of NO_x in 2020, a reduction of 71% since 2010. The rate of NO_x emissions decreased by 40% since 2010.

Trimble County Generating Station



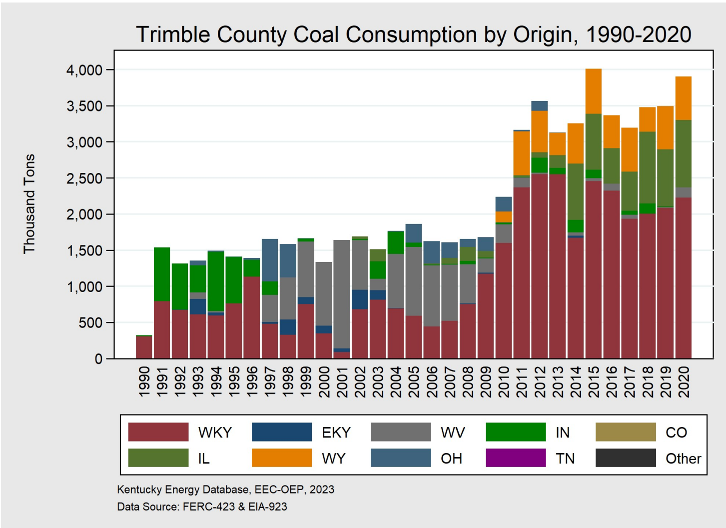


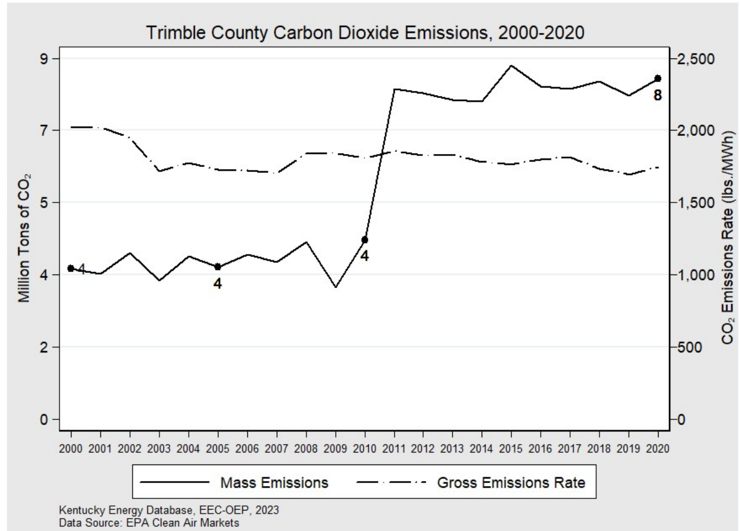
Unit Number	Online Year	Retire Year	Fuel	Capacity (MW)	Capacity Factor* (%)	Gross Generation* (GWh)	Net Generation* (GWh)	CO_2 Rate* (lbs./MWh)	SO_2 Rate* (lbs./MWh)	NO_x Rate* (lbs./MWh)
Plant	**1990**		**Coal & NG**	**2,345**	**24%**	**9,703**	**8,460**	**1,748**	**0.77**	**0.48**
1	1990		Coal	511	83%	3,830	3,508	1,786	1.00	0.72
2	2010		Coal	732	79%	5,306	4,952	1,769	0.69	0.32
5	2002		Natural Gas	159	5%	191	-	1,273	0.006	0.36
6	2002		Natural Gas	159	4%	34	-	1,317	0.007	0.36
7	2004		Natural Gas	159	6%	101	-	1,296	0.006	0.39
8	2004		Natural Gas	159	4%	79	-	1,308	0.006	0.36
9	2004		Natural Gas	159	5%	143	-	1,273	0.006	0.38
10	2004		Natural Gas	159	2%	19	-	1,274	0.006	0.36

The Trimble County Generating Station, near Bedford, consists of two coal-fired electricity generating units and six natural gas combustion turbines. The combustion turbines are used only to meet peak demand because they are more expensive to run, but are easily dispatched with electricity demand changes. The plant is 33 years old, making it the youngest coal-fired electricity generation plant in Kentucky. The coal units came online in 1990 and 2010, respectively. Trimble County Generating Station's coal units have a total nameplate capacity of 2,345 MW. In 2020, the plant generated 9.7 TWh of electricity, 9,136 GWh from coal and 567 GWh from natural gas. The plant had a combined capacity factor of 24%. Trimble County Generating Station is owned jointly by Louisville Gas & Electric, Kentucky Utilities, Illinois Municipal Electric Agency, and Indiana Municipal Power Agency.

*2020

Trimble County Generating Station

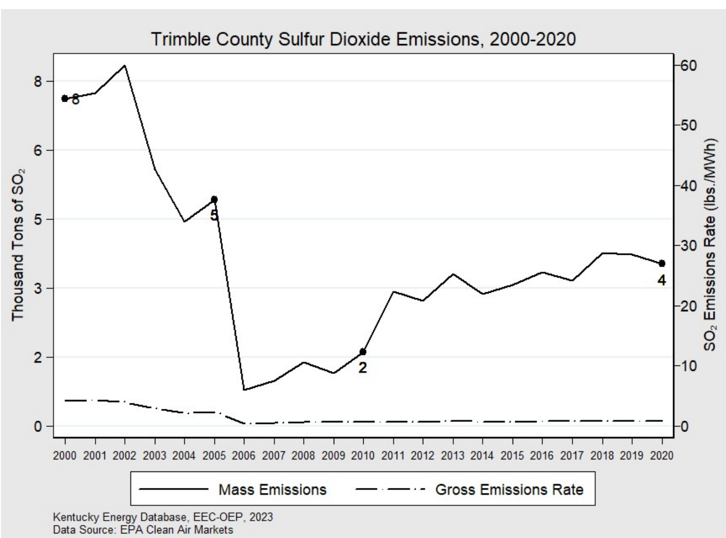


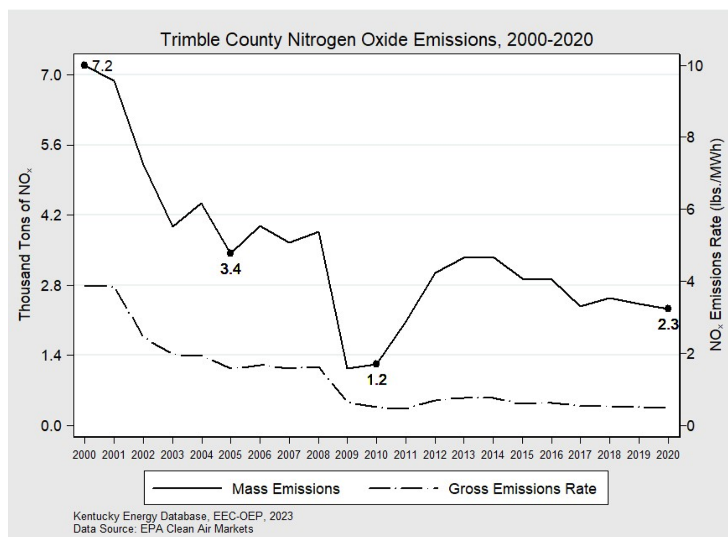


State	2020 Tons	Percentage
Total	3,904,570	100%
Western Kentucky	2,228,986	57.1%
Illinois	929,450	23.8%
Wyoming	605,446	15.5%
West Virginia	140,688	3.6%

Carbon Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	8,478,734	+90%
Rate (lbs./MWh)	1,748	-3%

The Trimble County Generating Station emitted 8.5 million tons of CO_2 in 2020, an increase of 90% since 2010. However, the rate of CO_2 emissions decreased by 3% during that period as Unit 2 started in 2010.





Sulfur Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	3,748	+119%
Rate (lbs./MWh)	0.77	+12%

Nitrogen Dioxide	2020 Value	Since 2010
Emissions (Tonnage)	2,335	+92%
Rate (lbs./MWh)	0.48	-2%

The Trimble County Generating Station emitted 3,748 tons of SO_2 in 2020, an increase of 119% since 2010. The rate of SO_2 emissions increased by 12% during that period.

The Trimble County Generating Station emitted 2,335 tons of NO_x in 2020, an increase of 92% since 2010. The rate of NO_x emissions decreased by 2% during that period.

Acknowledgements

The Kentucky Energy and Environment Cabinet would like to recognize the following individuals for their numerous contributions to the 2023 edition of the Kentucky Energy Profile.

Author:

Evan Moser, Data Scientist, Kentucky Office of Energy Policy

Contributors

Kenya Stump, Executive Director, Kentucky Office of Energy Policy

Carol Stringer, Federal Grant Programs Specialist, Office of Energy Policy

Zachary Barker, Intern, Office of Energy Policy

Eileen Hardy, Administrative Specialist, Office of Energy Policy

Please direct all inquiries to Evan Moser (Evan.Moser@ky.gov) or by telephone at 502-782-3867. All of the data in this report are public information aggregated from a variety of state and federal government agencies.

TEAM KENTUCKY®

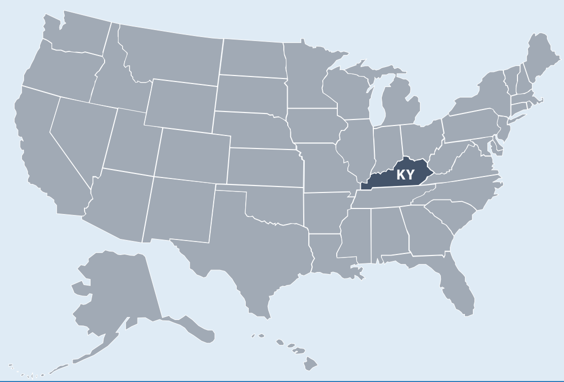
ENERGY AND ENVIRONMENT CABINET

Attachment 1:

Kentucky Energy Sector Risk Profile

State of Kentucky
ENERGY SECTOR RISK PROFILE

U.S. DEPARTMENT OF
ENERGY
Cybersecurity, Energy Security, and Emergency Response



Kentucky State Facts

POPULATION
4.47 M

HOUSING UNITS
2.00 M

BUSINESS ESTABLISHMENTS
0.09 M

ENERGY EMPLOYMENT: 42,797 jobs
PUBLIC UTILITY COMMISSION: KY Public Service Commission
STATE ENERGY OFFICE: KY Energy and Environment Cabinet
EMERGENCY MANAGEMENT AGENCY: KY Emergency Management
AVERAGE ELECTRICITY TARIFF: 8.52 cents/kWh
ENERGY EXPENDITURES: $3,893/capita
ENERGY CONSUMPTION PER CAPITA: 372 MMBtu
(15th highest of 50 states and Washington, D.C.)
GDP: $208.1 billion

Data from 2020 or most recent year available.
For more information, see the Data Sources document.

