



STEPPING LIGHTLY:

REDUCING THE ENVIRONMENTAL FOOTPRINT
OF OIL AND GAS PRODUCTION.

ABOUT IOGCC

The Interstate Oil and Gas Compact Commission is a multi-state government agency that is passionate about advancing the quality of life for all Americans. Without energy, the quality of life we enjoy today would not exist. That's why the Commission works to ensure our nation's oil and natural gas resources are conserved and maximized while protecting health, safety and the environment.

It's no secret that American energy is the most valuable to our nation. The responsible development of our own resources not only strengthens our economy by creating and maintaining jobs, but also lessens our dependence on foreign resources, making oil and natural gas available, and more affordable, for consumers.

The IOGCC advocates for environmentally-sound ways to increase the supply of American energy. We accomplish this by providing governors of member states with a clear and unified voice to Congress, while also serving as the authority on issues surrounding these vital resources.

The Commission also assists states in balancing a multitude of interests through sound regulatory practices. Our unique structure offers a highly effective forum for states, industry, Congress and the environmental community to share information and viewpoints to advance our nation's energy future. We stand dedicated to securing resources needed to ensure our nation's energy, economic and national security.

DISCLAIMERS AND ATTRIBUTION

This material is based upon work supported by the United States Department of Energy National Energy Technology Laboratory under Award Number DC-FC26-06NT42937. This document is based on the report of a study entitled "Reducing Onshore Natural Gas and Oil Exploration Impacts Using a Broad-Based Stakeholder Approach" conducted by ALL Consulting for the IOGCC. For more information about the IOGCC or to download the full copy of the study results "Reducing Onshore Natural Gas and Oil Exploration Impacts Using a Broad-Based Stakeholder Approach," visit the IOGCC Web site at www.iogcc.state.ok.us.

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OUR NATION AT A CROSSROADS

The path to meeting our nation's energy demands and the path to preservation of the natural world rarely seem to converge although they ultimately lead to the same place: quality of life. Fortunately, we are at a definitive moment in time where technology, knowledge, and necessity have increased to the point where it is possible to produce the nation's precious resources while also protecting the environment.

As part of its mission to promote the conservation and efficient recovery of domestic oil and natural gas resources while protecting health, safety and the environment, the IOGCC, through a cooperative agreement with the United States Department of Energy (DOE), contracted with ALL Consulting to conduct a study about technologies and practices that will reduce adverse environmental impacts that may result from oil and gas development. The results of the study, titled "Reducing Onshore Natural Gas and Oil Exploration Impacts Using a Broad-Based Stakeholder Approach," identifies and explores three important environmental issues that are being addressed using new technology and creative thinking. These critical issues are:

- **PROTECTING LANDSCAPES AND WATER BODIES**
- **PRESERVING AIR QUALITY**
- **SAFEGUARDING WILDLIFE**

This publication is designed to share the results of this study and to promote the IOGCC's continuing efforts to encourage collaboration among government agencies, energy producers, non-government organizations and private citizens to protect our natural world while meeting the nation's energy needs.

Air Quality

EARTH DAY 1970: A BREATH OF FRESH AIR

The 2008 Summer Olympics in Beijing pushed the issue of air quality front and center. Some athletes questioned the wisdom of going for the gold in a city where air pollution is so bad that many residents routinely wear surgical-type masks to protect themselves. Like China today, the United States once faced the growing pains that come hand-in-hand with burgeoning populations and booming industry. By the middle of the 20th Century, air quality in some heavily industrialized American cities was so poor that it sparked a movement culminating in the first Earth Day, April 22, 1970. Millions of people stood together to agree that environment is a treasure worth protecting.

While Earth Day 1970 marks the beginning of widespread public awareness of environmental protection, that historic event was actually the product of years of effort led by various other groups.

Oil producing states were among the first to promote conservation of oil and natural gas and work to ensure it is produced in harmony with the environment. Since its inception in 1935, the IOGCC, as the voice of producing states, has tackled environmental issues related to oil and gas production and the Commission continues to conduct research and public outreach activities to promote environmentally responsible recovery of domestic oil and gas. As science and technology show us new ways to protect the environment, the states will continue to lead the charge.

Thanks to all those environmentally aware pioneers who brought the topic into broad public awareness, the country enjoys better quality air today than it did even 25 years ago—and with vigilance, will continue to do so well into the future.



