Offshore Access

to Oil and Natural Gas Resources

March 2016

For the latest report, please visit www.api.org/offshoreaccess and www.americasoffshoreenergy.com

Table of Contents

Our Offshore Energy Opportunity

Unlocking America's Offshore Energy Opportunity ..... Page 1
Atlantic Energy, American Jobs ..... Page 2
Energy and Opportunity in the Eastern Gulf ..... Page 3
Power and Jobs From the Pacific ..... Page 4
Alaska – A State of Energy ..... Page 5
Fifty Miles Offshore – Jobs Onshore ..... Page 6
The Offshore Energy We Need ..... Page 7
When You Look For Resources You Find Them ..... Page 8
Seismic Surveys: Why and How Are Seismic Surveys Done ..... Page 9
Seismic Surveys: Safety, Science, and Research ..... Page 10
The Myth of Idle Leases ..... Page 11
Today's Decisions, Tomorrow's Energy ..... Page 12
The Offshore Leasing Process ..... Page 13

Safety and Technology

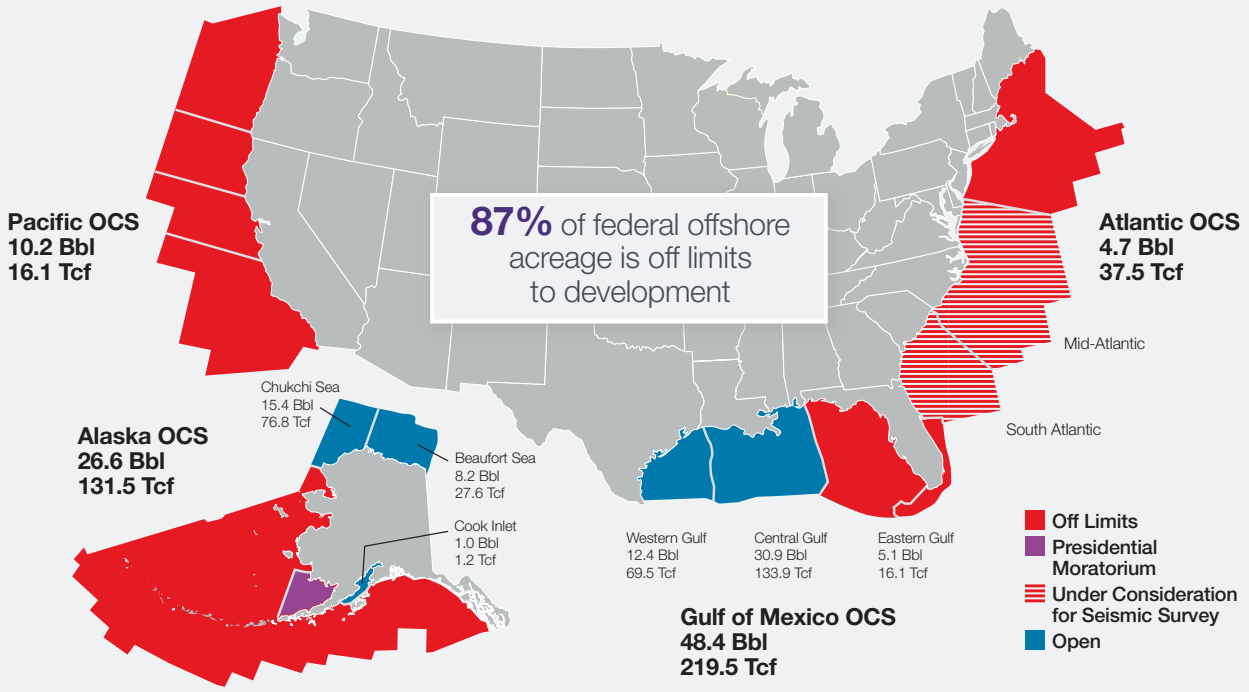
Standards ..... Page 15
Drilling Offshore ..... Page 16
Producing Offshore ..... Page 17
Subsea Production ..... Page 19
Oil Spill Response ..... Page 20
Subsea Well Control and Containment ..... Page 21
Industry Actions Since Macondo ..... Page 22
Federal Government Actions Since Macondo ..... Page 23
Resources ..... Page 24

Our Offshore Energy Opportunity

Unlocking America's Offshore Energy Opportunity

U.S. Offshore Undiscovered Technically Recoverable Federal Oil and Natural Gas Resources

(billion barrels — Bbl and trillion cubic feet — Tcf)



Source: The Bureau of Ocean Energy Management (BOEM).

America must pursue smart energy policy in order to continue as a global energy superpower. The U.S. Outer Continental Shelf (OCS) is estimated to contain vast undiscovered oil and natural gas resources. **Unfortunately, the federal government has placed most of the OCS off-limits to energy exploration and development.**

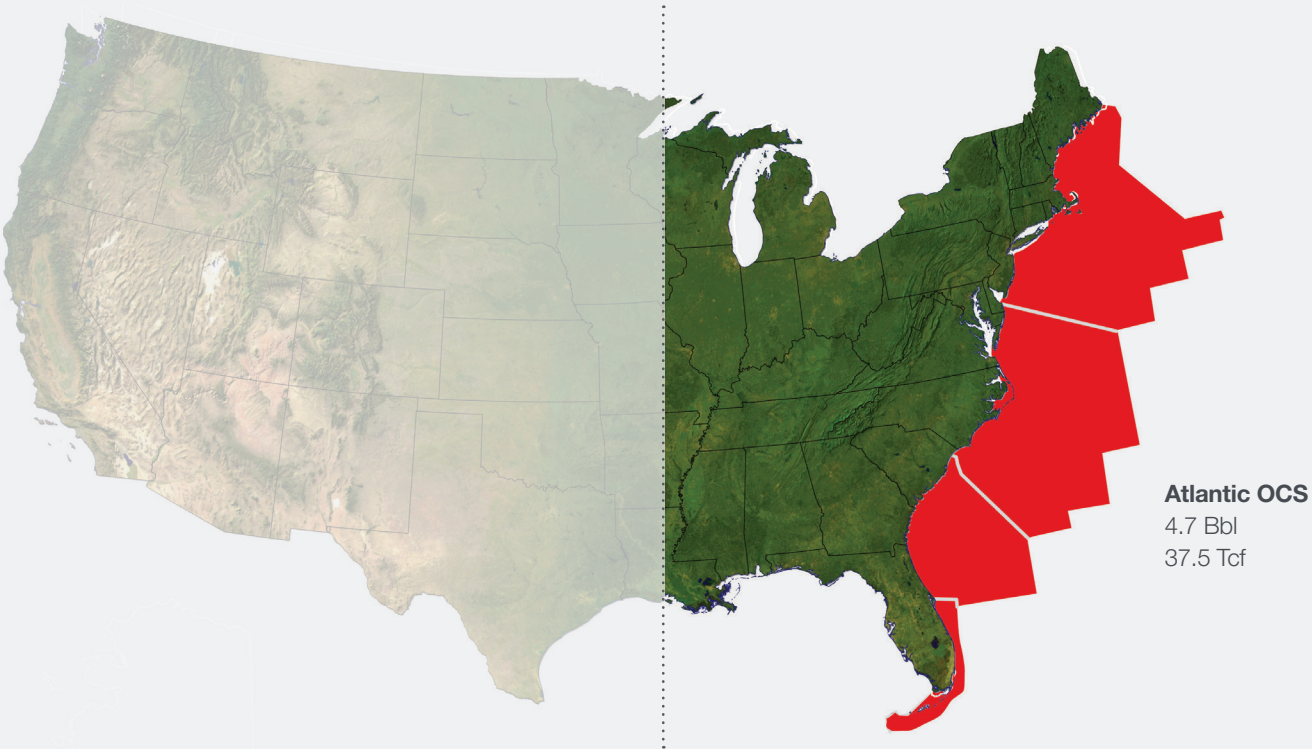
- The Bureau of Ocean Exploration and Management (BOEM) estimates that 89.9 billion barrels of oil and 404.6 trillion cubic feet of gas have yet to be discovered on the U.S. OCS.
- Unfortunately, some of **BOEM's estimates are 30 years old**. If Congress permits the use of state-of-the-art seismic surveying technology in largely unexplored areas of the Atlantic OCS, we may discover an even greater abundance of oil and natural gas.
- Developing these oil and natural gas resources will be vital to achieving energy security, growing our economy, and reducing government deficits.
- Studies by Quest Offshore Resources, Inc. show that offshore oil and natural gas leasing in the Atlantic OCS, Pacific OCS and Eastern Gulf of Mexico could, by 2035:
  - » Create nearly 840,000 American jobs
  - » Raise more than $200 billion in revenue for the government
  - » Increase U.S. energy production by 3.5 million barrels of oil equivalent per day

Even more jobs, energy and government revenue can be generated through greater development of oil and natural gas offshore Alaska.

- With over 65 years of experience operating in the Outer Continental Shelf, the oil and natural gas industry has a strong safety record, despite a work environment that often involves heavy equipment, hazardous materials, high temperatures and high pressures. Safety is our top priority, and we are constantly improving the technologies, standards and best practices, and programs that protect our workers and our environment.

Atlantic Energy American Jobs

Oil and natural gas production off our Atlantic coast could be great opportunities for the various regions. Developing oil and natural gas in the Atlantic could put hundreds of thousands of Americans to work, make us more energy secure, and bring in needed revenue for the government. But none of these benefits will appear unless the federal government follows pro-development energy policies