ANNUAL ENERGY CONSUMPTION

ELECTRIC POWER: 76,610 GWh
COAL: 29,300 MSTN
NATURAL GAS: 317 Bcf
MOTOR GASOLINE: 48,100 Mbbl
DISTILLATE FUEL: 22,700 Mbbl

ANNUAL ENERGY PRODUCTION

ELECTRIC POWER GENERATION: 57 plants, 71.8 TWh, *9.7 GW total capacity*
- **Coal:** 14 plants, 51.7 TWh, *13.5 GW total capacity*
- **Hydro:** 10 plants, 4.2 TWh, *1.1 GW total capacity*
- **Natural Gas:** 15 plants, 15.3 TWh, *8.5 GW total capacity*
- **Petroleum:** 1 plant, 0.1 TWh, *0.0 GW total capacity*
- **Wind & Solar:** 6 plants, 0.0 TWh, *0.0 GW total capacity*
- **Other sources:** 11 plants, 0.4 TWh, *0.1 GW total capacity*

COAL: 41,800 MSTN
NATURAL GAS: 90 Bcf
CRUDE OIL: 2,500 Mbbl
ETHANOL: 900 Mbbl

Data from EIA (2018, 2019).

This State Energy Risk Profile examines the relative magnitude of the risks that the state of Kentucky's energy infrastructure routinely encounters in comparison with the probable impacts. Natural and man-made hazards with the potential to cause disruption of the energy infrastructure are identified. Certain natural and adversarial threats, such as cybersecurity, electromagnetic pulse, geomagnetic disturbance, pandemics, or impacts caused by infrastructure interdependencies, are ill-suited to location-based probabilistic risk assessment as they may not adhere to geographic boundaries, have limited occurrence, or have limited historic data. Cybersecurity and other threats not included in these profiles are ever present and should be included in state energy security planning. A complete list of data sources and national level comparisons can be found in the Data Sources document.

Kentucky Risks and Hazards Overview

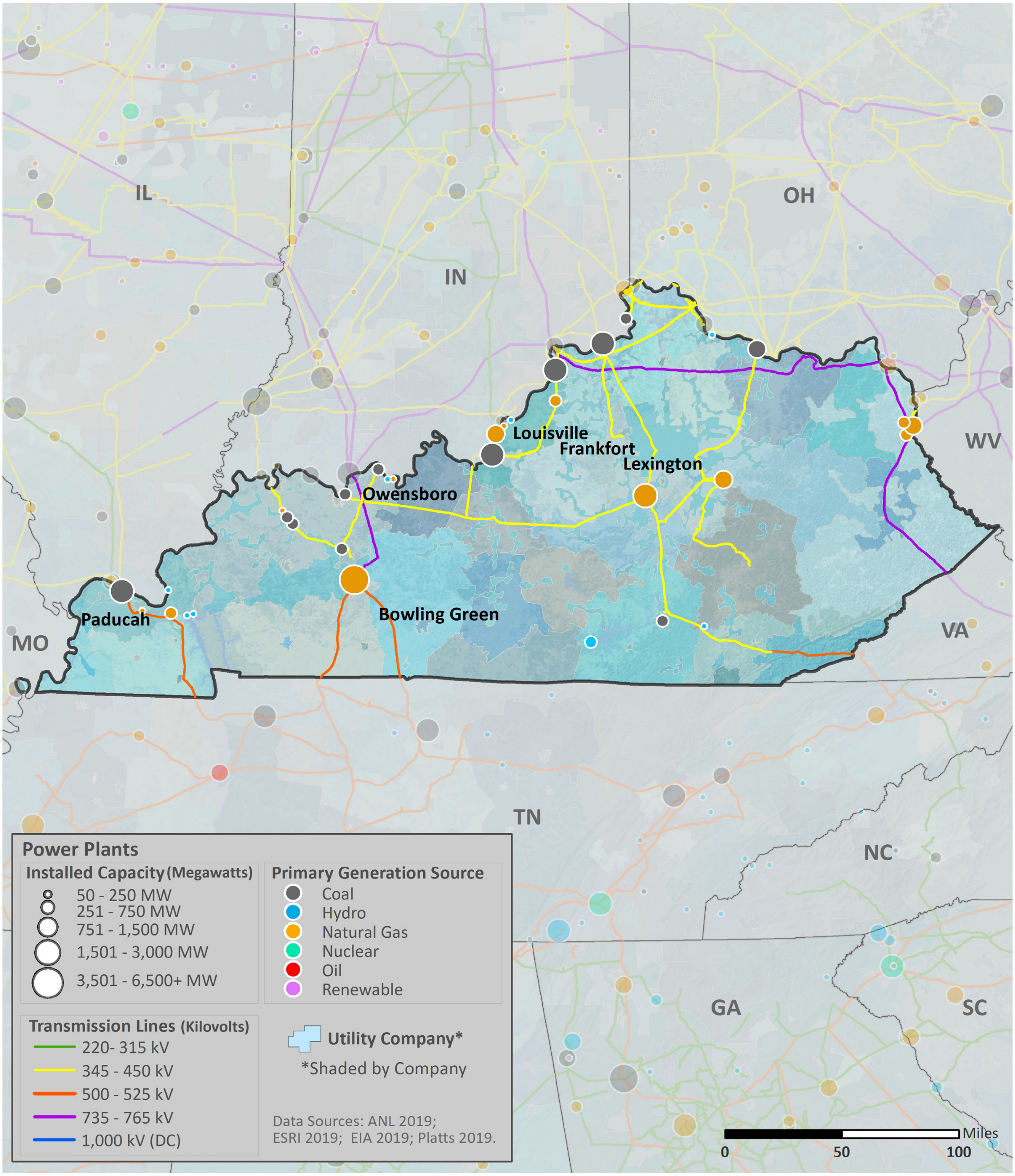
- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Winter Storms & Extreme Cold** at $33 million per year *(7th leading cause nationwide at $418 million per year).*
- Kentucky had 305 Major Disaster Declarations, 0 Emergency Declarations, and 5 Fire Management Assistance Declarations for 11 events between 2013 and 2019.
- Kentucky registered 14% fewer Heating Degree Days and 23% greater Cooling Degree Days than average in 2019.
- There is 1 Fusion Center located in Frankfort.

Annualized Frequency of and Property Damage Due to Natural Hazards, 2009 – 2019

	HAZARD FREQUENCY – Annualized	PROPERTY DAMAGE – Annualized ($Million per year)
Drought	2	$0
Earthquake (≥ 3.5 M)	<1	$0
Extreme Heat	6	$0
Flood	72	$18
Hurricane	0	$0
Landslide	1	$0
Thunderstorm & Lightning	131	$8
Tornado	18	$20
Wildfire	1	$0
Winter Storm & Extreme Cold	34	$33

Data Sources: NOAA and USGS

ELECTRIC


IL
IN
OH
WV
VA
MO
TN
NC
GA
SC
Louisville
Frankfort
Lexington
Owensboro
Paducah
Bowling Green
Power Plants
Installed Capacity (Megawatts)
50 - 250 MW
251 - 750 MW
751 - 1,500 MW
1,501 - 3,000 MW
3,501 - 6,500+ MW
Primary Generation Source
Coal
Hydro
Natural Gas
Nuclear
Oil
Renewable
Transmission Lines (Kilovolts)
220- 315 kV
345 - 450 kV
500 - 525 kV
735 - 765 kV
1,000 kV (DC)
Utility Company*
*Shaded by Company
Data Sources: ANL 2019; ESRI 2019; EIA 2019; Platts 2019.
Miles
0
50
100

Electric Infrastructure

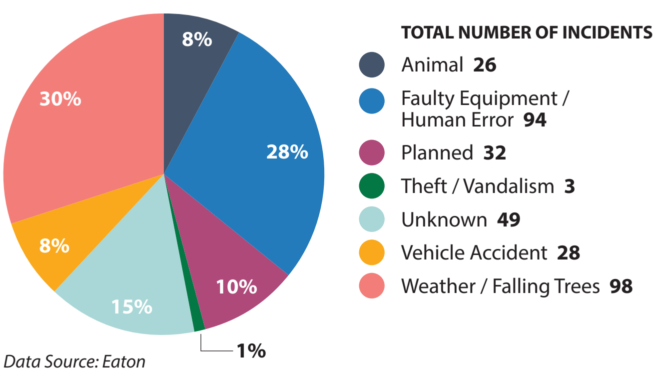
- Kentucky has 56 electric utilities:
  - *3 Investor owned*
  - *24 Cooperative*
  - *29 Municipal*
  - *0 Other utilities*
- Plant retirements scheduled by 2025: 7 electric generating units totaling 2,294 MW of installed capacity.
- In 2018, the average Kentucky electric customer experienced 1.8 service interruptions that lasted an average of 6.8 hours.
- In Kentucky, between 2008 and 2017:
  - *The greatest number of electric outages occurred in **January** (6th for outages nationwide)*
  - *The leading cause of electric outages was **Weather or Falling Trees** (leading cause nationwide)*
  - *Electric outages affected 203,086 customers on average*

