



# **Analysis of the Social, Economic and Environmental Effects of Maintaining Oil and Gas Exploration and Production Moratoria on and Beneath Federal Lands**

**Assessment of the Combined Relative Impacts of Maintaining Moratoria and  
Increased Domestic Onshore and Offshore Oil and Gas Resource Estimates**

**Science Applications International Corporation (SAIC)  
Gas Technology Institute (GTI)**

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# Moratoria Study Group



- **Moratoria study group participants:** Chairman G. O'Neal Hamilton (chairman of the National Association of Regulatory Utility Commissioners' [NARUC's] Gas Committee and past chairman, South Carolina Public Service Commission); Vice Chairman Dave Harbour (NARUC commissioner emeritus, Regulatory Commission of Alaska-Ret.); Commissioner Victor Carrillo (chairman, Texas Railroad Commission, NARUC/Interstate Oil and Gas Compact Commission [IOGCC]); NARUC Executive Director Charles Gray; Commissioner Colette D. Honorable (Arkansas Public Service Commission, NARUC); Commissioner Bob Pickett (chairman, Regulatory Commission of Alaska, NARUC); Marshall Johnson (NARUC commissioner emeritus, Public Service Commission of Minnesota-Ret.); Bob Keating (NARUC commissioner emeritus, Massachusetts Department of Public Utilities-Ret.); Don Mason, (NARUC commissioner emeritus, Public Utilities Commission of Ohio-Ret.); Doug Mood (NARUC commissioner emeritus, Montana Public Service Commission-Ret.); Commissioner Dan Seamount (chairman, Alaska Oil and Gas Conservation Commission, IOGCC); Commissioner Timothy Simon (California Public Utilities Commission, NARUC); Commissioner Stan Wise (Georgia Public Service Commission, NARUC).
- **Moratoria study group sponsors:** National Association of Regulatory Utility Commissioners, Interstate Oil and Gas Compact Commission, American Chemistry Council, American Gas Association, American Public Gas Association, American Petroleum Institute, BP America Production, Consumer Energy Alliance, Dominion Resources, DTE Energy, Edison Electric Institute, El Paso Natural Gas, EnCana Corporation, Independent Petroleum Association of America, Institute for 21st Century Energy (U.S. Chamber of Commerce), Interstate Natural Gas Association of America, National Fuel Gas Co., Natural Gas Supply Association, National Petrochemical and Refiners Association, Noble Energy, Marathon Oil Company, Piedmont Natural Gas, Questar Corporation, Shell Exploration and Production Co., TECO Peoples Gas System.
- **Moratoria study group official observers:** Michelle Michot Foss, Ph.D. (chief energy economist and head, Center for Energy Economics, Bureau of Economic Geology, University of Texas), John Cogburn (economist, AGL Resources), David E. Dismukes, Ph.D. (Center for Energy Studies, Louisiana State University), Edward O'Brien (economist), Richard P. O'Neill (Federal Energy Regulatory Commission), John Pyrdol (Department of Energy), A. Michael Schaal (Energy Information Administration), John W. Broderick (senior economist, Minerals and Realty Management, U.S. Bureau of Land Management), Sam Fraser (Minerals Management Service).

Study group members who are government employees provided essential public service guidance and information contributing to the excellence and objectivity of the process, but were deemed “ex-officio observers” and not voting members due to their public employment.



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# Project Objectives: Overview



1. Provide an updated assessment of the domestic oil and natural gas recoverable resources. (Conducted by GTI)
2. Use the National Energy Modeling System (NARUC-NEMS) to provide a comprehensive framework for analysis of the social, economic and environmental effects of *maintaining* oil and gas exploration and production moratoria on and beneath federal jurisdictional lands of the United States through 2030. (Conducted by SAIC)

The [NARUC Board of Directors Resolution](#) on July 18, 2007, project basis.

Use of the word “moratoria” in this study meets the intent of the National Association of Regulatory Utility Commissioners (NARUC) resolution by applying to all federal lands which have been or are still unavailable for oil and gas leasing via congressional, presidential and/or administrative actions.

The term “NARUC-NEMS” (NEMS stands for National Energy Modeling System) is used to distinguish use of the model in this project from uses by the U.S. Department of Energy’s Energy Information Administration (EIA).