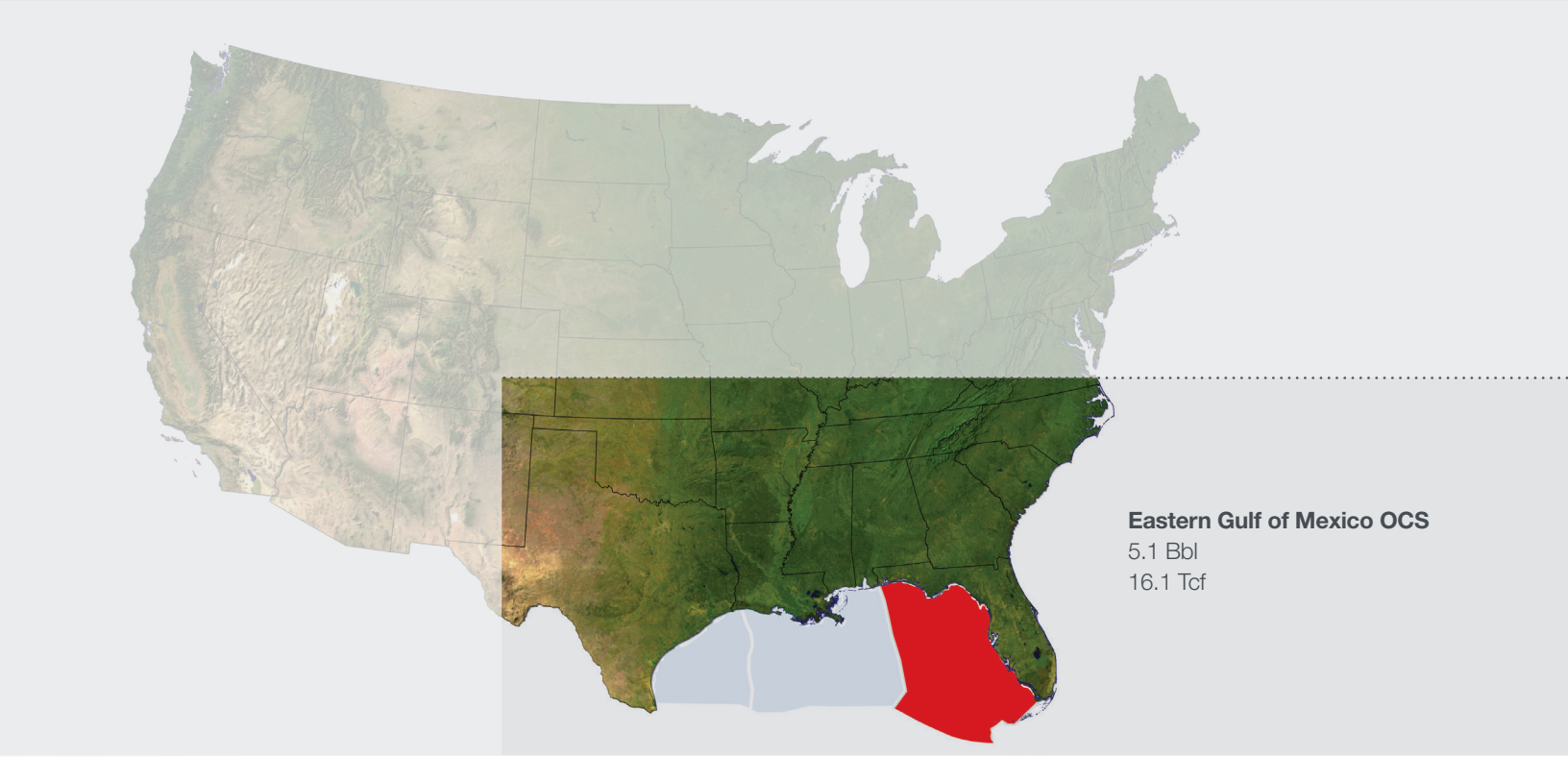
In January 2015, the Obama administration proposed a new offshore leasing program that includes plans for minor development of the Atlantic OCS. While this plan represents a positive first step, it remains an inadequate measure toward unlocking the nation's offshore energy potential. Despite overwhelming public support from Florida, Georgia, North Carolina, South Carolina and Virginia, just one lease sale is proposed in the Atlantic and would not happen until 2021.

Furthermore, the ultimate likelihood of a sale in the Atlantic remains tenuous according to Interior Secretary Sally Jewell, who declared that the Atlantic lease area may be "narrowed or taken out entirely in the future." Americans stand to benefit if the Atlantic and other offshore areas that have been kept off-limits are included in the next five-year leasing program. Major capital investments, job creation, and revenue to the government would all begin years before the first barrel goes to market. Expanding offshore energy production would also send a strong signal to the energy markets that America is leading the world in developing energy resources, which could help put downward pressure on prices.

Oil and natural gas development in the Atlantic OCS could deliver, by 2035:

- Nearly **280,000 new jobs** along the East Coast and across the country
- **$51 billion** in new revenue for the government
- **1.3 million barrels** of oil equivalent per day to domestic energy production

Energy and Opportunity in the Eastern Gulf



Increasing access to domestic sources of oil and natural gas would create new, good jobs when millions are still looking for work; bring billions of dollars to federal and state treasuries as governments are scrambling for revenue; reduce our balance of trade, and enhance America's energy security. Access to offshore resources currently off-limits in the Eastern Gulf of Mexico will benefit all Americans by providing more oil and natural gas to fuel our economy and maintain our quality of life.

98% of the Eastern Gulf of Mexico planning area is under a congressional leasing moratorium until 2022, putting nearly all of the area's 64.5 million acres off limits to oil and natural gas development. Granting access to the Eastern Gulf for oil and natural gas development could spur a flurry of investment and economic activity, putting hundreds of thousands of Americans to work, providing billions of dollars for federal and state treasuries, and further strengthening our energy security.

A recent study shows that providing access to Eastern Gulf of Mexico oil and gas resources could deliver, by 2035:

- Eastern Gulf of Mexico OCS resource development is projected to **support 230,000 jobs**
- **$18 billion** per year to the economy
- **$69 billion** in cumulative government revenue
- Nearly **1 million barrels** of oil equivalent per day and natural gas production

Power and Jobs from the Pacific

A balanced "all-of-the-above" energy policy will create jobs and spur investments in all forms of energy. No offshore oil and natural gas leases have been sold in the Pacific Outer Continental Shelf (OCS) since 1984, with the last of those limited to off southern and central California. None have been sold off the northern California, Oregon or Washington coasts since the 1960s.

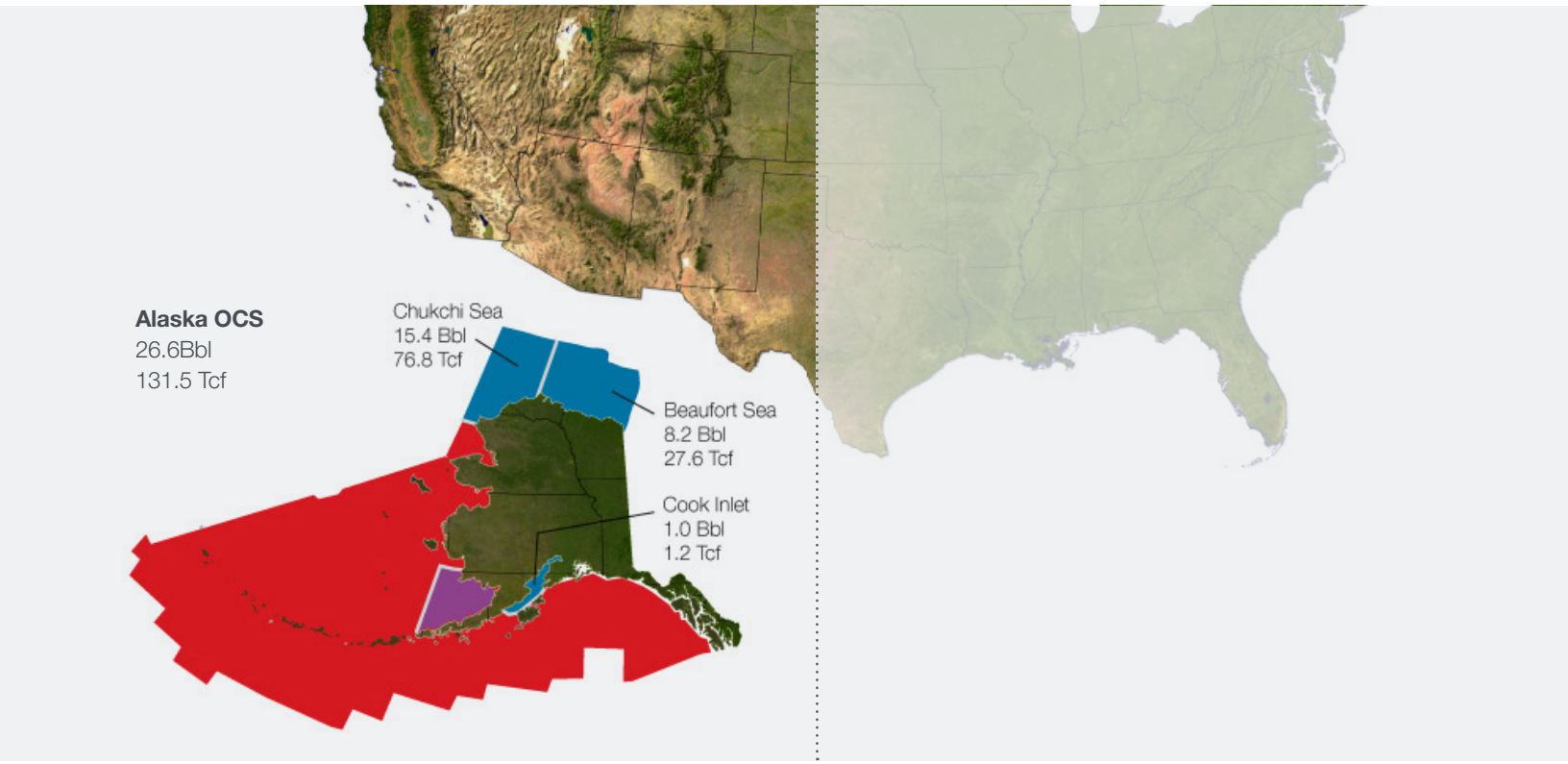
This means more than 240 million acres are currently off limits to oil and natural gas development. If access were provided to these areas it could launch a flurry of investment and economic activity, putting hundreds of thousands of Americans to work, providing billions of dollars for federal and state treasuries, and further strengthening our energy security.

Access to Pacific OCS oil and gas resources could deliver, by 2035:

- Pacific OCS resource development is projected to **support 330,000 jobs**
- **$28 Billion** per year to the economy
- **$81 Billion** in cumulative government revenue
- **1.2 Million barrels** of oil equivalent per day and natural gas production

Alaska A State of Energy

The long record of oil and natural gas operations in Alaska demonstrates that environmental impacts from exploration can occur in a way that enables protection of the environment, and with respect for the way of life of the people of the region and their communities.



Since statehood, Alaska has been among America's energy producing elites, an example to the lower 48 of what can be achieved with foresight, determination and innovation. It is one of the best examples of how energy policy can change not just the trajectory of energy production, but how it can greatly improve and enhance the lives and livelihoods of its citizens. And that developing energy resources to promote economic growth and to improve the lives of your citizens need not come at the expense of the environment or other natural resources.