OIL AND GAS EXPLORATION AND PRODUCTION AND THE ENVIRONMENT: IMPROVING OUR AIR QUALITY

Because oil and gas exploration and production activities emit significantly less pollution than many other industries, state and federal environmental agencies traditionally focused their attention elsewhere. This is no longer the case. Having made a significant impact on air quality by targeting stationary single sources of air pollution, environmentalists and regulatory agencies now are eyeing the aggregate accumulation from smaller, movable sources of pollution and greenhouse gases, including the oil and gas industry. This document discusses the challenges the industry faces in working with regulators and environmental groups to address air quality issues as the demand for domestic fuel grows.

The following sections identify sources of air pollution associated with oil and gas exploration and production and describe existing solutions and emerging technology that the industry is using to reduce adverse effects to air quality.

WANTED: FUGITIVE EMISSIONS

Escaped gases, commonly called “fugitive emissions” are a source of air pollution associated with oil and gas production. These gases, which are a byproduct of oil and gas production, may escape into the air unintentionally through leaks in pipes or equipment or, in some cases, small quantities (called “stranded gas”) are released (“vented”) or burned (“flared”) as a safety measure to prevent buildup of flammable gas. Reduction of both intentional and unintentional release of fugitive emissions is being accomplished by the oil and gas industry using a variety of methods.

Advances in technology make it both possible and economical for producers to capture stranded gas. Vapor Recovery Units (VRUs), capture approximately 95 percent of the flared or vented gas and directs it into pipelines. The captured gas can then be used to fuel onsite equipment, such as turbine power generators, or marketed along with other hydrocarbon products to create a win-win solution for producers and for the environment.

Another important advancement is the introduction of Leak Detection and Repair (LDAR) programs that use mobile infrared technology to spot previously undetectable levels of escaped gases. Infrared LADR programs save time, money, and protect the environment by allowing maintenance teams to repair minor leaks before they become significant sources of emissions.

Enhanced Oil Recovery (EOR) projects sometimes use injected gas such as carbon dioxide (CO₂) to improve the production of aging fields. CO₂ injection has been used effectively to increase oil production within the Permian Basin region of west Texas and southeast New Mexico since 1972, and many other regions since the early 1980s.

Although EOR projects have been successfully regulated by the states historically, the IOGCC recognized more than six years ago that as the technology progresses more consideration should be given to just how CO₂ injection and possible storage should be regulated.

Scientists are continuing to assess the impact of a variety of factors that could influence climate change. CO₂ levels have risen in the atmosphere and some scientists believe this could affect climate; however, methods of reducing this amount of CO₂ are being considered. The DOE considers the capture and injection of CO₂ into secure underground geologic formations - such as those that trap oil and natural gas - to be “one of the most promising ways” for reducing CO₂ levels.

In 2002, the IOGCC established a Geological CO₂ Sequestration Task Force, funded by DOE and its National Energy Technology Laboratory (NETL), to examine the technical, policy and regulatory issues related to the safe and effective storage of CO₂ in

subsurface geological media for both enhanced oil recovery and long-term CO₂ storage. In 2006, the task force began work on Phase II of the project to develop a detailed guidance document, which was completed and released in October 2007.



FOSSIL FUEL COMBUSTION ENGINES

Although the amount of fossil fuels consumed in the exploration and production of oil and gas is small compared to that of many other sources, reducing emissions from combustion engines is an important step that the industry can take to do its part to keep our air clean. Combustion engines

supply essentially all the power needed to operate drilling equipment. They provide power to pump jacks, compressor engines, dehydrators, other gas-processing equipment, and virtually all the vehicles used in the development of oil and gas sites. A fundamental step that oil and gas producers—and anyone else who uses fossil fuel combustion engines— can take in reducing harmful emissions is to operate and maintain

combustion engines according to the manufacturer’s instructions. In some cases it is feasible for operators to use an electric generator to replace several smaller internal combustion engines with one larger lean-burn engine for lower overall emissions.