Electric Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	**86%**	**36%**
Commercial	**13%**	**26%**
Industrial	**<1%**	**38%**
Transportation	**<1%**	**<1%**

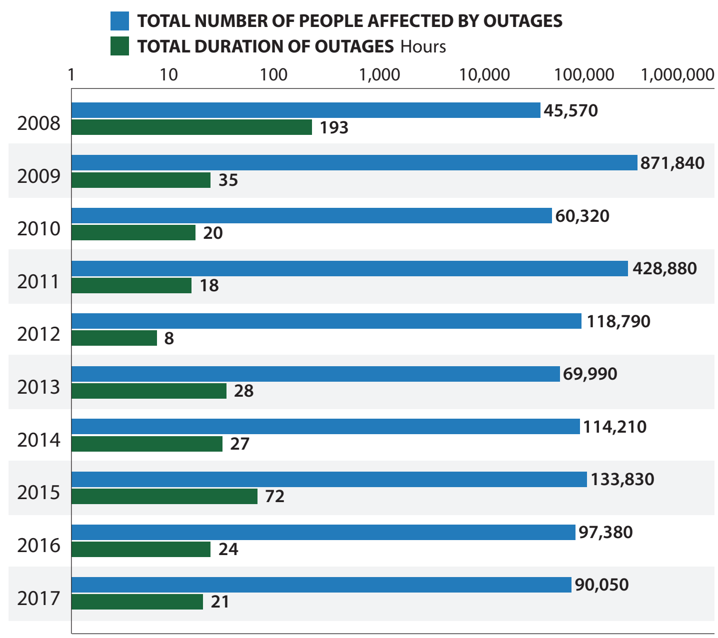
Data Source: EIA

Electric Utility-Reported Outages by Cause, 2008 – 2017



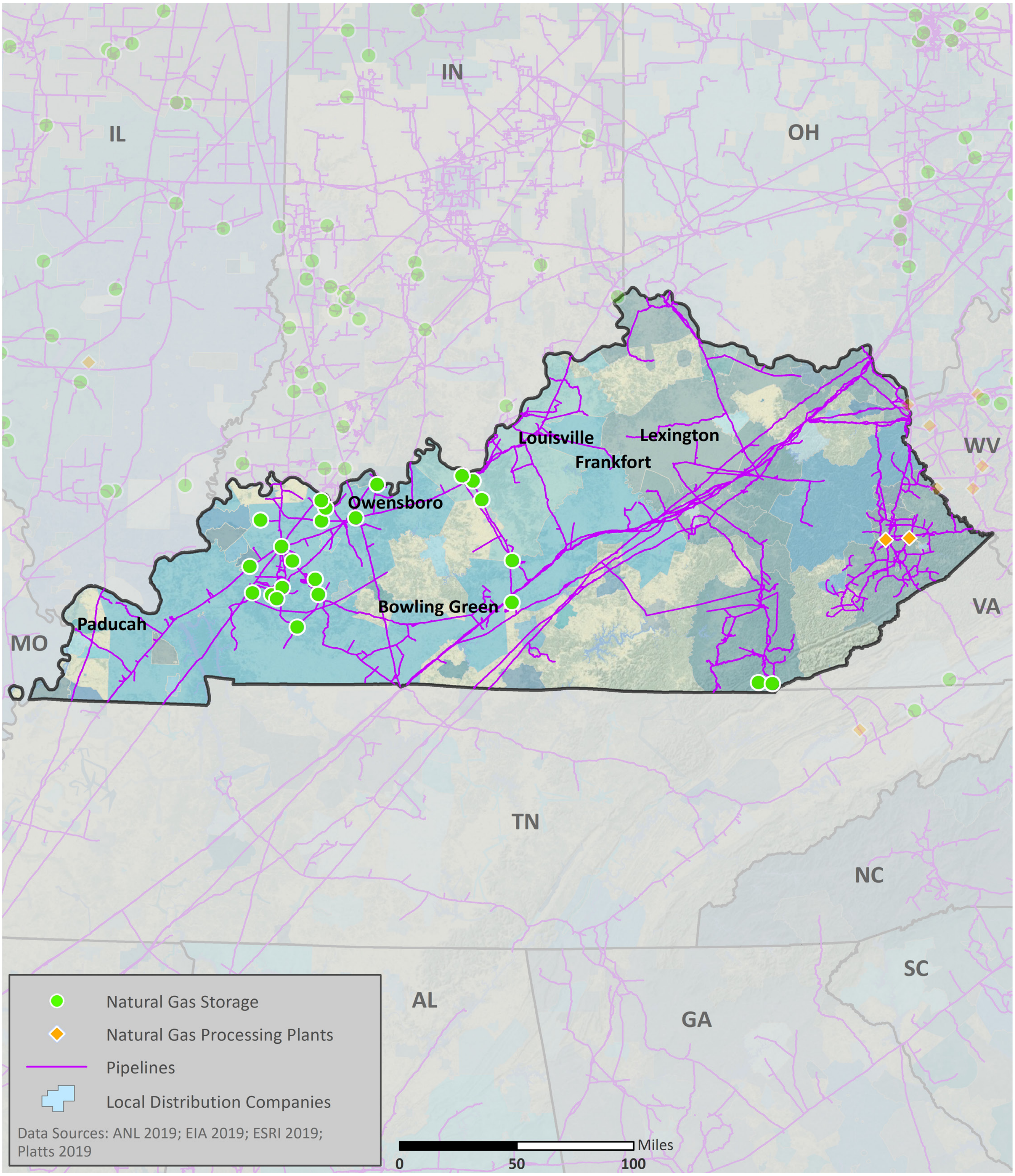
Data Source: Eaton

Electric Utility Outage Data, 2008 – 2017



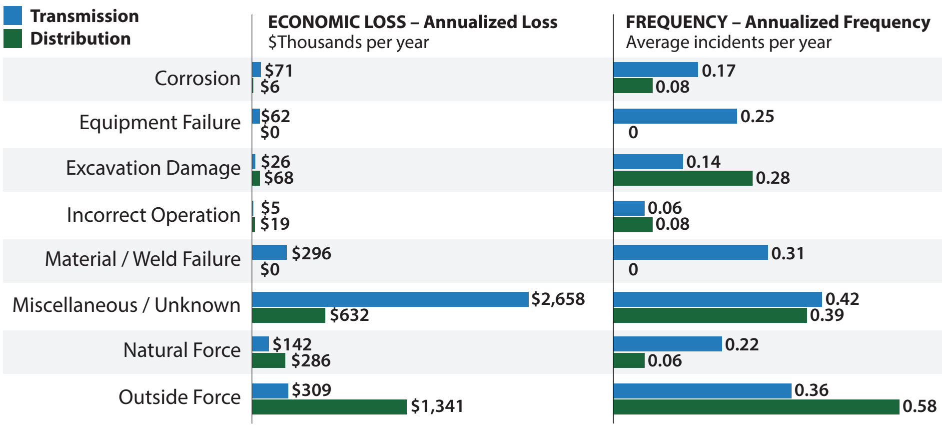
Note: This chart uses a logarithmic scale to display a very wide range of values.
Data Source: Eaton

NATURAL GAS


IN
IL
OH
WV
VA
MO
TN
NC
SC
AL
GA
Louisville
Lexington
Frankfort
Owensboro
Bowling Green
Paducah
Natural Gas Storage
Natural Gas Processing Plants
Pipelines
Local Distribution Companies
Data Sources: ANL 2019; EIA 2019; ESRI 2019; Platts 2019
Miles
0
50
100

Natural Gas Transport

Top Events Affecting Natural Gas Transmission and Distribution, 1984 – 2019



Data Source: DOT PHMSA

- As of 2018, Kentucky had:
  - *6,769 miles of natural gas transmission pipelines*
  - *18,834 miles of natural gas distribution pipelines*
- 72% of Kentucky's natural gas transmission system and 24% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, Kentucky's natural gas supply was most impacted by:
  - ***Miscellaneous or Unknown*** *events when transported by transmission pipelines (5th leading cause nationwide at $16.77M per year)*
  - ***Outside Forces*** *when transported by distribution pipelines (leading cause nationwide at $76.59M per year)*

