EXECUTIVE SUMMARY

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

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National Association of Regulatory Utility Commissioners

On behalf of

The NARUC Moratoria Study Group

February 15, 2010

EXECUTIVE SUMMARY

In recent decades our nation has restricted a significant expanse of federal onshore and offshore Outer Continental Shelf (OCS)[1] lands from natural gas and oil exploration and production.[2] The federal government estimates these lands may contain 285 Trillion cubic feet (Tcf) of natural gas and 46 Billion barrels of oil (Bbo) of undeveloped energy resources.[3]

This study: 1) updates[4] the nation's onshore and offshore natural gas and oil resource base in moratoria and non-moratoria areas; and, 2) using the updated resource estimates, assesses the *social, economic and environmental* impacts to the nation of maintaining the moratoria in the upcoming decades.[5] The findings reveal an energy future for the nation that increases the cost and restricts the availability of domestic oil products and natural gas. Primary residual impacts: **reduce real consumption levels; decrease gross domestic product (GDP); increase dependence on foreign oil and natural gas imports; increase payments to exporting nations; decrease real industrial shipments; elevate energy costs; decrease employment levels; decrease household income; and, produce a mix of negative and positive environmental effects.**[6] A summary of key study findings begins on page E-3.

> Accounting for the updated oil and gas resource base, ***maintaining*** the moratoria until 2030 will decrease cumulative U.S. GDP by $2.36 Trillion – an average annual reduction of 0.52 percent

STUDY BACKGROUND:

OCS Presidential and Congressional restrictions were eliminated in 2008, amid growing concerns about energy prices and security of oil and natural gas supplies.[7] (Some moratoria had been in effect for up to twenty-seven years). The Department of the Interior is now considering whether to lease and develop selected portions of these formerly restricted areas.[8] Over the past decade, the debate between pro- and anti-development concerns has focused on whether some of the onshore federal lands restrictions should be removed as well.

Environmental concerns about domestic resource development have been well documented. However, a *comprehensive* integrated analysis of the socio-economic and environmental effects of *not developing* the moratoria/restricted areas for oil and natural gas has been missing at both national and regional levels.[9] What has been needed – and is provided herein – are assessments of key social and economic indicators, including impacts on energy prices and supply, impacts on employment and household income, impacts on industrial shipments and GDP, and the impacts on imported oil and natural gas and the level of payments to OPEC. These essential informational components should assist the President and Congress in addressing the serious, interdependent energy, economic and employment challenges immediately facing the nation.

Intent on filling this information gap, the Board of Directors of the National Association of Regulatory Utility Commissioners (NARUC)[10] adopted a resolution in 2007, supported by the Interstate Oil and Gas Compact Commission (IOGCC),[11] instituting this study, guided by a large and diverse group of energy experts from both the private and public sectors (the "Moratoria Study Group").[12] Science Applications International Corporation (SAIC)[13] was selected to

provide energy expertise and energy markets modeling capabilities, together with the Gas Technology Institute (GTI)[14] as a sub-contractor providing oil and gas resource and development expertise, to support the Study Group.

This report is the consultants' independent product, though the consultants acknowledge with appreciation the willingness of the NARUC staff and Study Group participants to assist. The report achieves the dual goals of: 1) providing a comprehensive review and update of domestic oil and natural gas resources by GTI, and, 2) using the GTI updated resource estimates, projecting (using NARUC-NEMS) the relative social, economic and environmental effects on the nation of maintaining[15] various moratoria and restrictions on domestic oil and gas exploration and production through 2030.[16]

SUMMARY OF KEY FINDINGS:

GTI Updated Oil and Gas Resource Assessments

Based on historical trends, new production technologies, and increased geologic understanding, the study provides the most up-to-date assessment of America's onshore and offshore oil and natural gas resources in both moratoria and non-moratoria areas. Specifically, the study projects an increase in the oil and gas resource base currently represented in the Energy Information Administration's *AEO2009* Reference Case[17] by the following amounts as provided by GTI:

- The natural gas resource base is estimated to increase by **132 Tcf** onshore and **154 Tcf** offshore (excluding parts of Alaska[18]); and
- The offshore crude oil resource base is estimated to increase by 37 Bbo (excluding parts of Alaska[19]); the onshore crude oil resource base is estimated to increase by 6 Bbo for the Arctic National Wildlife Refuge (ANWR), with no estimated increase in the Lower-48 resource base.