DUST IN THE WIND

Air quality at well sites due to construction and access activities can be a concern. Dust kicked up by excavation and traffic, and diesel exhaust from vehicles can become suspended in the air as particulate matter, which the U.S. Environmental Protection Agency (EPA) regulates according to size. Practices that reduce particulate matter include spraying roads and pads with water to settle the dust and following proper maintenance schedules on vehicles or upgrading to vehicles that produce fewer emissions. The use of horizontal and directional drilling is dramatically reducing land disturbance because it allows production of several wells from a single location. Another solution operators are using is the sharing of central production facilities

with gathering lines from multiple wells. Technology, along with cooperation and some small efforts on the part of producers has come a long way in reducing the industry's footprint on the landscape. All along the way, state programs have sought to encourage best practices in road building and dust control.



REGULATORY OUTLOOK: CLEARING THE AIR

Permitting requirements for oil and gas production vary from state to state and region to region, and sometimes are interpreted differently within areas of the same oil or gas field. While awareness of air quality issues like global warming is a good thing, the resulting permitting processes have become a regulatory jungle. Most of the independent operators --- who produce 90 percent of this country's oil and gas --- have 20 or fewer employees. Many operators view air regulations and permits as overly complex. One major oil producer identified more than 900 sites and 80,000 different permit-related tasks, including 5,000 different environmental permits that required compliance tracking. The federal government's air pollution regulations are organized into a 22-volume document of more than 12,000 pages that the EPA is charged with enforcing. While the EPA retains the right to intercede, most of the regulatory requirements are delegated to local, state, federal, and tribal agencies, so a single activity might require a permit from several agencies.

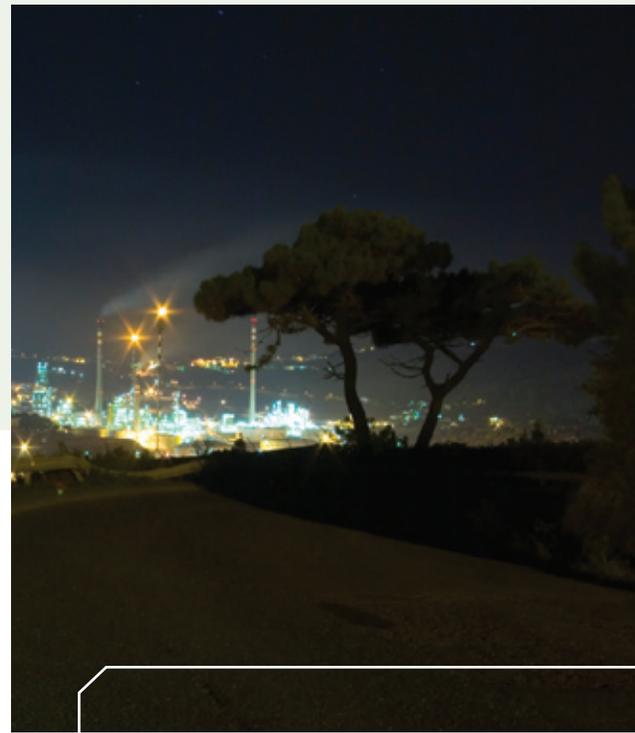
Use of a customized environmental management system (EMS), including software applications and permitting templates, can help oil and gas operators of every size to navigate the maze of regulations and permits and minimize delays that eventually end up costing consumers. The EPA has established online Compliance Assistance Centers to help various industries to understand their environmental obligations. Another way the EPA is assisting the industry is by allowing some permitting requirements to be evaluated on a case-by-case basis. Often, when oil and gas producers talk about regulatory burdens, they are not complaining about the measures they have to take to protect the environment; they are taking issue with the often bureaucratic and always complicated amount of time-consuming paperwork that the permitting process requires. A streamlined, collaborative, and cooperative approach to environmental compliance can make things easier for everyone and significantly improve the nation's air quality.

THIS LAND IS OUR LAND

Perhaps no event in history serves better to illustrate the effects man and machinery can have on the natural landscape than the infamous “Dust Bowl” of the great depression era. Increased demand for food driven by a population boom and World War I, compounded by a lack of information on the importance of soil conservation led to thick clouds of dust that choked the plains and dimmed the light of the sun as far away as the East Coast. Folklore has it that on the April day in 1935 when Hugh Hammond Bennett presented testimony to Congress stressing the need for a permanent soil conservation agency a dust storm descended on the skies of Washington. The research and education efforts of the Soil Conservation Service continue to protect the land today.