Natural Gas Processing and Liquefied Natural Gas

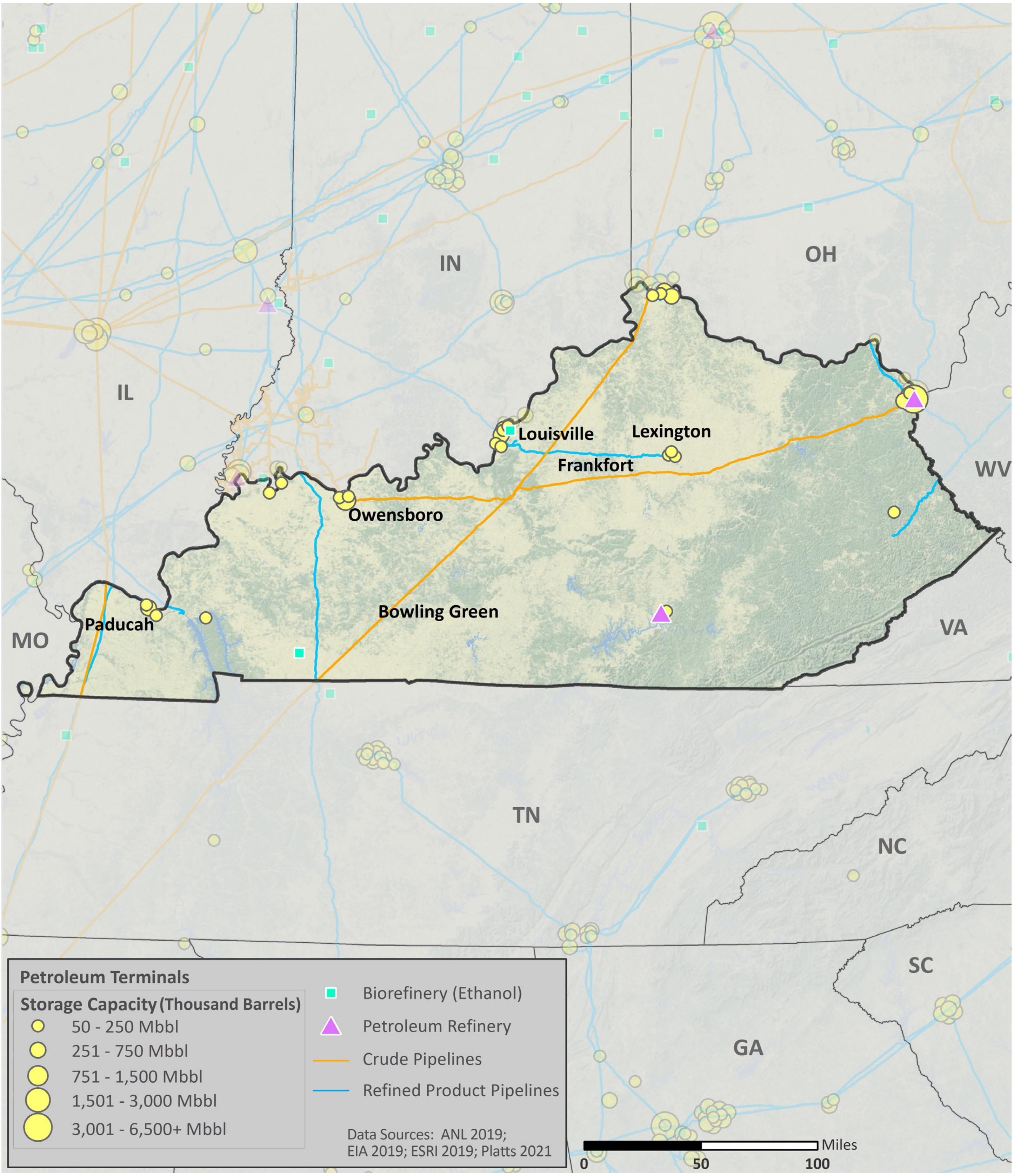
Natural Gas Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	90%	16%
Commercial	10%	12%
Industrial	<1%	37%
Transportation	<1%	<1%
Electric Power	<1%	36%
Other	<1%	<1%

Data Source: EIA

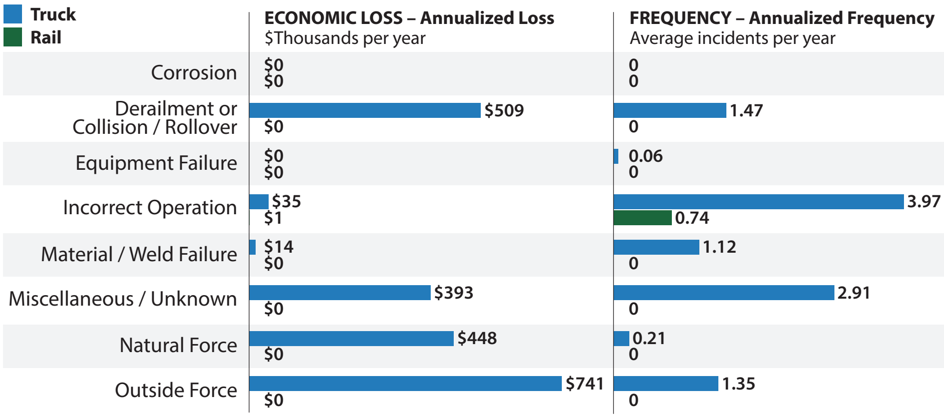
- Kentucky has 2 natural gas processing facilities with a total capacity of 365 MMcf/d.
- Kentucky has 0 liquefied natural gas (LNG) facilities.

PETROLEUM


IN
OH
IL
WV
MO
VA
TN
NC
SC
GA
Louisville
Lexington
Frankfort
Owensboro
Bowling Green
Paducah
Petroleum Terminals
Storage Capacity (Thousand Barrels)
50 - 250 Mbbl
251 - 750 Mbbl
751 - 1,500 Mbbl
1,501 - 3,000 Mbbl
3,001 - 6,500+ Mbbl
Biorefinery (Ethanol)
Petroleum Refinery
Crude Pipelines
Refined Product Pipelines
Data Sources: ANL 2019;
EIA 2019; ESRI 2019; Platts 2021
Miles
0
50
100

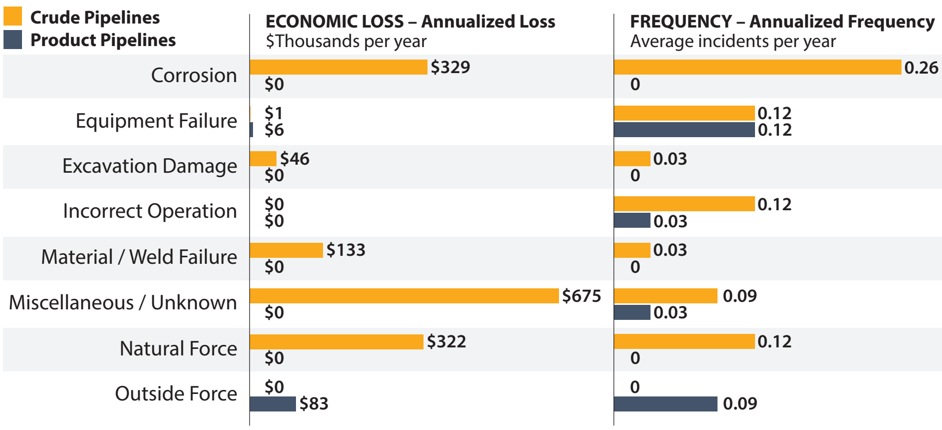
Petroleum Transport

Top Events Affecting Petroleum Transport by Truck and Rail, 1986 – 2019



Data Source: DOT PHMSA

Top Events Affecting Crude Oil and Refined Product Pipelines, 1986 – 2019



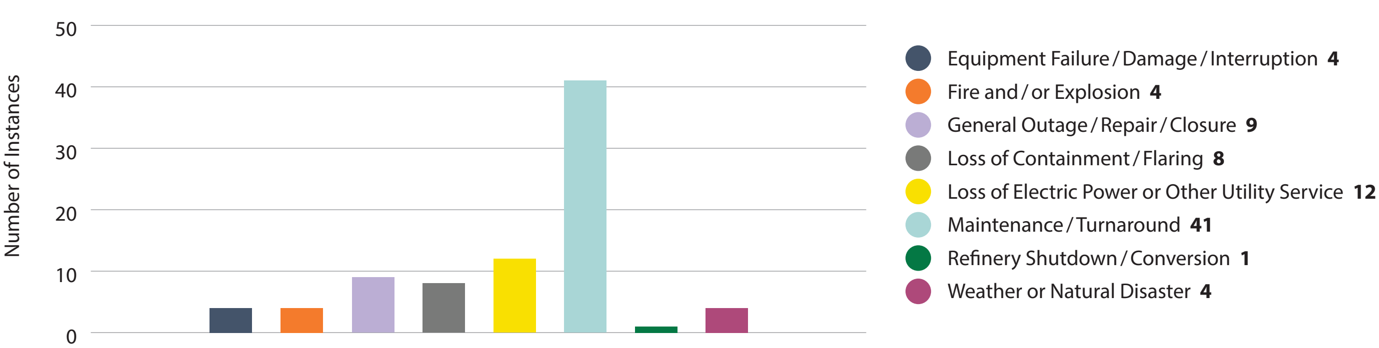
Data Source: DOT PHMSA

- As of 2018, Kentucky had:
  - *601 miles of crude oil pipelines*
  - *275 miles of refined product pipelines*
  - *0 miles of biofuels pipelines*
- 53% of Kentucky's petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, Kentucky's petroleum supply was most impacted by:
  - ***Outside Forces*** *when transported by truck (2nd leading cause nationwide at $60.45M per year)*
  - ***Incorrect Operations*** *when transported by rail (4th leading cause nationwide at $2.02M per year)*
  - ***Miscellaneous or Unknown*** *events when transported by crude pipelines (5th leading cause nationwide at $4.71M per year)*
  - ***Outside Forces*** *when transported by product pipelines (leading cause nationwide at $19.06M per year)*
- Disruptions in other states may impact supply.

Petroleum Refineries

- Kentucky has 2 petroleum refineries with a total operable capacity of 282.5 Mb/d.
- Between 2009 and 2019, the leading cause of petroleum refinery disruptions in Kentucky was:
  - ***Maintenance*** *(2nd leading cause nationwide)*

Causes and Frequency of Petroleum Refinery Disruptions, 2009 – 2019



Data Source: Hydrocarbon Publishing

APPENDIX F:

Energy Disruption Tracking Log

Kentucky ESF 12-Energy Disruption Tracking Log
Energy and Environment State Energy Office SEO-EEC
Severe Weather, 13 April Activation Order : 20221495

Date of monitoring	Energy Source Affected	Companies/Industries and Contact	Initiating Event	Event Description & Requests	Possible Cause	Area Affected	Type and Number of Customers Affected	Restoration Actions	ESF 12 actions	Governement Actions	Federal Actions	Event Close date
1/11/2021	Electric, Propane, Natural gas, Petroleum (propane)	Local, State, Private (Propane Distributors)	Winter Storm w/snow, ice, high winds, tornadoes, flooding, cybersecurity, man made (winter storm)	Several suppliers ran out of propane but there were no reports of residential outages	High demand for propane in Northeast made for long wait times at area terminals	Region, County, City (Western KY)	Propane Gas Users-50	HOS waiver approved-Logged into Web EOC and distributed to energy partners in ReadyOp	Validiated necessity of request, SEO-EEC routes request to KDOT (ESF 1)	KYEM opened emergency shelters in affected areas	PHMSA waiver issued 1/12/21, includes KY	1/15/2021
										Level 3 activation		