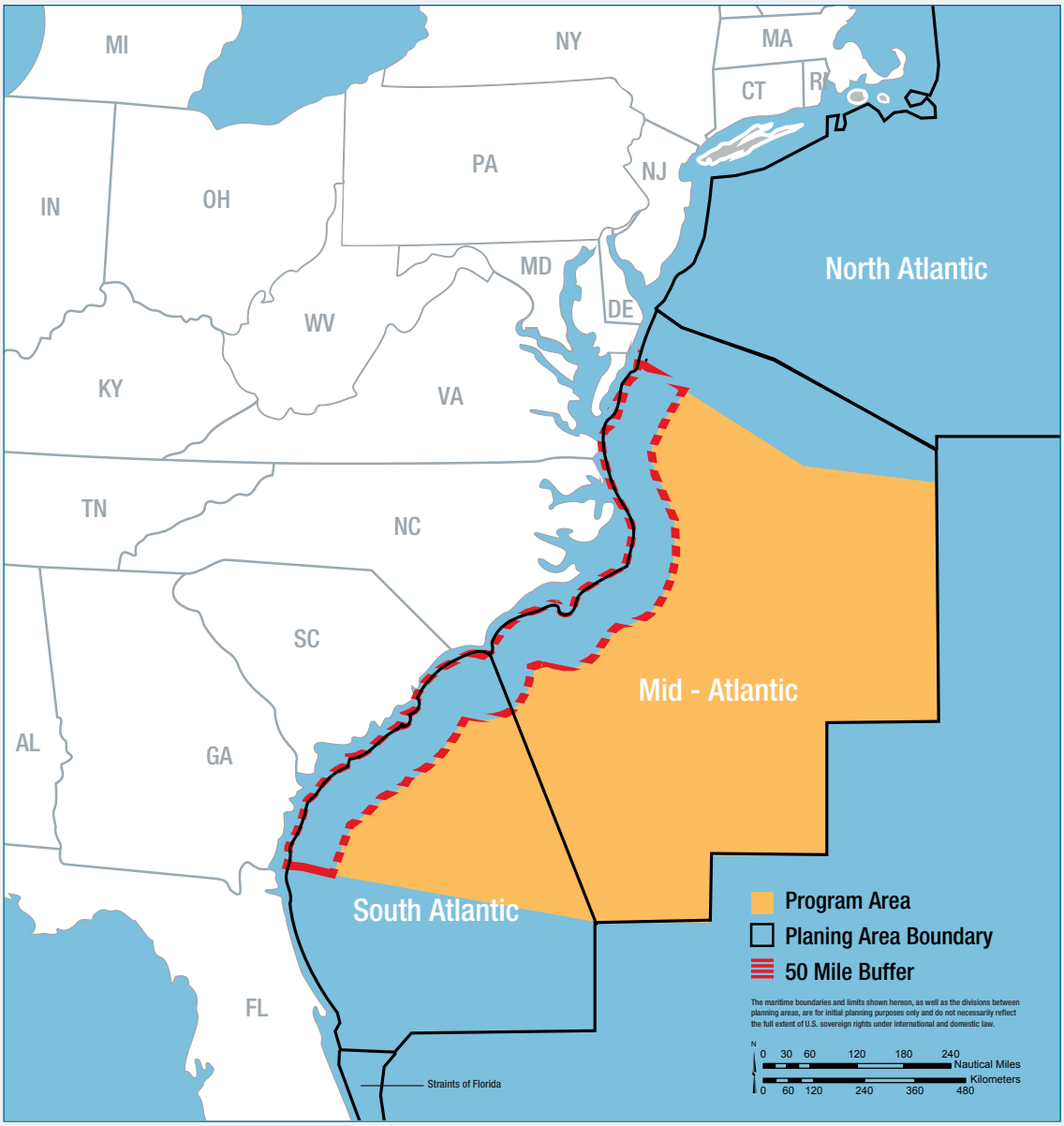
As it did a quarter century ago, Alaska today offers the U.S. an opportunity to increase our domestic oil supply. Exploiting that opportunity in the 1970s proved an extraordinarily valuable contribution to enhancing U.S. energy security. Given the prospects for future world supply, the value of the opportunity today is as great if not greater than it was then. But today the opportunity is not being seized, but forgone.

Policy makers need to embrace an 'all of the above' energy approach that leverages our offshore resources in Alaska to create an energy plan for America that boosts, rather than inhibits, our economy. The development of oil and gas resources in Alaska's OCS could produce almost 10 billion barrels of oil and 15 trillion cubic feet of natural gas – supporting almost 55,000 new jobs and **$145 billion** in new payroll nationally, as well as a total of **$193 billion** in government revenue through the year 2057. In addition increased OCS production in Alaska would also extend the operating life of the 800-mile Trans-Alaska Pipeline System (TAPS), a critical lifeline of domestic energy for America.

Based on current estimates, the Chukchi Sea and Beaufort Sea offer more energy resources than any other undeveloped U.S. basin. Fortunately, BOEM's draft leasing plan for 2017-2022 includes both these regions as targets for exploration and development.

Fifty Miles Offshore – Jobs Onshore

2017-2022 oil and Gas Leasing Draft Proposed Program. Midd-Atlantic and South Atlanic Program Area.



Source: http://www.boem.gov/Oil-and-Gas-Energy-Program/Leasing/Five-Year-Program/2017-2022/2017-2022-DPP-Mid-Atlantic-and-South-Atlantic.aspx

VIRGINIA: The Benefits of U.S. Offshore Oil and Natural Gas Development in the Atlantic

NORTH CAROLINA: The Benefits of U.S. Offshore Oil and Natural Gas Development in the Atlantic

SOUTH CAROLINA: The Benefits of U.S. Offshore Oil and Natural Gas Development in the Atlantic

The Bureau of Ocean Energy Management's proposed five-year plan calls for the Atlantic includes a 50-mile buffer zone where no drilling would occur which mean any activity would not be visible from shore.

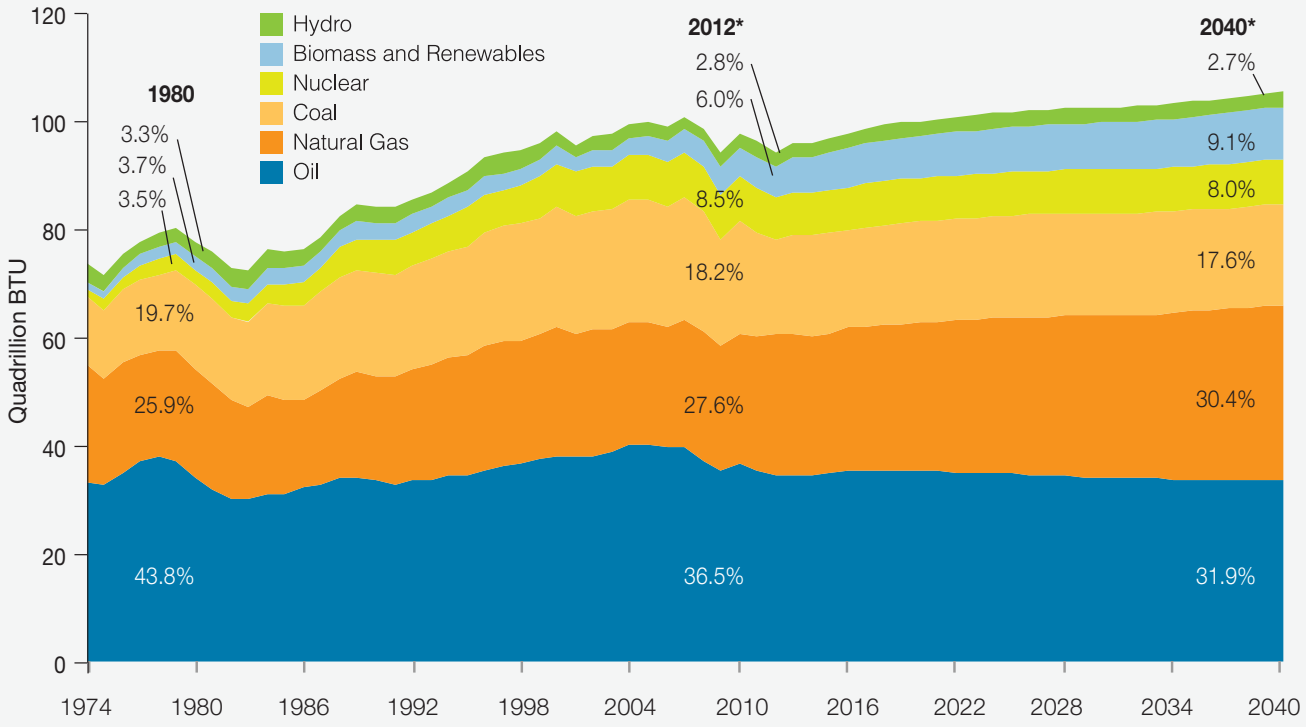
Meanwhile, onshore as lease sales and exploratory activity are completed, job creation and revenue to the government could all begin years before the first barrel goes to market.

And jobs are not isolated to the oil and natural gas companies; a diverse spectrum of industries from retail to real estate, from marine services in Virginia to high tech manufacturers in North Carolina and South Carolina will benefit.

Although the share of non-fossil fuels is growing rapidly, fossil fuels – oil, natural gas and coal – will continue to play leading roles through 2040

Future U.S. Energy Demand

The U.S. will require 12 percent more energy in 2040 than in 2012.



*Excludes non-biogenic municipal waste and net electricity imports. Source: EIA, Annual Energy Outlook 2014, Tables A1 and A17.

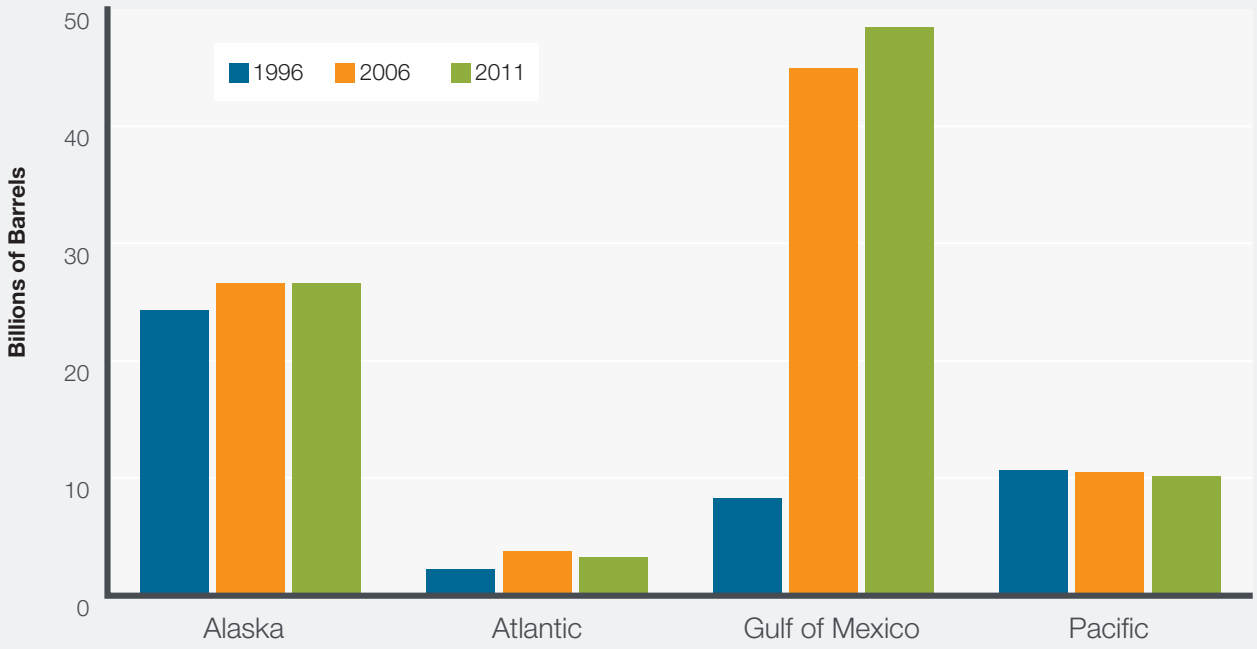
More total energy will be needed both in the United States and globally. The U.S. Energy Information Administration (EIA) forecasts U.S. energy demand will grow by 12 percent between 2012 and 2040, with more than 60 percent of the energy demand expected to be met by oil and natural gas, as is the case today. The United States is at the beginning of an energy revolution with domestic production reaching levels not seen in decades and our energy imports are falling. But in order to ensure our energy security and create economic growth it is vital that we take advantage of all of our energy resources, including those safely developed in American waters.