Having learned an important lesson, farmers put emerging technology, such as gasoline- operated farm equipment, to work in ways that protect the land while increasing crop yield. With the demand for energy outpacing production, through the IOGCC state regulators are working with the oil and gas industry to promote earth-friendly practices to protect the land and enable efficient, economic production of the resources available to meet the nation’s growing need for fuel. Whereas wildcatters once approached oil and gas fields with the same reckless abandon that farmers displayed when plowing up the southern plains, modern petroleum producers are working to find ways to mitigate—or avoid altogether—disturbing the land.

SURFACE DISTURBANCE



21ST CENTURY SOLUTIONS HORIZONTAL AND DIRECTIONAL DRILLING

Advances in technology are changing the way the world, including the oil industry, gets its work done. In the past, each well required construction of an individual site; building roads, installing power lines, excavating a drilling pad, and other activities that altered the landscape. Today computer-assisted horizontal and directional drilling techniques make it possible to drill multiple wells from a single location. Producers can reduce their environmental footprint to one site to recover reserves that would have required the construction of five, 10, or even more well sites in the past. Fewer sites mean less road traffic, reduced risk of land and water pollution, and more economical recovery of oil and gas. In addition to being more earth-friendly, directional drilling is wallet-friendly: reduced production costs translate into lowered energy bills for consumers.

EXTRA-TERRESTRIAL COMMUNICATIONS

Satellite communications make it possible to perform many tasks that once required having a “man on the ground.” Global Positioning System (GPS) and satellite imaging can be used to scope out a location before a shovel of dirt is overturned. Engineers are able to design earth-friendly solutions to access, construct, and manage well sites using the view from space. Rainwater can be managed with a birds-eye view of stream channels guiding development plans. Once construction is underway, satellite communications enable efficient

scheduling and work management to reduce unnecessary truck traffic. Boosted by the power of state-of-the-art seismic imaging programs that make the prospect of drilling a dry hole much less likely, satellite communications and directional drilling are enabling more petroleum production with less impact on the landscape than ever before.

Laptop computers, cell phones, PDAs, and all the other electronic gadgets that have become almost indispensable to many of us have also proven

themselves valuable tools that make oil and gas recovery more economical and environmentally friendly. Many state regulatory agencies have digitized records and implemented online permitting processes that drastically reduce auto travel and time for regulators and producers. The IOGCC is currently working on a project in conjunction with the DOE to determine the effects technology is having on energy production and to share information on the problems and successes state regulators have encountered so that other states may benefit from their experiences.

KEEPING THE LAND GRAND

The concept of proactive reclamation is being put to work in oil and gas exploration and production. Rather than wait until a well is completed to begin reclamation efforts, problems can be reduced or eliminated from the beginning. A good example of this is using wash stations to get rid of seeds picked up by vehicle tires. Washing the vehicle tires helps to avoid the introduction of plants and noxious weeds into areas where they are not naturally present. Other intermediate actions, such as reseeding with native grasses, help reduce erosion and keep the site looking beautiful. Erecting fences made with attractive materials, feathering cuts in vegetation, and building gently curving roads that blend into the landscape improve the visual impact of drilling activities. During the life of a well, producers can work with landowners to find creative ways to conceal tanks and other infrastructure, such as constructing sheds that complement the local architecture. Careful selection of paint colors to blend into the surrounding landscape is a simple solution that some producers use to make well sites less noticeable.



THE OLD FASHIONED WAY: USER INTERFACE

Oil and gas production often occurs alongside other planned uses such as agriculture, housing development, and recreational activity. Through cooperative agreements with landowners and other users, the infrastructure necessary to extract petroleum reserves can be built to fill multiple needs. Roads can be constructed or upgraded to bear the increased traffic anticipated for new housing development or to give a rancher better access to pastures, cropland, or water sources. Power lines

strung up or buried alongside utilities other users are developing confine the impact from two or more projects into one smaller environmental footprint. In urban areas, well sites can be constructed on parcels of property that are undesirable or ill suited for homes or businesses. In many places, storm water drain-off caused by access roads and drilling activity is being routed in ways that benefit recreational use or assist communities in meeting their needs. Produced water can be cleaned and

used for crop irrigation or livestock use. The IOGCC has made available a set of comprehensive tools for the practical management of produced water on their website to help regulators and producers manage this environmentally important byproduct of oil and gas production. Communication, early and often, between oil producers, landowners, and the public is key to building relationships that will help everyone meet their goals.