With these additions, GTI estimates the current resource base to increase from **1748 Tcf to 2034 Tcf for gas** and from **186 Bbo to 229 Bbo for oil.** The increases are driven by two primary factors: 1) the increased shale gas activity and development successes, and 2) an increase in resource estimates for the currently restricted offshore areas to better reflect the impact of new technology and successes in the currently available and developed offshore areas.

NARUC-NEMS Model Findings

The NARUC-NEMS modeling framework was used to project outcomes for three Baseline model scenarios and seven Alternative scenarios that represent different "*energy futures*" for the country based on different combinations of GTI's updates to the oil and gas resource base and moratoria locations. Direct comparison of any two scenarios yields incremental changes in modeling metrics that provide a quantitative perspective on the social, economic and environmental consequences associated with the different energy futures covering a projection period of 2009 through 2030. While a total of fourteen comparative cases were assessed to cover a range of scenario combinations of interest, only two cases represent the consequences of maintaining the full moratoria and the complete oil and gas resource update. These two primary comparative cases (identified in the report as C13 and C14, respectively) are defined as follows:

1. The "**Combined Comparative Case,**" whose results are highlighted here and presented in report Section 1, *represents a comparison between an energy future that maintains all production moratoria and uses the current EIA resource base estimate* ***and*** *an alternative*

energy future that eliminates all oil and gas production moratoria and makes use of the GTI updated estimate of the oil and gas resource base.

This case, by definition, yields the projected maximum social, economic, and environmental impacts that can be expected from the combination of maintaining all access restrictions and establishing an updated estimate of the oil and gas resources.

2. The "**Moratoria-Only Comparative Case**," whose results are presented in report Section 1.4.7, represents *a comparison between an energy future that maintains all production moratoria and uses the GTI updated resource base estimate* ***and*** *an alternative energy future that eliminates all oil and gas production moratoria and also makes use of the GTI updated estimate of the oil and gas resource base.*

   This latter comparison removes the impacts of updating the oil and gas resource base, allowing insight into the impacts of solely maintaining the moratoria access restrictions.

   Key findings include the following outcomes for the **Combined Comparative Case** (constant dollars except where net present value NPV noted):

Key findings include the following outcomes for the **Combined Comparative Case**:

Social Effects of GTI Updated Resources and Maintaining the Moratoria (2009 - 2030)[20]*:*

The model projected primarily negative effects, with some neutral effects, on the social indicators[21] for the nation covering the period of 2009 to 2030; aggregate and average annual changes are as follows:

- **Domestic Crude Oil Production is projected to decrease** by 9.9 billion barrels – an average annual decrease of nearly 15 percent in production.
- **Imports from OPEC for Oil are projected to increase** by 4.1 Billion barrels, an average annual increase of nearly 19 percent, resulting in increased cumulative payments to OPEC of $607 Billion ($295 Billion net present value "NPV" basis).
- **Domestic Natural Gas Production is projected to decrease** by 46 Tcf – an average annual decrease of nearly 9 percent in production.
- **Total Net Natural Gas Imports (LNG and pipeline) are projected to increase** by nearly 15.7 Tcf – an average annual increase of almost 75 percent.
- **Employment in Energy Intensive Industries is projected to decrease** by nearly 13 million jobs – an average annual decrease of 0.36 percent.
- **Housing Starts are projected to decrease** by nearly 200,000 – a 0.46 percent average annual reduction.
- **National Energy Consumption, Energy Intensity, and Vehicle Miles Traveled are projected to be essentially unchanged.**

Economic Effects of GTI Updated Resources and Maintaining the Moratoria (2009 – 2030):

The model projected negative effects on all national economic indicators:

- **Energy Prices are projected to be higher:**
  - Annual average natural gas prices increase by 17 percent
  - Annual average electricity prices increase by 5 percent