APPENDIX G:

Hours of Service (HOS) Waivers

APPENDIX G: Hours of Service (HOS) Exemption Request

[Guidance for States on Relief from Federal Motor Carrier Safety Regulations in an Energy Emergency]

NASEO

National Association of State Energy Officials

Guidance for States on Relief from Federal Motor Carrier Safety Regulations in an Energy Emergency

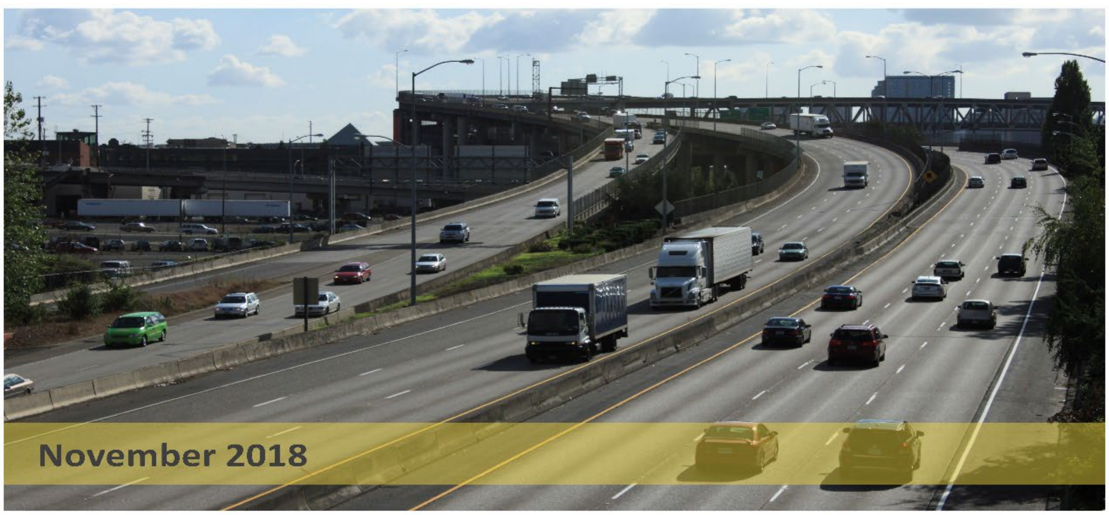


Image source: rlmartin

The Federal Motor Carrier Safety Administration (FMCSA), a stand-alone Department of Transportation (DOT) agency, has developed a detailed set of rules designed to keep roads safe by ensuring drivers limit the long hours they spend behind the wheel.

https://www.fmcsa.dot.gov/regulations/hours-of-service

These Hours of Service (HOS) regulations apply to all DOT regulated commercial motor vehicle operators in the US. All carriers and drivers operating commercial motor vehicles (CMVs) must comply with the HOS regulations found in 49 CFR 395. “Hours of service” refers to the maximum amount of time drivers are allowed to be on duty including driving time, and specifies number and length of rest periods, to help safeguard that drivers stay awake and alert.

In some cases due to extreme cold weather companies and/or trade associations in the energy industry may request a HOS exemptions. These requests are in direct conflict with federal and state regulations that have been developed for public safety and protection of the transportation infrastructure and must be carefully evaluated before exemptions are recommended and approved.

The State Energy Office (SEO) is not a regulatory agency – the SEO provides situational awareness with energy partners, KYDOT and KYEM regarding energy emergencies and can only make recommendations to KYDOT, or in certain cases, to the Federal Motor Carrier Safety Administration (FMCSA). FMSCA and KYDOT are the agencies with statutory authority to grant exemptions. The guidelines for recommended information the trade association should assemble are presented in Attachment 1.

The protocol outlined in this appendix provides responsible agencies with the best available information to make such decisions.

- Requests for an HOS exemption typically originate from an oil company, common carrier, or a trade association. Such requests are directed to KYTC, FMSCA or the SEO who will route the request in lieu of the company.

- The affected company/trade association will contact its respective membership to determine the magnitude, scope and estimated duration of the problem and follow minimum guidelines for gathering appropriate information.

- Upon notification of the request the SEO initiates fact-finding with the affected company/carrier/trade association. (In some cases to other state energy offices, industry, law enforcement agencies, weather prediction centers and federal agencies to assist in validating facts). Examples of energy partner situational analysis can be found in Attachment 2.

- If the SEO determines that there is not an emergency situation developing, they will advise the company/carrier/trade association and stakeholders that no recommendation is being developed. If the SEO determines that there is an emergency situation developing, the SEO will contact the EEC secretary and ESF 1-KYDOT for further action and recommendation for the Office of the Secretary.

Examples of draft recommendation can be found in Attachment 2. A formal request of the trade association is provided in Attachment 3.

- Upon receipt of the HOS exemption recommendation by the Office of the Secretary, KYDOT will conduct an internal review of the facts and make a decision. The KYDOT may accept or modify the recommendation, if approved KYDOT will request an HOS exemption Declaration of Emergency and Exemption of Hours of Service Regulations will be issued. A copy of the Declaration of Emergency and Exemption of Hours of Service Regulations for Delivery are provided in Attachment 4 and 5. A draft Declaration of Emergency Template is in Attachment 6.

- If the KYDOT disapproves the request, the SEO will be notified and SEO will notify the trade association and the respective stakeholders.

- Once the Declaration of Emergency and Exemption of Hours of Service Regulations is approved the KYDOT provides a signed copy to the KYDOT Fusion Center and the SEO. The SEO will upload the declaration to WebEOC and distribute to the requesting trade association and the respective stakeholders through ReadyOp.

- A Federal Motor Carrier Safety Administration (FMCSA) Regional Emergency Declaration for 49 CFR 390.23 is provided in Attachment 7.

Points of Contacts:

Kentucky Transportation Cabinet 4/1/2021

- Matt Cole, Commissioner Vehicle Regulation – 502-564-7000 or Matthew.Cole@ky.gov
- Todd Shipp, Assistant General Counsel – 502-564-7650 or
- todd.shipp@ky.gov
- Will Fogle, Executive Director Office of Legal Services – 502-564-7650 or William.Fogle@ky.gov
- Mary Cook, Assistant Director Division of Motor Carriers – 502-564-7000 or Mary.Morris@ky.gov
- William Hayes, ESF-1 Transportation- Incident Management- 502.229.5329 or William.hayes@ky.gov

More information can be found in the KY Petroleum Shortage Plan Annex (Appendix H)

Attachment 1:

Hours of Service (HOS) Exemption Requests

Guidelines
Hours of Service Exemption Requests

Kentucky Energy and Environment Cabinet
State Energy Office

The following guidelines have been developed to assist the energy industry by outlining the types of information needed from the affected business (usually an oil company or common carrier) or a trade association, to verify the nature, scope and estimated duration of the problem.

The SEO is not a regulatory agency – it can only make recommendations to KYTC, or in certain cases, to the Federal Motor Carrier Safety Administration (FMCSA). KYTC and FMCSA are the agencies with statutory authority to grant exemptions. The SEO can assist with routing requests and distributing the exemptions to KYEM and other ESF and energy partners.

Below is the recommended information needed to enable a rapidly response to an HOS exemption requests.

Guidelines for Requests

- Situation overview – a brief narrative outlining the nature of the problem (who, what, where, why, when).
- Who is having a problem? How widespread is it? Does in involve more than one company?
- What is the problem? Clearly define the exact nature of the problem. What are the impacts on consumers? Are there outages? If so for how long? How many consumers and what types of consumers (residences, motoring public, commercial businesses, factories, etc.) are affected?
- What caused the problem? Can you identify factors that contributed to the problem? (Weather, refinery breakdowns, product allocation, transportation bottlenecks such as queues at loading racks, etc.)
- Are you aware of other suppliers having similar problems – either in Kentucky or surrounding states?
- What is the industry doing to resolve the problem? Have you/ marketers/ retailers contacted alternate supply sources (if so, give names and contact numbers) or alternate transportation (e.g., common carriers).
- What specific relief are you requesting? What is the minimum amount of time this relief would be needed?
- What would happen if the requested relief was not granted?

Attachment 2:

Hours of Service (HOS) Exemption-Situational Analysis

EXAMPLE:

Hours of Service Exemption-Situational Analysis

Kentucky Energy and Environment Cabinet

State Energy Office

On Wednesday, January 21, 2009 the Kentucky Energy and Environment Cabinet (EEC) received a request from the Kentucky Propane Gas Association (KPGA) asking for relief from the driver hours of service (HOS) provisions of 49 CFR 395.3. The requested relief involves the delivery of propane from the present through February 9, 2009.

A declaration of emergency under the provisions of 49 CFR 390.23 would provide the relief being requested.

The text of the e-mail request from KPGA, is reproduced below:

> Situation Overview as of January 21, 2009
>
> Due to extreme cold weather in the northeastern states, supply of propane has put pressure on the TET pipeline resulting in allocation from Coshocton terminal east. TET began closing on the weekends in order to build inventories and reduce lines during the week. Trucks began moving down the pipeline looking for product last week putting additional pressure on Todhunter and Princeton terminals. As of this afternoon today, Todhunter had 60-70 trucks waiting in line with wait times approaching 6-10 hours. Princeton had 25 trucks in line with similar wait times.
>
> TEPPCO announced this afternoon that they have been experiencing unprecedented demand at Todhunter, which has lead to an excessive amount of trucks waiting in line at Todhunter and because of this situation, effective Monday morning, 1/26, at 0001 AM , Todhunter and Princeton will be placed on allocation. The ratio at Todhunter will be 12:1 and the ratio at Princeton will be 6:1. This allocation will surely place more stress on the system.
>
> The terminal at Markwest has shut down and won't be running again until Friday, January 23. They continue to experience mechanical problems and remain questionable. The cavern at Catlettsburg is empty and they are loading as they produce product for a minimal capacity of only 20 loads per day.
>
> In addition, surrounding and nearby states (Ohio, Virginia, West Virginia, Pennsylvania, New York) [http://www.npga.org/i4a/pages/index.cfm?pageid=832] have been operating under an hours of service exemption resulting in a shortage of truck drivers

coming into Kentucky. These carriers operating in the other states have exceeded their HOS drive time in those states and will be out of hours if they try to make deliveries in Kentucky.