QUALITY OF LIFE—WE CAN GET THERE TOGETHER

The development of onshore petroleum resources presents environmental challenges everywhere from the Sabine River Wetlands of Texas to the wide-open spaces of Wyoming to the frozen tundra of Alaska. Unfortunately, the solutions are not one-size-fits-all. Oil and gas producers find that by working alongside local regulators, landowners, public-interest groups, and other stakeholders, site-specific plans can be developed that reduce the possibility of damage and assist their neighbors in accomplishing their own goals for the land. A well-developed and carefully executed plan for each individual drill site is pertinent to the quality of life that energy and the earth make possible.

WILDLIFE



COMPETING FOR SPACE: MAN VERSUS WILDLIFE

The call of the wild beckoned those who set out to tame the West. The explorers who set out along the Oregon Trail believed it was their “manifest destiny,” and perhaps their duty, to expand the United States from coast to coast. These pioneers were continuing the age-old competition between the plant and animal species, to expand toward the outer limits of available space. While some species learn to exist in harmony with other groups, others push out everything that is not able to adapt.

Human beings have been extremely successful in claiming territory for themselves. Fortunately for many other species, humans also have come to value the diversity of life forms that share the planet and are recognizing the need to preserve those plants and animals that do not adapt well to man’s intrusion. Challenges arise when the needs of one species conflict with the needs of another.

The study this publication is based on, Reducing Onshore Natural Gas and Oil Exploration and Production Impacts Using a Broad-Based Stakeholder Approach, takes a look at the issues involved with oil and gas production in relation to the sage grouse to facilitate an understanding of the types of challenges and compromises various groups face as they work toward peaceful coexistence between human energy needs and protection of wildlife.

ENERGY INDEPENDENCE: STRIKING A BALANCE

Fuel costs for transportation and heating increase the strain on American pocketbooks. In addition to the price of fuel, dependence on foreign oil costs taxpayers billions of dollars in security to protect the nation’s interests in the oil-producing regions of the world that supply 60 percent of our fuel. Although drilling for more oil and gas in the United States will not eliminate these issues, advances in technology that enhance the harvest of previously unrecoverable reserves are making domestic oil and gas exploration and production an important part of the overall solution to the country’s energy problems.

Much of the recoverable oil and gas sits below the surface of federally owned land that serves as a haven for a variety of plant and animal species. The challenge is to strike a balance between the human need to produce this energy source and the needs of other species such as the sage grouse. Approximately 72 percent of the range of the sage grouse is on federally managed land, making energy production in sage grouse habitat a controversial issue. Although everyone agrees the sage grouse population has declined over the last century, the cause of the decline, the methods used to count the population, and the effectiveness of habitat restoration activities have all been hotly debated.



Bird on a Wire

Sage grouse are important to the culture of the people who share the sagebrush steppe of North America. Some Native American tribes once considered the bird sacred—probably because it was an important source of food. Later, sage grouse provided both nourishment and sport for the pioneers. Two California colleges keep the tradition alive by using the peculiar-looking bird as an athletic team mascot. In addition to its historic significance, sage grouse continue to provide a source of tourism dollars from hunters.

The migratory birds return to ancestral breeding grounds, or “leks,” each year to reproduce. Sage grouse require unbroken expanses of sagebrush or similar groundcover. The grouse’s need for space make coexistence with humans a challenge. A number of factors, including energy production, urbanization, herbicide use, invasive plants, agriculture, and intensive cattle grazing, have reduced sage grouse habitat significantly over the last century.

In 2005, the U.S. Fish and Wildlife Service (USFWS) completed a status review for listing the greater sage grouse under the Endangered Species Act. Although some areas showed significant declines in sage grouse populations, the USFWS determined that with an estimated total population of 100,000 to 500,000 birds, the species is not in significant jeopardy. Although this decision caused some controversy, the USFWS cites stabilized and even increasing populations in some states as justification for leaving the bird off the endangered species list.

Although it is not listed as endangered, the sage grouse has the support of a number of groups that are working to secure the bird’s future. The Bureau of Land Management (BLM), which administers more than half of the sagebrush habitat, considers the bird a “sensitive species” and has developed a National Sage Grouse Habitat Conservation Strategy. Other government organizations cooperating in sage grouse habitat management include the Western Association of Fish and Wildlife Agencies (WAFWA), the U.S. Geological Survey, the U.S. Forest Service, and the National Resource Conservation Service. Conservation groups, landowners, and industry members serve on working groups established by WAFWA while other interested parties have developed non-government partnerships such as the Cooperative Sagebrush Initiative.