- Annual average motor gasoline prices increase by 3 percent

- **Real Disposable Income is projected to decrease** cumulatively by $2.34 trillion ($1.16 trillion NPV or $4,500 per capita) – an annual average decrease of 0.65 percent.
- **Energy Costs to Consumers are projected to increase** cumulatively by $2.35 trillion ($1.15 trillion NPV or $3,700 per capita) – an annual average increased cost of 5 percent.
- **Real Industrial Shipments Costs are projected to decrease** cumulatively by $1.68 trillion ($840 billion NPV) – an annual average decrease of 1.2 percent.
- **Import Costs for Crude Oil, Petroleum Products, and Natural Gas are projected to increase** cumulatively by $1.6 trillion ($769 billion NPV) – an annual average increased cost of over 38 percent.
- **Gross Domestic Product (GDP) is projected to decrease** cumulatively by $2.36 trillion ($1.18 trillion NPV) – an annual average decrease of 0.52 percent in GDP.
- **Real Consumption is projected to decrease** cumulatively by $1.44 Trillion ($712 billion NPV) – an annual average decrease of 0.45 percent.

Environmental Effects of GTI Updated Resources and Maintaining the Moratoria (2009 - 2030):

With the exception of air emissions, the model is limited in providing direct environmental results applicable to this project. However, 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.**[22]
- **Environmental Effects associated with Crude Oil and Natural Gas Imports would 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. If the model included all of the currently inaccessible Alaska reserves, the effect of maintaining domestic moratoria results in even greater domestic and global environmental effects associated with counterbalancing imports.[23]
- **CO_2 from Energy Conversion would be 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 would be higher:** The cumulative use of renewable energy in electric power generation will increase by an annual average of over 1.4 percent, 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 percent, resulting in an inferred negative to neutral environmental effect.

- **Environmental Effects associated with Domestic Production of Different Fuels would be 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.

Non-Modeled Observations:

The shift in domestic oil and gas production versus overseas production yields "distant" versus "local" environmental effects that are beyond the scope of the NARUC-NEMS model. 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: (1) foreign production will increase the environmental effects in other countries where environmental standards are different (often less stringent) than those in the U.S.; and, (2) foreign production will 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.

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[1] The OCS is defined as submerged lands, subsoil, and seabed between the seaward extent of states' jurisdiction and the seaward extent of federal jurisdiction. Federal OCS jurisdiction extends from 3 nautical miles seaward to 200 nautical miles seaward from the coast of American territories.

[2] While moratoria were enacted by Congress and withdrawals were made by Presidential action, the net effect of both is the same. For simplicity, the use of the word "moratoria" in this report refers to both terms. Congressional and Presidential restrictions were lifted in 2008, and actions have been initiated to allow the lands to become part of the country's exploration program. The lands could be treated as restricted areas if action is not taken to merge them into leasing programs.

[3] Combined assessments reported in the "Inventory of Onshore Federal Oil and Natural Gas Resources and Restrictions to their Development", 2008, Department of Interior, and the "Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2006", Mineral Management Service. These estimates, as shown through the updated assessments in this study, appear to be conservative, since recent success with gas shale and ongoing offshore technology development suggest the numbers could be larger.

[4] The term update refers to a re-estimation of the baseline oil and gas resources for all moratoria and access-restricted areas (onshore and offshore), as well as other resource areas by the Gas Technology Institute.

[5] The analysis uses a modified, project-specific version of the U.S. government's National Energy Modeling System (NEMS) covering a timeframe extending to 2030. We refer to the application used for this study as "NARUC-NEMS" to distinguish it from EIA's use of the model and other modeling projects. NEMS is a national, economy-wide, integrated model used by the Energy Information Administration (EIA) to provide U.S. energy market and infrastructure forecasts in the EIA *Annual Energy Outlook* (AEO) and, in reply to Congressional requests, provide projected impacts of pending energy and environmental legislation. Modeling performed in this study is independent of modeling performed by EIA.

[6] A limited number of domestic environmental effects are quantified in this study. Other environmental effects, including international effects, are largely outside the scope of this study.

[7] The Presidential OCS withdrawals were lifted on July 14, 2008 and Congressional moratorium expired on October 1, 2008. The moratoria for most of the Eastern Gulf of Mexico Planning Area and a portion of the Central Gulf of Mexico Planning Area remain in effect until 2022 as part of the Gulf of Mexico Energy Security Act of 2006.