Dealers with rail siding are reporting a shortage of rail cars delivering propane into the state putting additional dependence on over-the-road transports.

The Kentucky Propane Gas Association respectfully requests relief from the driver hours of service provisions of 49 CFR 395.3. The requested relief involves the delivery of propane. The requested relief is needed through February 9, 2009 in order to provide time to replenish supplies and fill customer tanks throughout the state.

A similar request and corroborating information (below) was also received from a trucking company operating in Kentucky (Select Transport, Inc.,)

We are a carrier based in Ohio but we have trucks stationed around the Siloam, Catlettsburg areas as well as out of the Princeton, In area and we haul propane into Kentucky. The problems are the extreme cold that we have experienced has put a burden on the supply situation from the east coast out through the Midwest states. There are east coast trucks coming out to the terminals in Ohio, Kentucky, Indiana and Illinois to truck propane back out to the east coast. This has made extremely long lines at all of the loading locations in the Midwest who still have product available. Many terminals are either out of product or have been put on such allocation that there is no gas available at these terminals. Drivers are sitting in lines at these loading terminals for 3 to 8 hours in order to get a load to deliver to customers which is eating up their available hours to get loads to customers. Surrounding states have hours of service exemptions in place but we can not effectively use these exemptions if all of the states do not have them in place as the exemptions are for intrastate only. So if we load a load in Ohio destined for Kentucky, we can not deliver in a timely manner as we can not enter the state of Kentucky until the driver abides with the hours of service regulations. Basically all we are getting done is setting in lines. Any help or consideration of relief would be greatly appreciated by everyone in the propane industry in your state.

During the morning of Thursday, January 22, 2009 EEC staff conducted a brief telephone survey to verify the above. Results were:

- TEPPCO Pipeline Manager of Propane Supply said that:
    - TEPCO had indeed been experiencing loading delays at some terminals that serve Kentucky customers with as many as 60 to 80 trucks in line causing a delay of 6 to 8 hours in loading.

- Part of the problem at their Princeton Indiana and Todhunter Ohio terminals was cause by truckers from New England who were coming into the Midwest because they we unable to get propane in New England due to heavy demand from colder-than-normal winter weather. TEPPCO has been on allocation at New England terminals since November 23rd.
- Increase demand at these terminals has also been driven by operational problems and shut-downs at Kentucky's in-state propane terminals.
- TEPPCO has instituted an allocation program at its Princeton and Todhunter terminals in an effort to reduce loading delays.

- MarkWest Energy Partners' representatives said:
  - MarkWest's loading racks (Siloam, KY) had been shut down for several days while lines connecting to new propane storage facilities were tied into the racks. They expect to be loading product by tomorrow (Friday, January 23).
  - Their customers are allowed 100 percent of contract volumes but must pro-rate their purchases over the month.

- Marathon Petroleum said:
  - Marathon's Catlettsburg, KY refinery has had its propane loading racks closed intermittently for a variety of causes including pipe leaks under the loading area.
  - They have customers on 80 percent allocation.
  - Product is available only for their existing customers.
  - Characterized the situation as (tight but product is available).

Weather conditions in Kentucky are to trend toward warmer temperatures over the next few days but the 10-day forecast reflects below freezing temperatures at night. The 10-day forecast for the Northeast US reflects below freezing temperatures and possible snow showers. Conditions in Kentucky and the Northeast will continue to drive strong demand for propane.

At this time KPGA is not aware of any out-of-gas situations at the retail level but retailers are reporting that they are operating with very low stocks and disruptions in the supply flow will place them in critical condition.

RECOMMENDATION: Request that under state and federal authority (KRS 281.730 and 49 CFR 390.23) the Secretary of Transportation grant an Hours of Service Exemption for commercial motor vehicles and its operator transporting propane products until 12:01 a.m. Thursday, February 10, 2009.

Attachment 3:

Propane Industry's Formal Request for Hours of Service Exemption

Kentucky
Propane Gas
Association

Propane Industry's Formal Request for Hours of Service Exemption

This week, Kentucky has experienced a period of sub-zero temperatures with wind chills in the -10 to -25 range. With an already tight supply of propane, our marketers are struggling to keep up with demand for our product. Although the weather forecast indicates that temperatures will moderate in the next few days, the effects of this cold snap will last for several weeks. Therefore, our industry is sending this formal request for an hours of service exemption.

Yesterday, KPGA sent an email to our members asking for comments on our request for an exemption. Many responses were received and all were eager for an HOS exemption. Current reports by members in general indicate a tightening supply situation, terminal bottlenecks, and marketer demand outstripping their suppliers' ability to deliver to the retail plant locations.

Listed below are several actual responses:

- *We are experiencing increased demand along with tight supply. If weather stays little warmer, we would only need the HOS exemption for two to three weeks.*
  Rick Harris, Bright's Bottle Gas, Burgin, Ky., Phone- (859) 748-5382
  Empire Gas, Nicholasville, Mt. Sterling, London, Hazard, Monticello, Ky.
  Phone- (859) 885-7664 / (859) 498-5415 / (606) 864-4046

- *We are having difficulty getting gas ourselves. Common carriers are experiencing longer than normal wait times at the pipelines. We currently have to work our bobtail drivers in shifts to keep up with customer demand. Thank you,*
  --David Miller, Millers Bottled Gas, (270) 842-9427

- *In the Hopkinsville area we are experiencing extremely cold weather today. The cold is to continue throughout the week and we are having a difficult time getting transport deliveries of Propane. The problem seems to be in the transportation of the product, we currently have to transport from St. Louis and Robinson, Ill. The new HOS requirements of the drivers are causing major delays on deliveries to our bulk storage tanks. I understand the Princeton, IN. terminal is on a daily allocation but on Thursday, January 2nd and Friday the 3rd we received over 200 calls from our customers and customers of other companies requesting gas deliveries. Our drivers worked the weekend to get ahead of the weather that was coming in so no patron would be without gas.*

  Due to the delays in transport deliveries to us this is causing a delays to our customer's as well, we cannot deliver product we do not have. If the weather forecast is correct our deliveries should return to somewhat normal by the end of next week. If Kentucky will allow an HOS this will be very beneficial to our customers and everyone who hauls propane in the state. It is my understanding that Indiana has already issued a HOS Exemption and we are asking for the exemption for Kentucky as well. Thank You.
  --John Camp, Southern States Cooperative, Hopkinsville, KY (270) 886-1303

- With colder weather the demand has increased simply to keep warm. Other problem the supply of propane has decreased due to allocations at supply pipe line terminals and the export of the product to other countries for suppliers to make extra profit. With less product to deliver and increased demand, we have to do shorter drops at each tank, equates more driving time to help all customers. Thanks,
  –**J.T. Hagedorn, Fischers Tru-Flame Gas Co.,** (812) 547-2351

- The extreme temperatures are causing delays with transports and deliveries.
  We expect to be caught up by 12/13/2014. We are currently out of gas at one of my plants and awaiting transport.
  –**Don Pruitt, AmeriGas- New Haven, KY** (800) 564-3113

- Our demand is almost double to where it was this time last year, We truly need exemption of hours
  –**Jimmy Carter, Ferrellgas, Hagerhill, KY** (606) 789-4084

- Due to the recent weather situation, the demand has increased drastically. An HOS Waiver would greatly ease the burden we are experiencing with delivering LP. We are playing catch up from the weekend deliveries due to weather, lines and loading delays. Mixed with increase demand and we have a snowball effort for delivering LP. If this lasted through the weekend, it would be a huge help to our customers in providing propane.
  –**Charlotte Tate, Southern States Corporate, Richmond, VA** (804) 281-1000

In summary, the extreme cold temperatures and snow accumulation across Kentucky has slowed deliveries immensely and drivers are now working overtime to catch up. With continued propane demand along the pipeline system, the terminal system will continue to experience backups and cause hours of service limits to be exceeded.

The Kentucky Propane Gas Association respectfully requests current relief from the driver hours of service provisions of 49 CFR 395.3. The requested relief involves the delivery of propane. The requested relief is needed through **January 28, 2014** in order to provide time to replenish supplies and fill customer tanks throughout the state.

CONTACT:
Jay McCants, Executive Director
Kentucky Propane Gas Association
512 Capitol Ave., Frankfort, KY 40601
(502) 875-2686 office, (502) 875-1595 fax
jmccants@kypropane.org

Attachment 4:

January 23, 2009 Declaration of Emergency

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.transportation.ky.gov/

Steven L. Beshear
Governor

Joseph W. Prather
Secretary

OFFICE OF THE SECRETARY

OFFICIAL ORDER NO. 105128

SUBJECT: DECLARATION OF EMERGENCY AND EXEMPTION OF HOURS OF SERVICE REGULATIONS FOR DELIVERY OF PROPANE

WHEREAS, extremely cold weather in the New England area has caused sharp increases in the demand for propane and has led to propane buyers trucking propane from propane pipeline terminals in the Midwest; and

WHEREAS, this change in the distribution patterns for propane and recent cold weather in the Midwest has increased demand for propane in the region above historical levels; and

WHEREAS, several propane terminals have experienced temporary shut-downs; and

WHEREAS, this situation has resulted in distribution and delivery problems in that loading delays for propane transports have been reported to be as long as 6 to 7 hours in duration; and

WHEREAS, 49 CFR Part 395, KRS 281.730, and 601 KAR 1:005 impose maximum driving times upon the drivers of motor carriers delivering propane,

NOW THEREFORE, pursuant to the authority vested in me by KRS 281.730 and 49 CFR 390.23, I hereby declare:

1. That a state of emergency exists requiring relief from the hours of service imposed upon the transporters of propane
2. That a commercial motor vehicle and its operator transporting propane shall be exempt from the hours of service imposed under 49 CFR 395, 601 KAR 1:005 and KRS 281.730 during the period of this emergency.
3. That all other safety requirements shall remain in full force and effect.
4. This declaration of emergency shall remain in effect until 12:01 AM EST February 10, 2009, unless extended.
5. That any driver operating under authority of this Declaration of Emergency should have a copy of this Declaration in the cab of the vehicle.