	2012		2040		
Consumption	**Quads**	**%Share**	**Quads**	**%Share**	**%Change**
Liquid Fuels and Other Petroleum	35.87	37.7%	35.35	33.3%	-1.4%
Oil	34.65	36.5%	33.86	31.9%	-2.3%
Ethanol, Biodiesel and Green Liquids	1.22	1.3%	1.49	1.4%	22.1%
Natural Gas	26.20	27.6%	32.32	30.4%	23.4%
Coal	17.34	18.2%	18.75	17.6%	8.1%
Nuclear Power	8.05	8.5%	8.49	8.0%	5.5%
Hydropower	2.67	2.8%	2.90	2.7%	8.6%
Biomass and Renewables	4.50	4.7%	8.15	7.7%	81.1%
Other**	0.39	0.4%	0.35	0.3%	-10.3%
Total	**95.02**	**100.0%**	**106.31**	**100.0%**	**11.9%**
Oil and Natural Gas	62.07	65.3%	67.67	63.7%	9.0%
Oil, Natural Gas and Coal	79.41	83.6%	86.42	81.3%	8.8%

**Other includes non-biogenic municipal solid waste and net electricity imports.

When You Look For Resources You Find Them

Oil — Undiscovered Technically Recoverable Resources of the OCS



Limiting access not only limits production but it also limits our knowledge about the resources we have. Government estimates of resources in Alaska, the Atlantic and Pacific remained flat over the past seventeen years, but estimates for the Gulf of Mexico have increased dramatically. Why? Because that's where production has been.

When oil and natural gas companies are allowed to look for oil and natural gas, they find it, and the statistics become more than just guesses or estimates. That's why the important number in the president's proposed five-year plan for offshore oil and natural gas development is that only 13 percent of the outer continental shelf (OCS) is open to actual drilling operations. And if you can't drill for oil and natural gas, you can't know how much you have.

Seismic Surveys Why and How Are Seismic Surveys Done

Seismic technology is the tool that guides the industry to locations where new resources can be discovered by drilling.

Why are Seismic Surveys Needed in the Atlantic OCS?

The first step in exploring for offshore oil and natural gas resources is often conducted through seismic surveys, which are like ultrasounds of the earth that help scientists "see" below the ocean floor.

- The last surveys of the Atlantic Outer Continental Shelf (OCS) were conducted over 30 years ago. Due to technological advances, the existing estimates of 4.7 billion barrels of oil and 37.5 trillion cubic feet of natural gas are out of date.
- Advances in seismic imaging technology and data processing over the last decade have dramatically improved the industry's ability to locate oil and natural gas offshore.
- Exploration and development activities generally lead to increased resource estimates. For example, in 1987 the Minerals Management Service estimated only 9.57 billion barrels of oil in the Gulf of Mexico. With more recent seismic data acquisition and additional exploratory drilling, that estimate rose in 2011 to 48.4 billion barrels of oil — a fivefold increase.

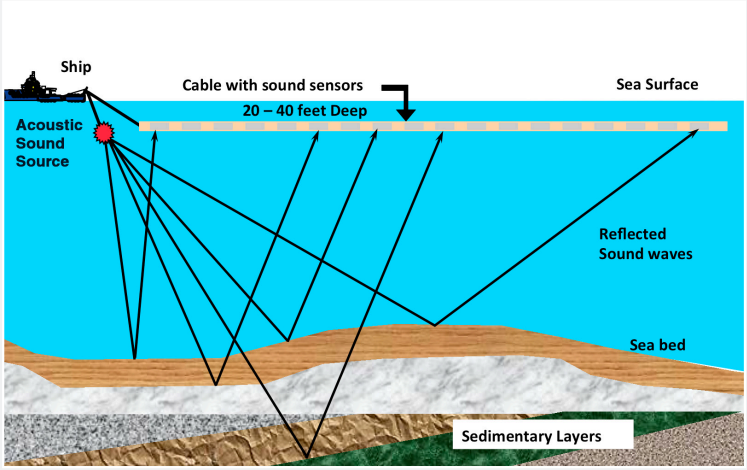
Seismic surveys are a safe and proven technology that help make offshore energy development safer and more efficient.

- Governments and the private sector have used this method of exploration in the U.S. and around the world for over 40 years.
- In addition to the oil and natural gas industry, seismic surveys are commonly used by the U.S. Geological Survey, the National Science Foundation, and the offshore wind industry.
- A rigorous permitting process ensures that seismic surveys are properly managed and conducted so they have minimal impact on the marine environment.

How do Seismic Surveys Work?

Sound waves help scientists map the ocean floor and geology beneath it.

- Surveyors release compressed air into the water to create short duration sound waves that reflect off subsurface rock layers and are "heard" by sensors being towed behind the vessel.
- Scientists analyze the collected data and use it to create maps of geologic structures that could contain energy resources beneath the ocean floor.
- The sound produced during seismic surveys is comparable in magnitude to many naturally occurring and other man-made ocean sound sources, including wind and wave action, rain, lightning strikes, marine life, and shipping.
- Survey operations are normally conducted at a speed of approximately 4.5 to 5 knots (~5.5 mph), with the sound source typically activated at 10-15 second intervals. As a result, the sound does not last long in any one location and is not at full volume 24 hours a day.



How do Seismic Surveys Impact Marine Life?

After examining decades of scientific research and real-world experience, federal regulators determined that seismic surveys in the Atlantic OCS will have no measurable impact on fish or marine mammal populations.

- In the words of the federal Bureau of Ocean Energy Management (BOEM), "there has been no documented scientific evidence of noise from air guns used in geological and geophysical (G&G) seismic activities adversely affecting marine animal populations or coastal communities."
- According to BOEM, seismic surveys in the Atlantic OCS "should not cause any deaths or injuries to the hearing of marine mammal[s] or sea turtles."
- Dr. William Brown, chief environmental officer for BOEM, told National Geographic that claims to the contrary are "wildly exaggerated and not supported by the evidence."
- While fish and some whales may swim away from an area and return after the survey vessel has passed, bottlenose dolphins are known to swim toward survey vessels to ride their bow waves.

Despite the already negligible risks, the industry follows standard operating procedures known as "mitigation measures" to provide even more protection for marine life.

- Trained protected species observers (PSOs) are onboard to watch for animals. Operations stop if certain marine animals enter an "exclusion zone" established around the operation and are not restarted until the zone is all-clear for at least 30 minutes.
- When starting a seismic survey, operators use a ramp-up procedure that gradually increases the sound level being produced, allowing animals to leave the area if the sound level becomes uncomfortable.

What is the Current State of Science and Research?

The best science and research indicates that seismic surveys have little-to-no impact on marine wildlife populations.

- Based on both available scientific knowledge and operational experience, there is no evidence to suggest that the sound produced during an oil and gas industry seismic survey has resulted in any physical or auditory injury to a marine mammal.
- Seismic surveys are predominantly low frequency. Not all marine life hears the same frequencies equally well. Just as humans, bats and dogs hear differently, some marine animals hear better at higher frequencies while others hear better at lower frequencies.
- The best available scientific information also indicates that any sound related injury to dolphins occurs at levels higher than the sound generated by a seismic survey.
- Animal strandings can occur for a number of reasons, e.g., sickness, disorientation, natural mortality, extreme weather conditions or injury, but no correlation has been found with seismic surveys.

The industry remains committed to improving the scientific understanding of the impacts of our operations on marine life.

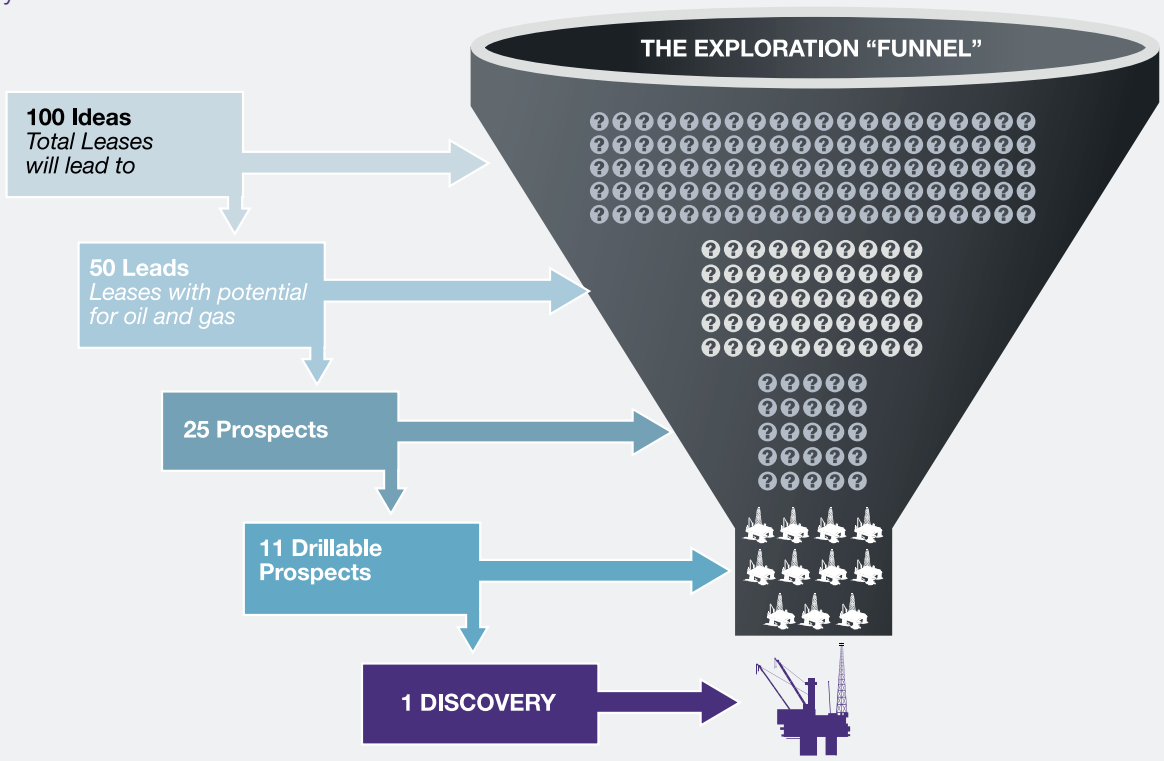
- To provide the utmost safety precautions, seismic surveys in the U.S. Outer Continental Shelf are only conducted with measures in place to protect animals from high sound exposure levels.
- Industry continually monitors the effectiveness of its mitigation strategies and funds research to better understand interactions between offshore operations and marine life, including fish.