OCS – Outer Continental Shelf; refers to all submerged lands, its subsoil and seabed, that belong to the United States

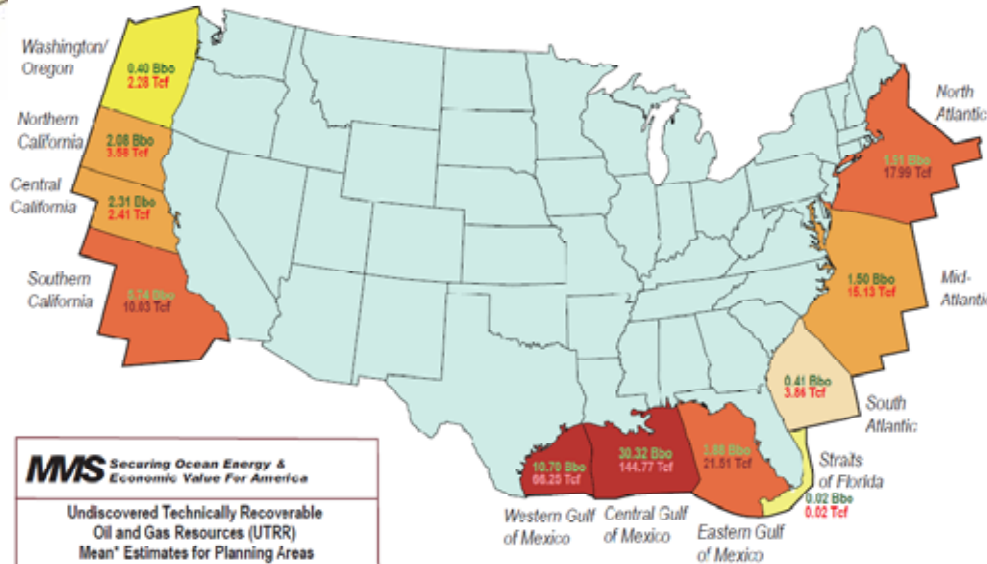
# Moratoria and Restricted Areas: Offshore



**Alaska OCS**  
132 Tcf  
27 Bbo

*Source: MMS Report—"Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2006"*

**Pacific OCS**  
18 Tcf  
10 Bbo



**Atlantic OCS**  
37 Tcf  
4 Bbo

**MMS** Securing Ocean Energy & Economic Value For America  
Undiscovered Technically Recoverable Oil and Gas Resources (UTRR) Mean\* Estimates for Planning Areas

**GOM OCS**  
232 Tcf  
45 Bbo

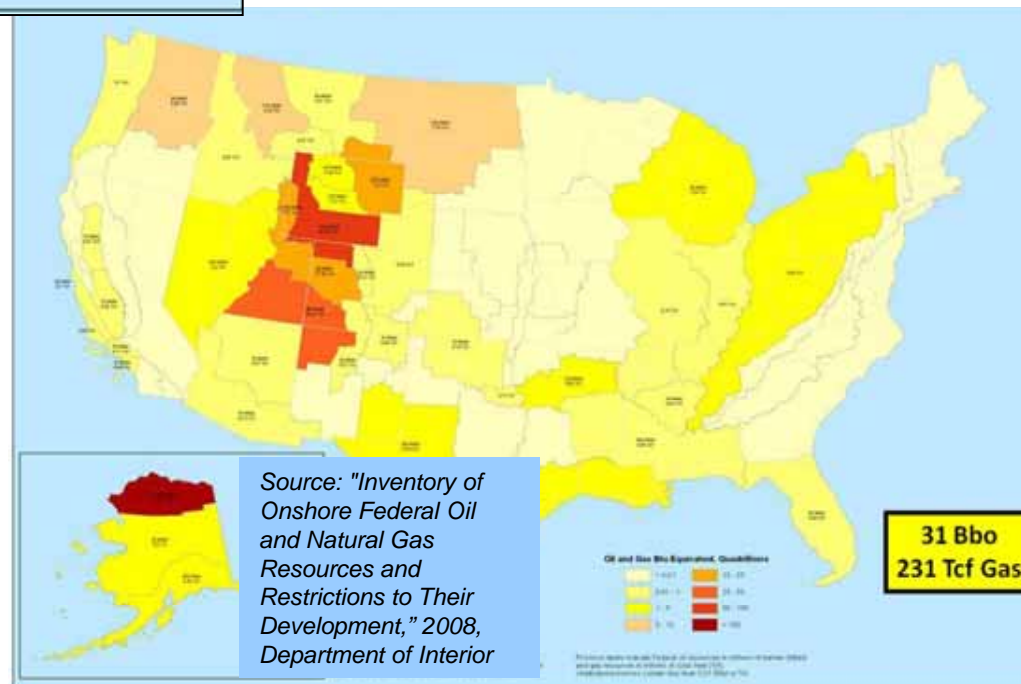
MMS = Minerals Management Service  
OCS = outer continental shelf  
Tcf = trillion cubic feet  
Bbo = billion barrels of oil  
GOM = Gulf of Mexico