Joseph W. Prather, Secretary
Transportation Cabinet

Done this 23rd day of January, 2009 at Frankfort, Kentucky.

Approved as to Form and Legality:

Office of General Counsel and Legislative Affairs

Kentucky UNBRIDLED SPIRIT

An Equal Opportunity Employer M/F/D

Attachment 5:

January 8th, 2014 Declaration of Emergency

TRANSPORTATION CABINET

Steven L. Beshear
Governor

Frankfort, Kentucky 40622
www.transportation.ky.gov/

Michael W. Hancock, P.E.
Secretary

OFFICE OF THE SECRETARY

OFFICIAL ORDER NO. 108656

SUBJECT: DECLARATION OF EMERGENCY AND EXEMPTION OF HOURS OF SERVICE REGULATIONS FOR DELIVERY OF PROPANE

WHEREAS, Kentucky and a significant portion of the United States has experienced a prolonged period of below-freezing temperatures; and

WHEREAS, the current weather forecasts call for this trend to continue well into the middle of January, with weekend temperatures to be in the single digits and wind chills well below zero degrees; and

WHEREAS, cold temperatures across the nation have led to tightening supply situation, and market demand has led to a sharp decline in propane inventories; and

WHEREAS, this situation has resulted in distribution and delivery problems in that loading delays for propane transports have been reported to be as long as 6 to 7 hours in duration, and shut downs entirely at distribution points within the Commonwealth; and

WHEREAS, 49 CFR Part 395, KRS 281.730, 601 KAR 1:005 impose maximum driving time upon the drivers of motor carriers delivering propane;

NOW THEREFORE, pursuant to the authority vested in me by KRS 281.730 and 49 CFR 390.23, I hereby declare:

1. That a state of emergency exists requiring relief from the hours of service imposed upon the transporters of propane;
2. That a commercial motor vehicle and its operator transporting propane shall be exempt from the hours of service imposed under 49 CFR Part 395, 601 KAR 1:005 and KRS 281.730 during the period of this emergency;
3. That all other safety requirements shall remain in full force and effect;
4. That this declaration of emergency shall remain in effect until 12:01 AM EDT, January 28, 2014;
5. That any driver operating under authority of this Declaration of Emergency shall have a copy of this Declaration in the cab of the vehicle.

Michael W. Hancock, P.E., Secretary
Kentucky Transportation Cabinet

Done this 8th day of January, 2014 at Frankfort, Kentucky

Approved as to form and legality:

Office of Legal Services

Kentucky
UNBRIDLED SPIRIT

An Equal Opportunity Employer M/F/D

Attachment 6:

Draft Declaration of Emergency

Draft Declaration of Emergency Template

COMONNWEALTH TRANSPORTATION CABINET
FRANKFORT, KY

OFFICE OF THE SECRETARY OFFICIAL ORDER NO. ------

SUBJECT: DECLARATION OF EMERGENCY AND EXEMPTION OF HOURS OF SERVICE REGULATIONS FOR DELIVERY OF _____________[specify products/services, e.g. "propane," or "heating fuels"]

WHEREAS, [insert causal factors, e.g. "severe cold weather has resulted in an increased demand for supplies of propane"]; and

WHEREAS, [insert causal factors, e.g. "current weather forecasts call for continuing below freezing temperatures"]; and

WHEREAS, [[insert causal factors, e.g. "this situation has resulted in distribution and delivery problems in that loading delays for propane transports may be as long as 3 to 7 hours in duration"]; and

WHEREAS, 49 CFR Part 395, KRS 281.730, and 601 KAR 1:005 impose maximum driving times upon the drivers of motor carriers delivering -----------. [Identify the same product or products as in the SUBJECT above]

NOW THEREFORE, pursuant to the authority vested in me by KRS 281.730 and 49 CFR 390.23, I hereby declare:

That a state of emergency exists requiring relief from the hours of service imposed upon the transporters of -----------------------. [Identify the same product(s) as in the SUBJECT above]

That a commercial motor vehicle and its operator transporting --------------- shall be exempt from the hours of service imposed under 49 CFR 395, 601 KAR 1:005 and KRS 281.730 during the period of this emergency.

That all other safety requirements shall remain in full force and effect.

This declaration of emergency shall remain in effect until 12:01 AM EST [normally set to expire at midnight], [insert date], unless extended.

That any driver operating under authority of this Declaration of Emergency should have a copy of this Declaration in the cab of the vehicle.

____
XXXXXXXX XXXX, Secretary
Transportation Cabinet
Done this ---- day of -------, 20-- at Frankfort, Kentucky.

Approved as to Form and Legality:

____
Office of General Counsel and Legislative Affairs

Attachment 7:

February 5th, 2014 Declaration of Emergency

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

Southern Service Center
1800 Century Blvd. – Suite 1700
Atlanta, GA 30345

FEBRUARY 5, 2014

EMERGENCY DECLARATION 49 CFR § 390.23 & EXTENSION OF STATE DECLARATIONS NOTICE 49 CFR § 390.25

Pursuant to Title 49 CFR §§ 390.23 and 390.25, I, Darrell L. Ruban, Field Administrator of the Federal Motor Carrier Safety Administration, declare an emergency exists that warrants issuance and extension of the State Regional Emergency Declarations continuing the exemptions granted in accordance with §§ 390.23 and 390.25 from Part 390 through 399 of the Federal Regulations (Federal Motor Carrier Safety Regulations), except as otherwise restricted by this declaration. The emergency declarations were in response to the extreme cold experienced throughout the Southern states from the polar vortex and the possible continuing effects of the arctic cold on people and property, including an immediate threat to human life or public welfare in the Southern United States.

The emergency exemption is issued as a result of extreme arctic cold weather conditions causing shortages and interruptions in the availability and/or delivery of propane and other home heating fuels throughout the States affected in the Southern Region to include the following: Kentucky, North Carolina, South Carolina, Georgia, Tennessee, Arkansas, Alabama, Mississippi, Louisiana, Oklahoma and Florida.

This declaration provides for the regulatory relief for commercial motor vehicle operations while providing direct assistance supporting the delivery of propane and home heating fuels into the affected areas and consumers in the above mentioned states during the emergency. Direct assistance terminates when a driver or commercial motor vehicle is used in interstate commerce to transport cargo or provide services not directly supporting the emergency relief effort.

Nothing contained in this declaration shall be construed as an exemption from the controlled substances and alcohol use and testing requirements (49 CFR Part 382), the commercial driver's license requirements (49 CFR Part 383), the financial responsibility (insurance) requirements (49 CFR Part 387), applicable size and weight requirements, or any other portion of the regulations not specifically authorized pursuant 49 CFR §390.23.

Emergency Declaration Restrictions & Limitations

By execution of this Emergency Declaration Extension, motor carriers and drivers providing direct assistance to the propane and home heating fuel emergency within the identified states are **not granted** emergency relief from and must comply with the following Federal Motor Carrier Safety Regulations (FMCSR) and conditions:

1. 49 CFR Part 392 related to the operation of a commercial motor vehicle in accordance with state laws and regulations, including compliance with applicable speed limits.
2. 49 CFR Part 392 related to operation of a commercial motor vehicle while a driver's ability or alertness is so impaired, or so like to become impaired, through fatigue, illness, or any other cause, as to make it unsafe for him/her to begin or continue to operate the commercial motor vehicle.
3. 49 CFR Part 395 related to the preparation, retention and accuracy of a driver's record of duty status (RODS). Drivers are directed to note "Emergency Declaration" in the remarks section of the RODS to identify that their operation is in direct assistance to the emergency relief.

4. A motor carrier whose driver is involved in a crash while operating under this emergency declaration must report any recordable crash within 24-hours, by phone or in writing, to the FMCSA Division Office where the motor carrier is domiciled. The carrier must report – date, time, location, driver and vehicle identification and brief description of the crash.

5. Motor carriers or drivers currently subject to an out-of-service order are **not eligible** for the relief granted by this declaration until they have met the applicable conditions for its rescission and the order has been rescinded by FMCSA.

6. Drivers for motor carriers operating under this declaration must have a copy of the declaration in their possession.

7. Upon termination of direct assistance to the emergency relief effort, the motor carrier and driver is subject to the requirements of 49 CFR Parts 390 through 399, except that a driver may return empty to the motor carrier's terminal or the driver's normal work reporting location under the terms of the declaration. Direct assistance terminates when a driver or commercial motor vehicle is used in interstate commerce to transport cargo not in direct furtherance of the emergency relief efforts. Upon return to the terminal or other location, the driver must be relieved of all duty and responsibilities.

8. Upon termination of direct assistance to the emergency relief effort, no motor carrier shall require or permit any driver used by it to drive, nor shall any such driver drive in interstate commerce until the driver has met the requirements of §395.3(a) and (c), and § 395.5(a).

In accordance with Title 49 CFR § 390.25, this declaration is effective today and shall remain in effect for the duration of the emergency (*as defined in Title 49 CFR § 390.5*) or until 11:59 P.M., CST, March 1, 2014 whichever is less.