Developed in conjunction with the International Association of Geophysical Contractors (IAGC) and the National Ocean Industries Association (NOIA).

The Myth of Idle Leases

The purchase of a lease is always a gamble. Exploration is not a risk-free proposition, but it is an essential part of the energy business. There is nothing idle about it.

The Myth of Idle Leases



Source: API, 2008.

Sometimes when a lease is not producing, critics claim it is "idle." Much more often than not, non-producing leases are not idle at all; they are under geological evaluation or in development and could become an important source of domestic supply.

Companies purchase leases hoping they will hold enough oil or natural gas to benefit consumers and become economically viable for production. Companies can spend millions of dollars to purchase a lease and then explore and develop it, only to find that it does not contain oil and natural gas in commercial quantities. It is not unusual for a company to spend in excess of $100 million only to drill a dry hole. The reason is that a company usually only has limited knowledge of resource potential when it buys a lease. Only after the lease is acquired will the company be in a position to evaluate it, usually with a very costly seismic survey followed by an exploration well.

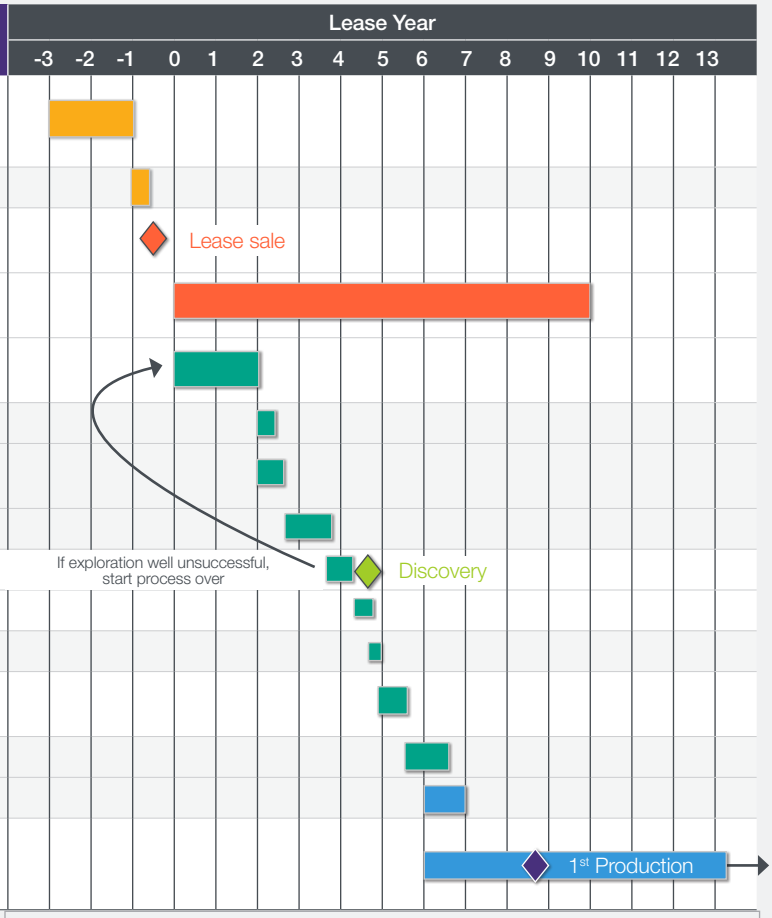
If a company does not find oil or natural gas in commercial quantities, the company hands the lease back to the government, incurs the loss of invested money and moves on to more promising leases.

If a company finds resources in commercial quantities, it will produce the lease. But there sometimes can be delays — often as long as ten years — for environmental and engineering studies, to acquire permits, to install production facilities (or platforms for offshore leases) and to build the necessary infrastructure to bring the resources to market. Litigation, landowner disputes and regulatory hurdles also can delay the process.

Today's Decisions Tomorrow's Energy

Gulf of Mexico Deepwater Frontier Exploration and Production Timeline
Individual Prospect: 5,000' Water Depth, 30,000' Drilling Depth

Cost (miilions)	Cumulative Cost (miilions)	Activity
$1-5	$1-5	Acquire 2D and 3D seismic and evaluate geological, geophysical and engineering data to identify leads/drilling ideas.
Prepare bids for lease sale.		
$10-200	$11-205	Lease sale - sealed competitive bidding process.
$1-2	$12-207	High bid leases awarded (10 year term). Cumulative annual lease rentals.
$5-10	$17-217	Acquire and interpret 3D and other data to turn ideas into drillable prospects.
Find partners to share costs to drill exploratory well.		
Perform shallow hazard, archeological and other regulatory permitting requirements to obtain federal approval to drill.		
Contract a rig to drill.		
$100-150	$117-367	Drill exploration well.
$40-60	$157-427	Drill sidetrack to exploration well.
Evaluate results.		
$100-300	$257-727	If encouraging, drill appraisal/delineation well(s) and sidetrack(s).
Evaluate well results, formulate plan of development for discovery.		
Prepare and file permits for development, wait for approvals.		
$1,000-5,000	$1,300-5,700	Sanction commerciality, build and install facility, drill and complete producing wells to achieve production.



Source: API.

Legend: Pre-Leasing Evaluation; Lease Term; Exploration Phase; Development Phase

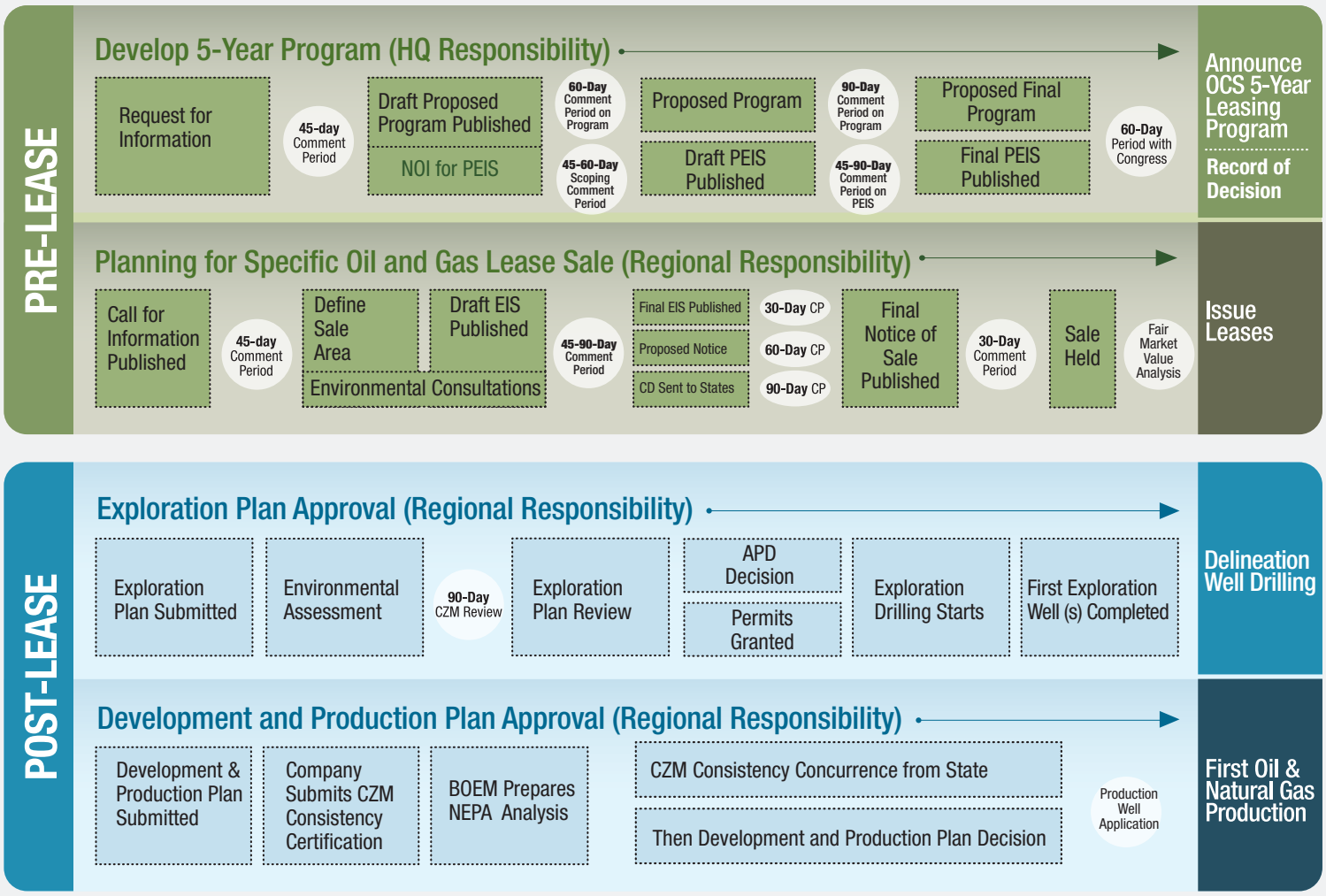
Keeping our role as the world leader in energy will require a commitment to opening new areas to offshore oil and natural gas development. Offshore oil and natural gas development is a long-term investment.

The energy America produces offshore today is only possible because of decisions made over several decades by both regulators and the private sector. For the same reason, how much energy we produce offshore fifteen and twenty years from now depends on the decisions being made today.

The Offshore Leasing Process

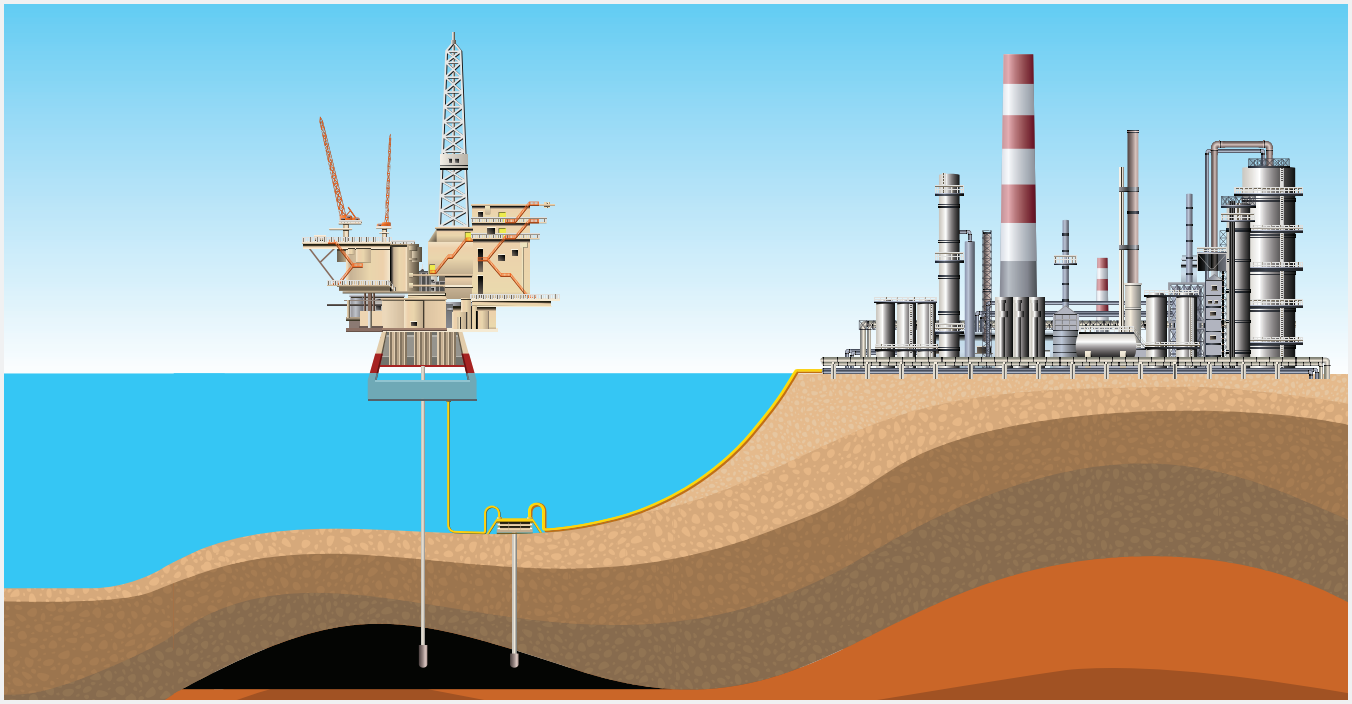
As required by the Outer Continental Shelf Lands Act, the U.S. Department of the Interior has a well-established process in place for managing offshore oil and natural gas leasing, exploration and development. With multiple environmental analyses and opportunities for stakeholder input, this process helps to balance the nation's need for energy with strong environmental safeguards.