[8] *Federal Register*, January 21, 2009 (74 FR 3631)

[9] The study references several other reports that have considered some elements of the potential social and economic benefits that could result for the nation if the moratoria were *removed.*

[10] Founded in 1889, NARUC is a non-profit organization representing State public service agencies regulating utilities that provide to America's economy vital services including but not limited to energy, water, telecommunications, and transportation. For the Resolution, see http://www.naruc.org/Resolutions/GS-1%20Developing%20Reliable%20Research%20Regarding%20the%20Social%20and%20Economic%20Costs_July07.pdf

[11] In 1935, the IOGCC originated when several states endorsed and Congress ratified a compact to enable state regulation of petroleum activity to control overproduction and waste of the resource. The IOGCC membership is represented by governors and appointed representatives of oil and gas producing states and associate states—about ¾ of the states—and enjoys affiliation with many foreign countries and Federal agencies, including the Departments of Energy, Interior, Environmental Protection and FERC. For the Resolution, see http://www.iogcc.state.ok.us/2007-resolutions

[12] **Moratoria Study Group Participants:** Chairman G. O'Neal Hamilton (Chairman of 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/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.
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(Federal agency economists provided essential public service guidance and information contributing to the excellence and objectivity of the process but were deemed "non-voting observers" due to their public employment).

[13] SAIC is a FORTUNE 500® scientific, engineering and technology applications company that uses its deep domain knowledge to solve problems of vital importance to the nation and the world, in national security, energy and the environment, critical infrastructure, and health. The company is a leading provider of energy services with clients around the world and has exceptional experience and a proven track record in utilizing multi-dimensional teams to provide deep knowledge and thought leadership to our clients. The modeling team within SAIC has a combined experience of over 125 person-years in energy modeling, much of which has been dedicated to supporting and applying NEMS. http://www.saic.com/about/

[14] GTI is an independent technology organization, established as an Illinois not-for-profit corporation. GTI provides products, services and information that help customers solve problems or capitalize on opportunities related to finding, producing, delivering and using natural gas. Customers include energy industry companies, equipment manufacturers, government agencies, and other organizations. http://www.gastechnology.org/

[15] The use of the word "maintaining" originated in the NARUC and IOGCC Resolutions, prior to the 2008 Presidential and Congressional removals of the OCS moratoria. It includes "reinstating", and is a shorthand reference for "not developing".

[16] To be precise, the previous OCS moratoria were not on "exploration and development", but applied to new "pre-leasing" and "leasing" of federal lands. OCS moratoria did not apply to activities on existing leases, where exploration and development could proceed (unless otherwise restricted). To clarify, use of the word "moratoria" applies to offshore OCS, and onshore "restricted" federal lands which are unavailable for leasing or areas where leasing is not permitted.

[17] The *Annual Energy Outlook 2009 (AEO2009)* was prepared by EIA to present long-term projections of energy supply, demand and prices through 2030. The results are from EIA's NEMS.
http://www.eia.doe.gov/oiaf/archive/aeo09/index.html

[18] A report by Northern Economics, "Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin" in March 2009 stated "Based on the MMS resource assessments and the production scenarios described above for all three OCS areas, the total OCS oil and gas that might be produced through 2057 could amount to about 10.2 billion barrels of oil and 19.8 trillion cubic feet of gas. This translates to a peak daily production from all three OCS areas equal to 1.8 million barrels of oil and 2.9 billion cubic feet (BCF) of gas. In comparison, in 2007 the total statewide daily production of oil and gas was 796,289 barrels and 8.831 BCF, respectively, although most of the gas was re-injected to maintain reservoir pressure (Division of Oil and Gas, 2007 Annual Report)." http://www-static.shell.com/static/usa/downloads/about_shell/strategy/major_projects/alaska/econanalysisofoffshoreogdevpt.pdf

[19] Ibid.

[20] These effects are quite conservative considering that the NEMS-NARUC model is not configured to capture the effects of not developing Alaska resources that may not currently be accessible to transportation modes. In other words, with successful Alaska exploration and development much more negative social and economic effects can be avoided. While the environmental effects of keeping Alaska reserves off-line maintains environmental status quo, it causes environmental effects to shift to other jurisdictions from whence the United States imports energy.

[21] Social indicators include the availability of energy to the U.S.

[22] While this study focuses on the social, economic and environmental effects of *maintaining* the moratoria, it includes for perspective, identification of environmental considerations supporting the original decisions to impose the moratoria. The study does not re-examine these considerations. It is noted that energy production experts state that improved exploration and production technologies have mitigated many of the original environmental concerns.

[23] See footnote 18.