Study and conservation methods used by these groups include geographical information systems (GIS) monitoring of leks, radio telemetry collars to track birds, evaluation of land reclamation projects, prescribed burning, and habitat restoration initiatives.

Oil and gas producers play a significant role in habitat conservation. In some areas such as the Cedar Creek Anticline and Powder River Basin, the industry surveys and monitors the birds while collecting data that are important to the development of conservation programs. The oil and gas industry also is becoming a more proactive partner in environmental protection by funding research and implementing best management practices (BMPs) that contribute to habitat conservation.

Oil and gas production BMPs that protect sage grouse include burying electrical lines to eliminate well site perches for raptors and other predators, green-stripping (planting strips of sagebrush and other vegetation) along access roads, reducing intrusive noise by locating water treatment plants and large compressors outside areas identified as crucial habitat, and suspending drilling operations during sage grouse mating seasons. Directional drilling technology allows the development of multiple wells from a single site and centralized processing facilities reduce habitat disturbance.



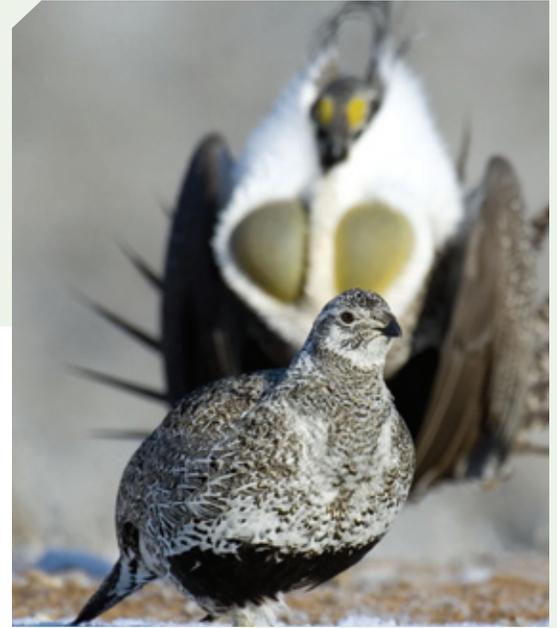
IOGCC'S 'FAIR TO FOWL' RECOMMENDATIONS

The IOGCC is passionate about advancing the quality of life for all Americans. However, without energy, the quality of life we enjoy today would not exist. The responsible development of domestic resources not only strengthens our economy by creating and maintaining jobs, but also lessens our dependence on foreign resources, making oil and natural gas more affordable for consumers. That is why the Commission works to ensure that oil and natural gas resources are conserved and maximized while protecting health, safety, and the environment. The IOGCC recommends:

Continuing collaboration between oil and gas producers, government agencies, landowners, and conservation groups to preserve sage grouse habitat.

Standardizing research methods to accurately assess bird populations and the effectiveness of conservation measures.

Sharing information and educating oil and gas producers on best management practices (BMPs).



SYNERGY: LIFE IS BETTER WHEN WE WORK TOGETHER

The IOGCC recognizes that the only way to address energy challenges appropriately is through an all-inclusive, collaborative approach that includes input and expertise from all of the parties involved, including industry, regulators, government representatives, and communities. Utilizing this synergistic approach, the hope is to find system-wide solutions that are the most beneficial.

The IOGCC urges legislators, regulators, producers and operators, individuals,

and communities to be good stewards of the environment, good citizens, and good neighbors. By working together to preserve the environment while meeting the nation's energy needs, these groups can mold various answers into one solution that is superior to the individual parts. This means establishing and developing relationships with other groups, going above and beyond what is required, and seeking to understand the perspectives of all of the parties involved in energy production.

IOGCC RECOMMENDATIONS //

Work collaboratively to create land use plans that take into account all of the probable effects of exploration and production on a given area so that efficient recovery of oil and gas resources occurs with the smallest environmental footprint possible.

Understand that local, state, and federal regulatory processes are designed to protect the environment. We urge regulators to streamline processes so that they are easier to understand and to navigate. We urge producers to cooperate and collaborate with regulators and local communities when preparing for exploration and production.

Be informed. Citizens can make the most of their efforts by learning about the energy production process and potential mitigation factors and becoming better partners in creating solutions that meet the needs of their area.



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