OCS Oil and Gas Leasing, Exploration, and Development Process



Abbreviations: APD, Application for Permit to Drill; CD, Consistency Determination; CZM, Coastal Zone Management; EIS, Environmental Impact Statement; HQ, Headquarters; NEPA, National Environmental Policy Act, PEIS, Programmatic Environmental Impact Statement. www.api.org **Source: BOEM**

Safety and Technology



Delivering offshore energy to the American people is safer than ever as a result of industry's leadership and continuous investments in safety, as evident in API's robust slate of offshore standards, the Center for Offshore Safety, the Marine Well Containment Company and Helix Well Containment Group, and an enhanced regulatory regime. Extensive resources have been devoted to safety, drawing on the best minds from the industry and government to build a multi-layer system, with many built-in redundancies to help prevent incidents, to intervene and stop a release that might occur, and to manage and clean up spills.

There are 3 critical aspects to this network of safety for offshore operations:

1) Prevention, through industry standards, the promotion of robust safety and environmental management systems through the creation of the Center for Offshore Safety
2) New, innovative well containment and intervention capabilities
3) Improved planning and resources for oil spill response

Through API, the oil and natural gas industry is focused on prevention-oriented reforms, including new guidance on deepwater well design and installation, maintaining multiple barriers during well construction to mitigate any loss of well control, cementing to prevent and control flows, and operator and contractor interface.

Drilling Offshore

There are different types of drilling facilities, based on the depth of water.

In the search for oil and natural gas under the ocean, three general types of drilling rigs are used:

- A “jackup” drilling rig is a floating barge with drilling equipment on its deck and long support legs, and is used in shallow waters up to 300 feet.
- A semi-submersible is the most common type of offshore drilling rig, used for drilling in waters more than 300 feet deep. Semi-submersibles are floating vessels supported on large pontoon-like structures submerged below the sea surface. Semi-submersibles are attached to the ocean floor using strong chains or wire cables.
- Farther offshore, specially designed rigs mounted on ships can drill a well in waters over 10,000 feet deep. These rigs float and can be attached to the ocean bottom using traditional mooring and anchoring systems or they maintain their position by using thrusters to counteract winds, waves and currents.

There are different types of production facilities, based on the depth of water.

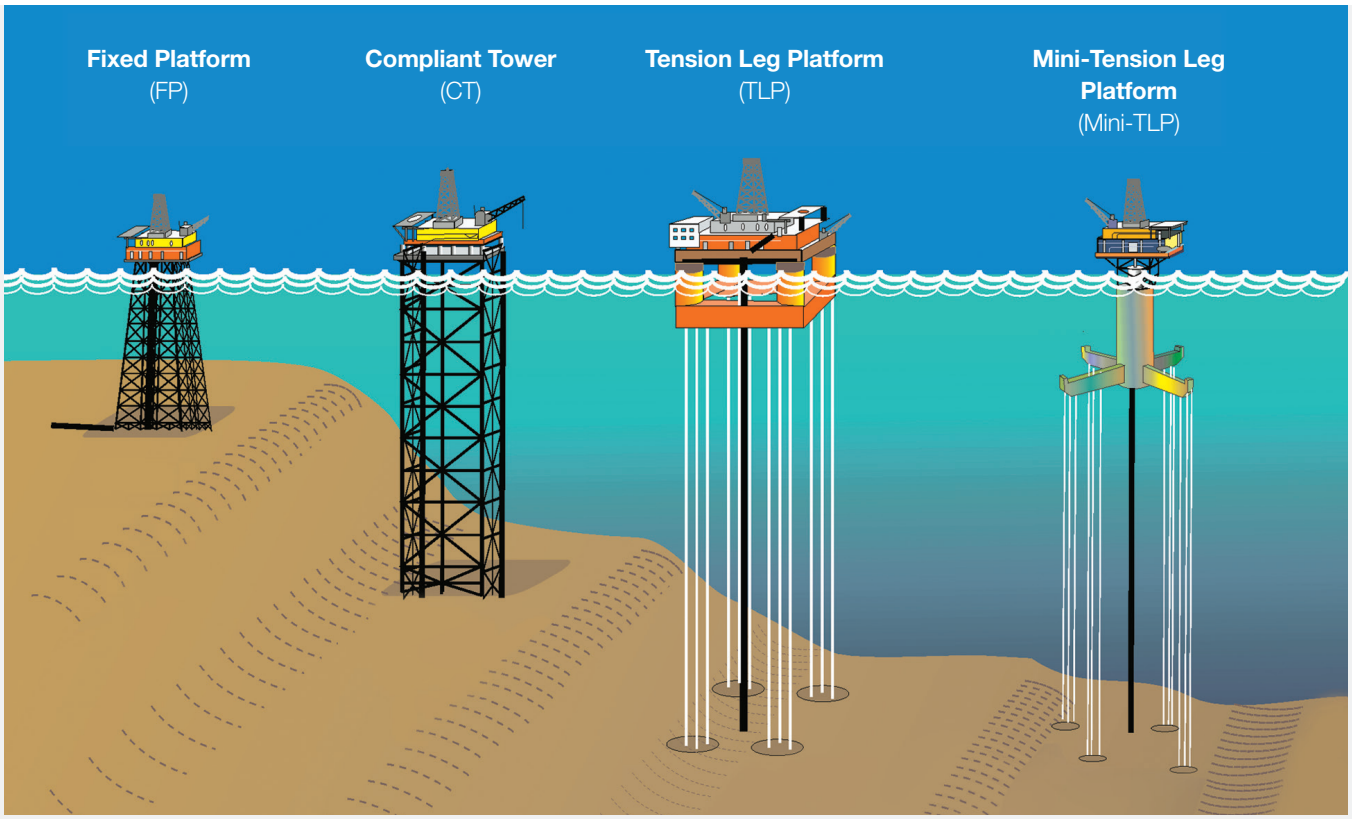


Image courtesy of The Bureau of Ocean Energy Management (BOEM)

Each of these systems is designed to withstand the wide range of wind and wave forces, including severe winter storms and hurricanes. Courtesy of the U.S. Minerals Management Service, here is a description of each type of platform:[2]

A **Fixed Platform (FP)** consists of a jacket (a tall vertical section made of tubular steel members supported by piles driven into the seabed) with a deck placed on top, providing space for crew quarters, a drilling rig, and production facilities. The fixed platform is economically feasible for installation in water depths up to 1,500 feet.

A **Compliant Tower (CT)** consists of a narrow, flexible tower and a piled foundation that can support a conventional deck for drilling and production operations. Unlike the fixed platform, the compliant tower withstands large lateral forces by sustaining significant lateral deflections, and is usually used in water depths between 1,000 and 2,000 feet.

A **Tension Leg Platform (TLP)** consists of a floating structure held in place by vertical, tensioned tendons connected to the sea floor by pile-secured templates. Tensioned tendons provide for the use of a TLP in a broad water depth range with limited vertical motion. The larger TLPs have been successfully deployed in water depths approaching 4,000 feet.

A **Mini-Tension Leg Platform (Mini-TLP)** is a floating mini-tension leg platform of relatively low cost developed for production of smaller deepwater reserves which would be uneconomic to produce using more conventional deepwater production systems. It can also be used as a utility, satellite, or early production platform for larger deepwater discoveries. The world's first mini-TLP was installed in the Gulf of Mexico in 1998.

[2] Deepwater Development Systems, Gulf of Mexico, www.gomr.mms.gov

The deeper the water, the more technologically advanced the equipment must be.