Sincerely,

Darrell L. Ruban

Darrell L. Ruban
Field Administrator

APPENDIX H:
PETROLEUM SHORTAGE ANNEX

APPENDIX I:

Cyber Security PSC Order 2012-00428

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

CONSIDERATION OF THE IMPLEMENTATION
OF SMART GRID AND SMART METER
TECHNOLOGIES Case No. 2012-00428

Cybersecurity-

In the Executive Summary of the Report, the Joint Utilities state that all stakeholders' interests are aligned and that utilities should take reasonable measures to prevent cyber-attacks. However, they state that existing mandatory and voluntary cybersecurity standards, frameworks, and guidelines are sufficient, and that adding regulations or rules serves to weaken utilities' ability to thwart cyber-attacks. They state that the focus should be on the ability to evolve with emerging threats and not on compliance with cybersecurity standards. They believe an effective cybersecurity process is one that is continuously evolving based on emerging threat intelligence. As a result, they assert that additional requirements at the state level are not necessary or advisable.[83]

As the Joint Utilities note, some members are subject to mandatory cybersecurity standards to protect the Bulk Electric System.

These include the Critical Infrastructure ("CIP") Standards developed by the North American Electric Reliability Corporation ("NERC"), approved by the Federal Energy Regulatory Commission ("FERC"). and administered and enforced by NERC and its regional entities, including the SERC Reliability Corporation ("SERC") .[84] [85]

85. SERC has jurisdiction over all of Kentucky except the easternmost portion, which is under the jurisdiction of the Reliability First Corporation.

The Joint Utilities cite and discuss the eight CIP standards that apply to cybersecurity,[86] as well as the voluntary cybersecurity guidelines developed by the National Institute of Standards and Technology.[87]

The Joint Utilities also provide a discussion of the tools that comprise the "Guide to Developing a Cyber Security and Risk Mitigation Plan ," developed by the National Rural Electric Cooperatives Association and the Cooperative Research Network ("CRN"). The purpose of the CRN guide is to enable cooperatives to strengthen their security posture and allow for continuous improvement.[88]

Finally, the Joint Utilities cite the "Cyber Security Risk Assessment and Risk Mitigation Plan Review for the Kentucky Public Service Commission" ("Guernsey Report") that shows that oversight activities are being conducted for utilities not subject to mandatory requirements.[89]

The Guernsey Report offered a focused assessment and general guidance on areas of utility operations that may be susceptible to cyber threats for Kentucky's smaller electric cooperatives and other similarly situated entities. Although participation in the Guernsey cybersecurity assessment was voluntary and limited to only six electric cooperatives, the intent was to develop a document that could be a starting point for further evaluation and improvement of utility operations. Twenty one topical areas were identified in the Guernsey Report for the purpose of evaluating the general effectiveness of utility operations and identifying opportunities for improvement in mitigating cyber risks. Since release of the Guernsey Report, the Kentucky Association of Electric Cooperatives has spearheaded a workgroup to further develop operating procedures and work practices to address cybersecurity threats for its membership.

The Joint Utilities state that none of its group takes cybersecurity lightly.[90] However, they argue that more requirements may be counterproductive because cyberattacks are constantly evolving and a focus on compliance could create a false sense of security. [91]

The AG recommends that the Commission require compliance with the mandatory and voluntary standards, guidelines and resources cited in the Report.[92]

The AG also recommends that the Joint Utilities use the best foreseeable measures possible to secure their cybersecurity.[93] To support its position, the AG cites comments from several cybersecurity experts and from a Chairman's forum on cybersecurity hosted by the Commission.[94] CAC states that utilities should work diligently to take reasonable measures to prevent and defeat cyber-attacks.[95]

The Commission agrees with the Joint Utilities that a mature, effective cybersecurity process is one that is continuously evolving to address new cyber threats. However, the Commission believes that each utility should have some form of cybersecurity plan in place beyond the FERC or NERC mandatory standards. Therefore, the Commission will require that the Joint Utilities develop internal procedures addressing cybersecurity.

Having met with representatives of each of Kentucky's major jurisdictional electric, gas, and water utilities to discuss cybersecurity, the Commission is generally aware of the effort the Joint Utilities have taken (and are taking) to address cyber threats.[96]. Each utility particularly cited the confidential and sensitive nature of their plans to address cyber issues. Given the sensitivity of cybersecurity concerns, the utilities should be allowed to keep their procedures confidential. The Commission, therefore, will not require each utility's actual internal procedure be filed; rather each utility will be required to certify the development of cybersecurity procedures. The utilities will then be required to make a presentation describing their procedures to the Commission (and the AG, should he wish to attend).

In addition, the Joint Utilities will be required to continue to make cybersecurity presentations every two years to the Commission through the Track Meeting process.

All utilities are advised to develop, maintain and enforce a management approved written cybersecurity policy that addresses known and reasonably foreseeable cybersecurity risks. The policy and any subsequent procedures developed should incorporate essential elements of each utility's system that may be susceptible to cyber threats in conjunction with plans for hazard mitigation, emergency response and recovery and other relevant continuity of service arrangements.

96 The AG was invited and participated in person or by phone in each meeting.

APPENDIX J:

NATURAL GAS TRANSMISSION CAPACITY

APPENDIX K:

NATURAL GAS TRANSMISSION UTILITIES

APPENDIX L:
PRIME SUPPLIES CONTACTS

APPENDIX M:
Motor Fuels Retailers

APPENDIX N:
AVIATION FUEL DISTRIBUTORS

APPENDIX O:
PROPANE DISTRIBUTORS

APPENDIX P:

Hazardous Material Pipeline Disruption

Hazardous Material Pipeline Disruption
Response Protocol

Concept of Operations:

This protocol has been developed to address how the Energy and Environment Cabinet (EEC) and the Division of Emergency Management (KYEM) will respond to hazardous materials pipeline disruption.

Response
In the event of a hazardous materials pipeline disruption, (explosion, break, rupture, etc.), the EEC's Environmental Protection Division, (KDEP) Environmental Response Team (ERT) is the primary entity for coordinating state agency activities and response to oil and hazardous materials incident under Emergency Support Function 10 (ESF-10).

KDEP carries out the ESF 10 responsibilities under the KY Emergency Operation plan (EOP) to coordinate, integrate, and manage overall efforts to detect, identify, contain, clean up, dispose of, or minimize releases of oil or hazardous materials, and prevent, mitigate, or minimize the threat of potential releases, in accordance with existing delegations of authority.

KDEP will assign an ESF 10 representative to the State Emergency Operations Center (SEOC) who will work in conjunction with Kentucky Division of Emergency Management (KYEM), and other state and federal agencies on hazardous materials incidents.

Kentucky Division of Emergency Management (KYEM), in conjunction with local authorities, coordinates resources for all ESFs. Such functions include security of the area, monitoring, shelter measures, coordination of evacuation efforts, public information, warning statements, and logistic requirements. KYEM will also contact the affected Emergency Management Area Managers and local government officials and the Federal Emergency Management Agency (FEMA) as appropriate.

The ESF-12 served by the EEC's State Energy Office (SEO) and the Public Service Commission (PSC) will be activated either remotely or to the SEOC during times of energy emergencies. The SEO is the primary body responsible for facilitating the flow of information among and between states, federal, and non-governmental agencies during an energy emergency and has direct responsibility for the coordination of petroleum fuels – propane, heating oil, kerosene, gasoline and diesel fuels. The ESF 12 role is one of facilitator, channeling and sharing current energy emergency data within the Commonwealth and among all providers. This free exchange of information will aid in helping all participants maintain perspective on the energy situation and ongoing restoration efforts.

Impact Assessment
If the disruption involves a natural gas pipeline the PSC shall coordinate with the appropriate members of the Gas and Electric partners of the Energy Assurance Advisory Group (EAAG) established in ESF - 12 of the Kentucky Emergency Operations Plan (EOP). If the disruption involves a petroleum pipeline (crude oil, refined petroleum product or LPG), the SEO shall coordinate with the EAAG Petroleum partners.

The SEO-EEC will alert and coordinate with the Department of Energy – Office of Energy Assurance on all energy-related pipeline disruptions regardless of product. The SEO-EEC will keep the EEC Secretary, apprised of the situation. The SEO-EEC and the PSC, as appropriate, will also notify their counterparts in surrounding states if the pipeline disruption could affect energy supplies in those states.

HAZARDOUS MATERIALS PIPELINE DISRUPTION PROTOCOL
CONTACT LIST

Energy and Environment Cabinet-
Department of Environmental Protection – Emergency Response Team (ERT)
800.282.0868

Name	Title	Office Number	Cell Number	E-mail Address
James McCloud	Manager, ERT	(502) 782-6360	(606) 309-7506	James.Mccloud@ky.gov
Tony Hatton	Commissioner, DEP	(502) 782-6648	(502) 598-7372	Tony.Hatton@ky.gov

State Energy Office-SEO-EEC

Name	Title	Office Number	Cell Number	E-mail Address
Kenya Stump	Director, OEP	(502) 782-7083	(859) 333-7487	Kenya.stump@ky.gov
Amanda LeMaster	Energy Coordinator	(502) 782-0156	(502) 226-0043	Amanda.lemaster@ky.gov
Evan Moser	Environmental Scientist	(502) 782-7246s		Evan.Moser@kky.gov

Public Service Commission (PSC)
502-564-3940

Name	Title	Office Number	Cell Number	E-mail Address
Linda Bridwell	Vice Chairman	(502) 782.2560	(859) 537-0747	Linda.bridwell@ky.gov
Melissa Holbrook	Asst. Director DOI	(502) 782-2603	(502) 791-0583	Melissac.Holbrook@ky.gov
Lindsey Flora	Deputy Exec. Director	(502) 782-7000	(502) 330-5981	Lindsey.flora@ky.gov

Kentucky Division of Emergency Management (KYEM)
502.607.1682

Name	Title	Office Number	Cell Number	E-mail Address
Dustin Heiser	Asst. Director of Ops	(502) 607-1601	(502) 401-8558	Dustin.Heiser@ky-em.org
Steve Brukwicki	Ops Section Chief	(502) 607-5759	(502) 330-3407	Steven.e.brukwicki.nfg@mail.mil
Duty Officer (24/7)		(800) 255-2587		

APPENDIX Q:

Kentucky's Railroads

KENTUCKY ACTIVE RAIL LINES