# Moratoria and Restricted Areas: Onshore



**Undiscovered, Technically Recoverable Oil and Gas on Federal Lands**



Tcf = trillion cubic feet  
Bbo = billion barrels of oil



# Summary of Key Findings – GTI Oil and Gas Resource Update



- The study, through GTI, provides the most up-to-date assessment of U.S. on-shore and off-shore oil and natural gas resources in federal moratoria and non-moratoria areas, and non-federal areas
- Based on historical trends, new production technologies, and increased geologic understanding, GTI projects an increase in the oil and gas resource base currently acknowledged by Department of Energy/Energy Information Administration (DOE/EIA) in its 2009 reference case forecast (AEO2009), as follows:

## – Natural gas:

- **Offshore resource base increases by 154 Tcf** [excluding parts of Alaska OCS]\*
- **Onshore resource base increases by 132 Tcf**

**Total natural gas resource base increases from 1748 Tcf to 2034 Tcf**

(In 2009 the United States consumed 22.8 Tcf and, of that amount, imported 2.7 Tcf.)

## – Crude oil:

- **Offshore resource base increases by 37 Bbo** [excluding parts of Alaska OCS]\*
- **Onshore resource base increases by 6 Bbo** for the Arctic National Wildlife Refuge and no increase in Lower-48

**Total oil resource base increases from 186 Bbo to 229 Bbo**

(In 2009 the United States consumed 5.2 Bbo oil, produced 1.9 Bbo at home and imported 3.3 Bbo.)

**\* NARUC-NEMS model accounts for project field-specific oil and gas production from Alaska's onshore North Slope, offshore North Slope, and other Alaska (primarily the Cook Inlet area). Other OCS areas are not included.**

Tcf = trillion cubic feet    Bbo = billion barrels of oil    OCS = outer continental shelf

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# NARUC-NEMS Model Methodology



SAIC executed the NARUC-NEMS model to provide 14 comparative cases using the GTI updated resource base.

**Three comparative cases are key:**

**1. “Resource Base Comparison”:**

Compares the current government resource base versus the GTI updated resource base (moratoria removed for both)

**2. “Moratoria Only Comparison”:**

Compares moratoria “maintained” versus moratoria “removed” (GTI updated resource base used for both)

**3. “Combined Comparison”:**

Combination of 1 and 2: Accounts for

GTI updated resource base versus the current government resource base and Moratoria “maintained” versus moratoria “removed”



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# NARUC-NEMS Model “Indicators”



Results are in the form of social, economic and environmental “indicators”.

## Key Samples of Social, economic and environmental “indicators”

SOCIAL	ECONOMIC	ENVIRONMENTAL
<p>Domestic onshore/offshore energy production by fuel type</p> <p>Energy consumption by sector and fuel type</p> <p>Energy intensity</p> <p>International energy purchases</p> <p>Housing starts</p> <p>Employment in energy intensive industries</p> <p>Vehicle miles traveled</p>	<p>Energy prices</p> <p>Real disposable income</p> <p>Cost of energy to consumers</p> <p>Cost of real industrial shipments</p> <p>Cost of energy imports</p> <p>GDP</p> <p>Real consumption</p>	<p>Environmental effects can be inferred from the following indicators:</p> <ul style="list-style-type: none"> <li>• Domestic oil and natural gas production</li> <li>• Other domestic fuels production</li> <li>• Crude oil and natural gas imports</li> <li>• Renewables utilization</li> </ul> <p>Carbon dioxide production from energy conversion - - direct effect</p>
<p>These are only a representative sample of the multiple model “indicators” The Final Report expands on these indicators.</p>		

# Key Findings – NARUC-NEMS Model “Combined Comparison” (2009 – 2030)



## Social Effects of GTI Updated Resources and *Maintaining the Moratoria*

The model projected primarily negative effects, with some neutral effects, on the social indicators for the nation for the period 2009 to 2030; projections for **aggregate** and **average annual changes (avg. ann.)** are as follows:

- **Domestic crude oil production: decrease** by 9.9 billion barrels (avg. ann. decrease of 15%)
- **Imports from OPEC for oil: increase** by 4.1 billion barrels ( avg. ann. increase of 19%)  
Results in increased cumulative payments to OPEC of \$607 billion
- **Domestic natural gas production: decrease** by 46 Tcf (avg. ann. decrease of 9%)
- **Total net natural gas imports: increase** by 15.7 Tcf (avg. ann. increase of 75%)
- **Employment in energy-intensive industries: decrease** by 13 million jobs (avg. ann. decrease of 0.36%).
- **Housing starts: decrease** by nearly 200,000 – a 0.46% avg. ann. reduction.
- **National energy consumption, energy intensity, and vehicle miles traveled: essentially unchanged.**

\* Note that these results account for the combination of both maintaining the moratoria and GTI's increase in the oil and gas resource base relative to the current resource base



## Key Findings – NARUC-NEMS Model (cont'd) “Combined Comparison” (2009 – 2030)



### Economic Effects of GTI Updated Resources and *Maintaining the Moratoria*

The model projected negative effects on all national economic indicators for the period 2009 to 2030 projections for **aggregate** and **average annual changes (avg. ann.)** are as follows:

- **Energy prices: increase** in avg. ann. prices for
  - natural gas prices by 17%; electricity prices by 5%; motor gasoline prices by 3%
- **Real disposable income: decrease** cumulatively by \$2.34 trillion (\$4,500/capita); avg. ann. decrease of 0.65%
- **Energy costs to consumers: increase** cumulatively by \$2.35 trillion (\$3,700/capita); avg. ann. increase of 5%
- **Real industrial shipments costs: decrease** cumulatively by \$1.68 trillion; avg. ann. decrease of 1.2%
- **Import costs for crude oil, petroleum products, and natural gas: increase** cumulatively by \$1.6 trillion
  - an avg. ann. increase of over 38%
- **Gross Domestic Product (GDP): decrease** cumulatively by \$2.36 trillion (\$1.18 trillion NPV)
  - an avg. ann. decrease of 0.52%
- **Real consumption: decrease** cumulatively by \$1.44 trillion; avg. ann. decrease of 0.45%

**Note that these results account for the combination of both maintaining the moratoria and GTI's increase in the oil and gas resource base relative to the current resource base.**



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## Key Findings – NARUC-NEMS Model (cont'd) “Combined Comparison” (2009 – 2030)



### Environmental Effects of GTI Updated Resources and Maintaining the Moratoria

Since domestic environmental effects depend on the relative change in fuel resource utilization, general environmental effects from the projected fuel utilization changes can be inferred, but not quantified, for the period covering 2009 to 2030, as follows:

- **Environmental effects associated with domestic oil and natural gas production:** If the moratoria are *maintained*, oil and natural gas production levels and, by inference, associated domestic environmental effects, are **unchanged**. In the comparative modeling, if the moratoria were removed, oil and gas production levels would increase and, by inference, associated domestic environmental effects would **increase**.
- **Environmental effects associated with crude oil and natural gas imports:** **increase**. If the moratoria are maintained, crude oil and natural gas imports would increase, resulting in inferred increased domestic and global environmental effects associated with such imports.
- **CO2 from energy conversion:** **essentially unchanged** in the electric power and refining sectors with minimal annual decreases, resulting in neutral environmental effects – a direct, not inferred, environmental result from the model.
- **Renewable energy utilization:** **higher**. The cumulative use of renewable energy in electric power generation will increase by an annual average of over 1.4%, resulting in an inferred positive environmental effect. Countering this positive trend is the projected increase in total energy consumption by an annual average close to 1%, resulting in an inferred negative to neutral environmental effect.
- **Environmental effects associated with domestic production of different fuels:** **mixed**. With domestic production of crude oil and natural gas reduced, domestic production and use of other fuels will increase, including coal, nuclear, biomass and other renewable energy – resulting in an inferred mixed effect on the environment.

**Note that these results account for the combination of both maintaining the moratoria and GTI's increase in the oil and gas resource base relative to the current resource base**



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# Further Findings



## Non-modeled observations

- While not a product of the modeling, the study observes that *maintaining* the moratoria will cause a **shift to overseas fuels production** with commensurate effects on the environment

Foreign production will:

- (1) **Increase the environmental effects in other countries** where environmental standards are different (often less stringent) than those in the U.S. and
- (2) Impose an unknown **increase in environmental effects on domestic and international air and waters** due to increased oil and LNG shipping transport.

## Regional model results

- The model projects the differences among nine census regions in the social and economic impacts of maintaining the moratoria.
- For example, it projects significant differences among the regions in the impacts on real, disposable income due to unequal impacts on regional energy prices and types of energy consumption.



LNG = liquefied natural gas

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