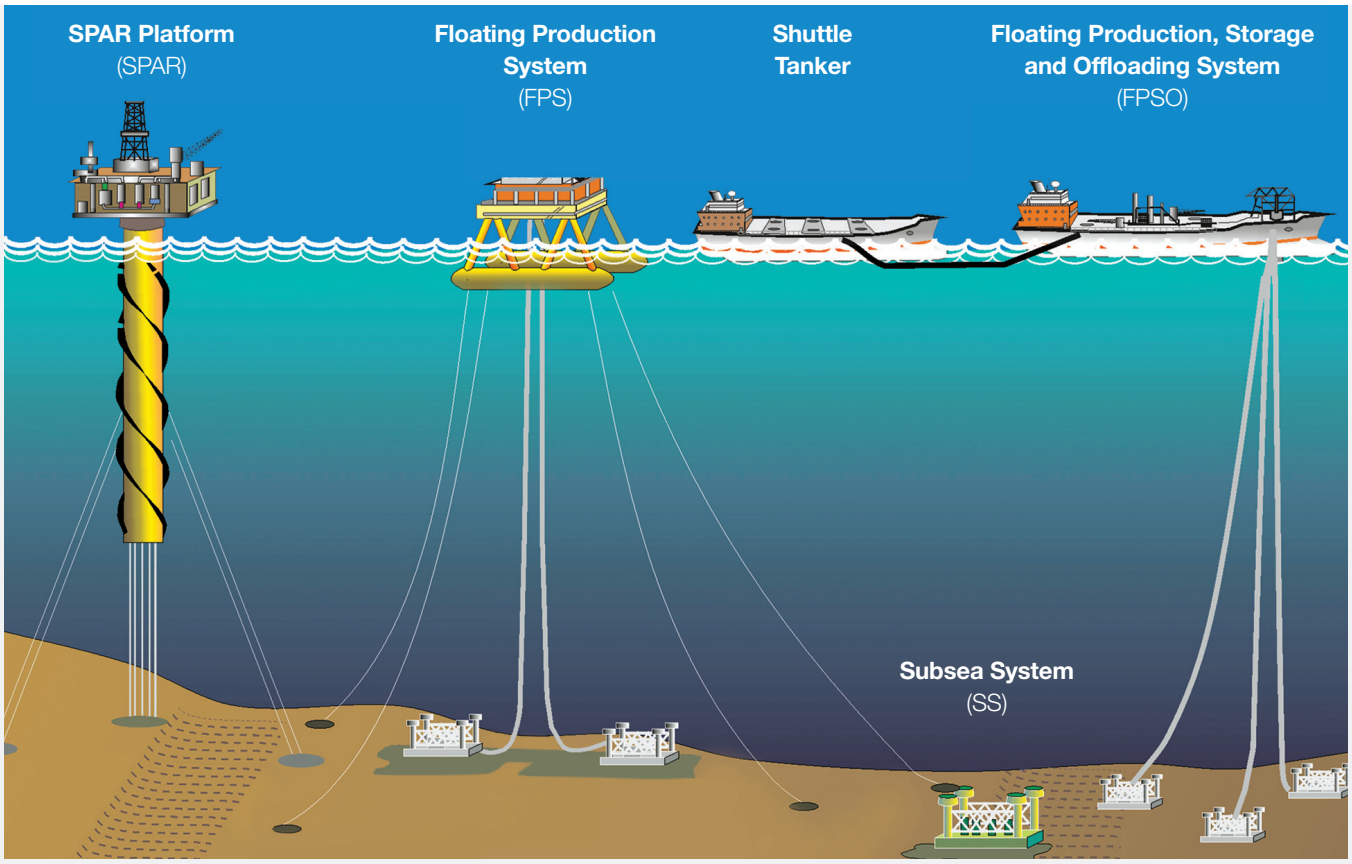


Image courtesy of The Bureau of Ocean Energy Management (BOEM)

A **SPAR Platform (SPAR)** consists of a large diameter single vertical cylinder supporting a deck. It has a typical fixed platform topside (surface deck with drilling and production equipment), three types of risers (production, drilling, and export), and a hull which is moored using a taut caternary system of six to twenty lines anchored into the seafloor. SPARs are presently used in water depths up to 3,000 feet, although existing technology can extend its use to water depths as great as 7,500 feet.

A **Floating Production System (FPS)** consists of a semi-submersible unit which is equipped with drilling and production equipment. It is anchored in place with wire rope and chain, or can be dynamically positioned using rotating thrusters. Production from subsea wells is transported to the surface deck through production risers designed to accommodate platform motion. The FPS can be used in ultra deep water.

A **Subsea System (SS)** ranges from single subsea wells producing to a nearby platform, FPS, or TLP to multiple wells producing through a manifold and pipeline system to a distant production facility. These systems are can be used in all water depths but are generally used in water depths greater than 1,000 feet.

A **Floating Production, Storage and Offloading System (FPSO)** consists of a large tanker type vessel moored to the seafloor. An FPSO is designed to process and stow production from nearby subsea wells and to periodically offload the stored oil to a smaller shuttle tanker. The shuttle tanker then transports the oil to an onshore facility for further processing. An FPSO may be suited for marginally economic fields located in remote deepwater areas where a pipeline infrastructure does not exist.

Subsea Production

The search for resources deep below the ocean has spurred tremendous technological innovation, including the ability to produce and transport these resources using equipment installed on the floor of the ocean.

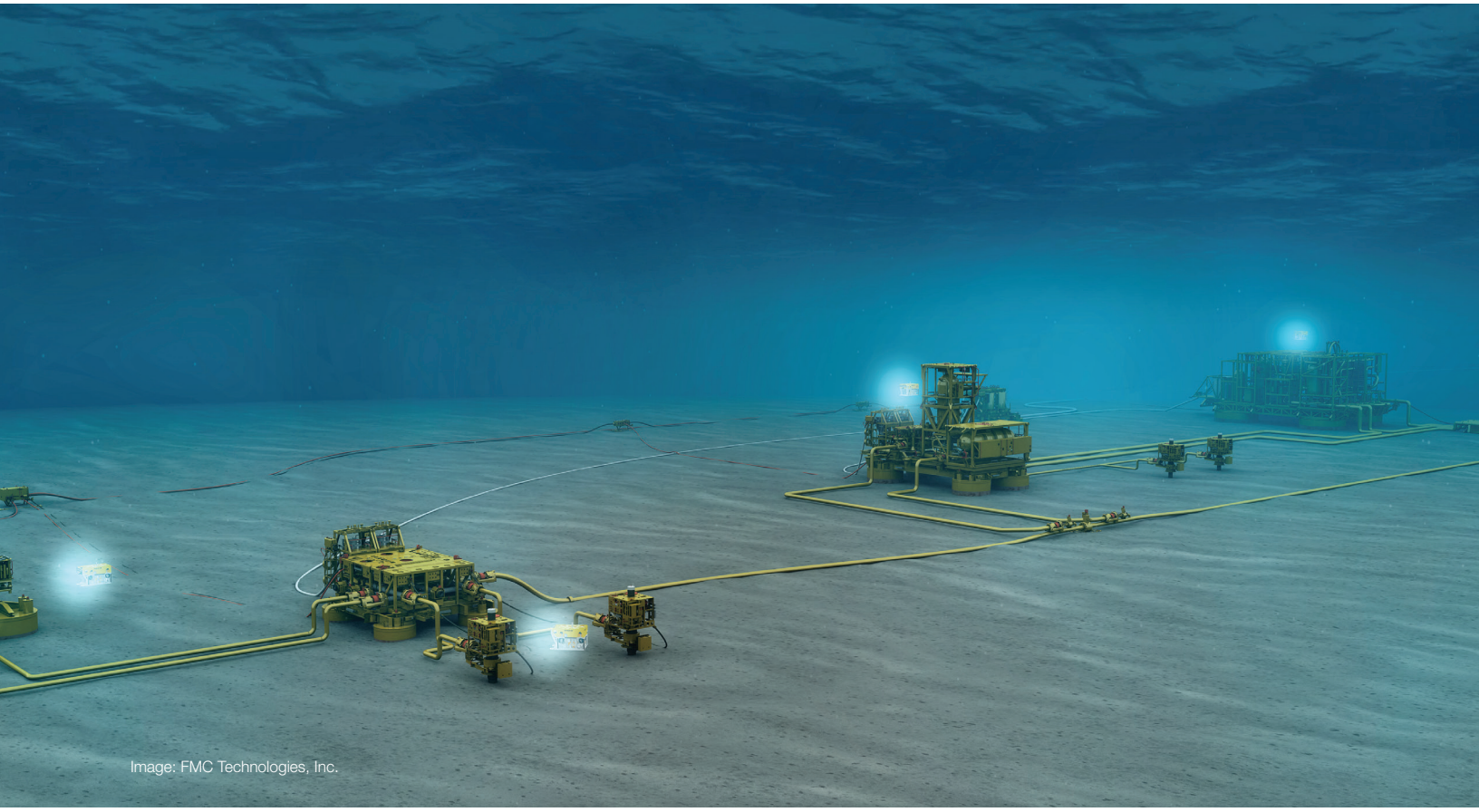


Image: FMC Technologies, Inc.

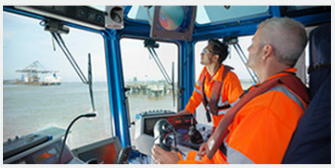
Subsea production systems include a series of gathering lines that connect the production from multiple wells into a single processing hub, allowing the production from the wells to be transported to a platform, where the oil, gas and produced water are separated for transport to shore through a pipeline. The most sophisticated systems operate as a processing system underwater, separating the oil, gas and produced waters so the product can go directly into pipelines to shore.

The equipment on the seafloor is maintained using robots, known as Remote Operating Vehicles (ROVs), which are tethered to a vessel. ROVs serve as eyes underwater for these operations, and are designed to connect to the subsea equipment.

These systems are being installed at depths of almost 10,000 feet of water in the Gulf of Mexico, where deepwater development plays a significant role in current and future energy production. Using this advanced technology, producers can use a single platform to develop resources from 40 miles away.

Oil Spill Response

Prevention

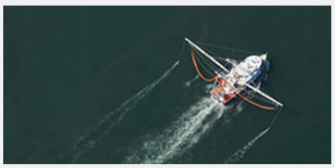


The U.S. oil and natural gas industry is committed to meeting the nation's energy needs while maintaining safe and environmentally sound operations.

Preparedness

In partnership with governments and communities, industry members dedicate significant time and resources to appropriately preparing and planning.

Cleanup



Industry resources are cascaded from around the world in order to rapidly address a spill of any magnitude.

Spill Sources

Accessing petroleum resources carries some inherent risk and the potential for a spill. Industry understands these issues and takes extensive precautions.

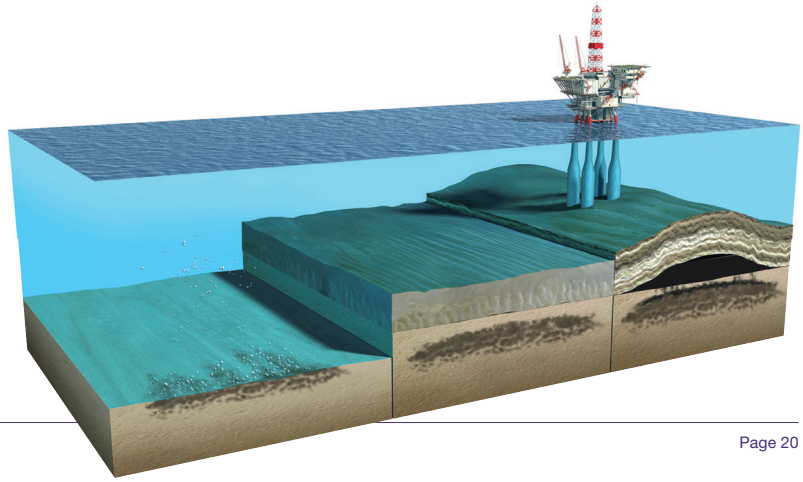
Source: Oil Spill Prevention and Response – http://www.oilspillprevention.org/

The U.S. oil and natural gas industry is committed to meeting the nation's energy needs while maintaining safe and environmentally sound operations. This requires continuous investment and improvement in every phase of preparedness and operations in which oil is produced, transported, stored, and marketed.

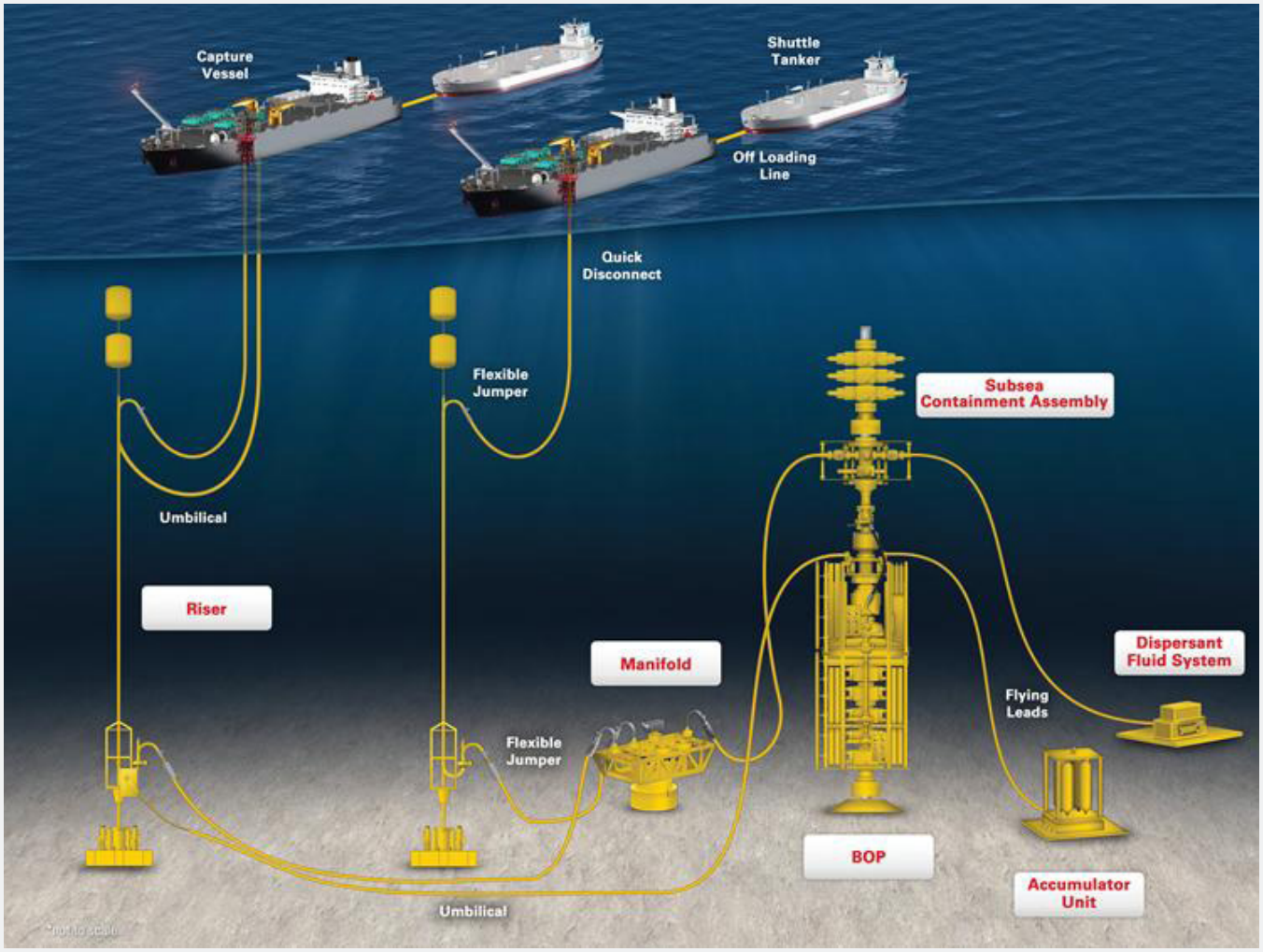
Today, more than 99.9995% of the oil produced, refined, stored, and transported in the United States reaches its destination safely and without incident. This performance is the result of years of investment in continuously improving practices and technologies. Exploration and production facilities use advanced technologies, materials, and practices, which incorporate multiple back-up safety systems. Pipelines employ computers, electromagnetic instruments, and ultrasonic devices that detect vulnerabilities to enable proactive maintenance and repair. Marine terminal and vessel designs are constantly improved; tankers, for example, are now built with double hulls as an extra measure of security. Additionally, storage tanks are now constructed with special materials to withstand corrosion.

Prevention, however, is not just a responsibility for industry; consumers also play an important role in keeping oil and other fuels out of the environment by observing proper handling and disposal practices.

Industry also invests in practices and technologies that ensure a quick and effective response in the event of a spill. The United States has established one of the world's most sophisticated and well-coordinated spill response networks by bringing together the resources and expertise of private industry, public agencies, and academia; and, through initiatives such as the Joint Industry Task Force, we're making sure we learn everything we can from past incidents.



Deepwater Horizon Containment and Response: Harnessing Capabilities and Lessons Learned



Source: http://www.energy-pedia.com/news/general/bp-announces-intent-to-join-marine-well-containment-company--providing-experience-and-equipment

The Marine Well Containment Company and the Helix Well Containment Group maintain quickly deployable systems that are designed to stem any uncontrolled flow of hydrocarbons from a subsea well and train their member companies on the installation and operation of these systems.

These systems also provide the potential to capture flow from a subsea well incident via subsea equipment, risers and containment vessels that can safely capture, store and offload the oil.

Industry Actions Since Macondo

Immediately after the Macondo incident, the U.S. oil and natural gas industry launched a comprehensive review of offshore safety measures and operations to identify improvements in spill prevention, intervention and response capabilities.

Improved Industry Standards to Help Prevent an Event from Occurring

- Since 2010 API has published over 100 new and revised exploration and production standards; including standards on well design, blowout prevention equipment, subsea equipment, and worker safety.
- Since 1924, reviewing and improving industry standards has always been a top priority of the American Petroleum Institute (API) and its American National Standards Institute (ANSI) accredited standards program that strives to promote equipment reliability and operational safety through the use of proven engineering practices.
- More than 100 API standards have been incorporated into federal regulations.

Subsea Well Intervention Capability

- The Marine Well Containment Company and the Helix Well Containment Group were founded in 2010 to provide containment technology and response capabilities for the unique challenges of capping a well that is releasing oil thousands of feet below the water's surface.
- These companies must provide flexible and adaptable systems to contain the well subsea and safely capture, store and offload oil.

Oil Spill Preparedness and Response

- Immediately after the Macondo incident, a number documents and field guides were created to address planning, exiting capabilities of mechanical recovery systems, best practices for cleaning sand beaches, and how to best assess alternative technologies.
- Oil spill response organizations have increased their capabilities by keeping more equipment that is fit for specific purposes such as in-situ burning in inventory and increasing training.
- API has established a robust oil spill response research and development program that oversees more than 25 projects in eight areas, including mechanical recovery, dispersant use, in situ burning, remote sensing, shoreline protection, and alternative technologies.

Center for Offshore Safety

- In 2011, the industry formed the Center for Offshore Safety (COS) to foster innovation, share best-practices in safety and environmental management and help improve the safety of America's offshore oil and natural gas industry.
- The COS promotes the highest level of safety and continuous improvement for offshore drilling and operations through enhanced communication, safety management systems, and independent third-party auditing and certification.
- The Bureau of Safety and Environmental Enforcement (BSEE) has already adopted three COS guidelines into its regulations.

Federal Government Actions Since Macondo

The federal government responded to the Macondo incident by reorganizing the Minerals Management Service (MMS) and focusing on three areas of regulatory policy: 1) drilling safety, 2) well containment, and 3) spill response.

The Minerals Management Service was reorganized into three new agencies to avoid any appearance of a conflict of interest in the agencies' missions.

- The Bureau of Ocean Energy Management (BOEM) formed and became responsible for energy leases in areas of the U.S. Outer Continental Shelf.
- The Bureau of Safety and Environmental Enforcement (BSEE) formed and became responsible for enforcement of safety and environmental protection in all offshore energy activities.
- The Office of Natural Resources Revenue (ONRR) formed and became responsible for management of royalties and revenues.

Regulatory actions were initiated and new policies implemented.

Drilling Safety Rules (Interim Final Rule) were put in place.

- Well Integrity
  - » Isolating Potential Flow Zones (Use of API Standard 65-2 became mandatory)
  - » Well design (casing and cement program) must be certified by Professional Engineer (PE)
  - » Two Independent Barriers (certified by PE) are during completion activities
  - » Procedures for installation, sealing, and locking of casing hangers required
  - » Specific approvals needed for change-out to lighter weight fluids and negative test procedures
- Blowout Preventer (BOP) and Control Systems
  - » New blind-shear ram function testing and 3rd Party verification required
  - » New requirements & function testing for auto shear & deadman systems
  - » Minimum requirements and testing for ROV intervention established
  - » BOP inspection & maintenance to API RP 53 required
  - » Minimum requirements established for personnel operating BOP equipment

Worst Case Blowout Discharge (WCD) & Blowout Response (NTL-2010-N06) policies were established.

- New requirements and definitions for WCD calculations
- New requirements for describing intervention & relief well drilling constraints

Demonstration of adequate spill response capability and well containment resources (NTL-2010-N10) were required.

- Signed statement of compliance required
- Well Containment Screening Tool developed to demonstrate that well design withstand being capped or captured
- Well Containment Plan required (usually including a contract for the services of a Well Containment Company)
- Must demonstrate access to equipment & staff resources to deploy containment prior to drilling a well

Safety and Environmental Management Systems regulations were strengthened.

- All elements of API RP 75 Safety and Environmental Management System (SEMS) were made mandatory
- SEMS audits and reporting are now required
- Operators are now responsible for verification of Contractors SEMS

Resources

1. Oil Spill Prevention and Response – http://www.oilspillprevention.org/
2. Center for Offshore Safety – http://www.centerforoffshoresafety.org/
3. Geophysics Rocks – Educational resource on geophysical technologies – http://www.geophysicsRocks.com/
4. Marine Geophysical Operations – IAGC – http://bit.ly/1zNLwqo
5. Marine Environment Resources – IAGC – http://bit.ly/1zNMKCa
6. Potential National-Level Benefits of Alaska OCS Development – Northern Economics and Institute of Social and Economic Research, University of Alaska – http://bit.ly/1yKTTz0
7. The Economic Benefits of Increasing U.S. Access to Offshore Oil and Natural Gas Resources in the Atlantic – http://www.api.org/oil-and-natural-gas-overview/exploration-and-production/offshore/benefits-of-us-offshore-oil-and-natural-gas-development/Benefits-Atlantic-OCS
8. The Economic Benefits of U.S. Offshore Oil and Natural Gas Development in the Eastern Gulf of Mexico – http://www.api.org/oil-and-natural-gas-overview/exploration-and-production/offshore/benefits-of-us-offshore-oil-and-natural-gas-development/Benefits-Eastern-Gulf-OCS
9. The Economic Benefits of U.S. Offshore Oil and Natural Gas Development in the Pacific – http://www.api.org/oil-and-natural-gas-overview/exploration-and-production/offshore/benefits-of-us-offshore-oil-and-natural-gas-development/Benefits-Pacific-OCS
10. Seismic Surveys: Exploring What Lies Beneath – http://www.seismicsurvey.co.nz
11. Deep Sea Facts – http://www.deepseafacts.co.nz/#location
12. Joint Industry Task Force Reports – http://bit.ly/1xjpj49

For more information, please visit
www.energytomorrow.org
www.api.org

energy API®

AMERICAN PETROLEUM INSTITUTE

API Digital Media: DM2016-018 | 03.03 | PDF