

Before the
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Public Utilities and Energy Committee
The Honorable John P. Hagan
Chair

Testimony Regarding
Issues Related to the Cost of Natural Gas

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On Behalf of the Ohio Public Interest Research Group, Ohio PIRG, I would like to thank you, Chairman Hagan, and members of the House Public Utilities and Energy Committee for this opportunity to offer testimony regarding natural gas issues. I am Amy J. Gomberg and I serve as the Environmental Associate of Ohio PIRG, the state-based, non-partisan public interest advocacy organization. Our mission is to serve the public interest by protecting our environment, encouraging a fair, sustainable economy, and fostering responsive, democratic government.

Ohio PIRG has been representing the public in Ohio since 1973, through issue based advocacy and education. On behalf of thousands of Ohioans that have contributed to our organization for the past 30 years I can respectfully share with you the widespread public support to keep Lake Erie, and the 3 % of our lands which are of state owned natural & recreational areas, in their current wilderness states.

While there are many facets related to the issues of the cost of natural gas, my testimony is focused on the previously expressed interest in opening up Lake Erie to natural gas and oil exploration. Jack Shaner, from the Ohio Environmental Council, Chris Bunch, from the Medina Summit County Land Conservancy, and Chris Crews, from the Buckeye Forest council will focus on various other aspects regarding the cost of natural gas in Ohio.

Today, my testimony will concentrate specifically Ohio's primary natural treasure, Lake Erie and the potential environmental, economic, and public health threats posed by the possibility of gas and oil drilling. I will also site examples of accidents from off-shore and directional drilling in the Great Lakes Basin. Most importantly, I discuss alternative solutions to the problems regarding high natural gas prices.

In order to rightfully address the natural importance of Lake Erie I would like to quote the testimony of Dr. Jeffrey M. Reutter, the Director of the Ohio Sea Grant College Program, the F.T. Stone Laboratory, Center for Lake Erie Research (CLEAR), and Great Lakes Aquatic Ecosystem Research Consortium at The Ohio State University. Dr. Reutter testified before the Ohio State House of Representatives, Agriculture and Natural Resources Committee on May 16, 2001,

“Lake Erie is arguably the most important lake in the world and a major economic asset to the State of Ohio. Much of this economic value is linked to major improvements in the ecosystem and the associated recreational businesses – marinas, restaurants, hotels, charter fishing, beaches, etc. We must protect this resource and these businesses. It is estimated that 50% of the US population lives within 50 miles of the coast (including the Great Lakes coastline) and this number is expected to increase to 75% by 2025. Consequently, we must protect the environmental health of this region and the public health of its current and future residents...I do not believe that it is in the best interest of the people of Ohio or Lake Erie to allow gas and oil exploration...I encourage you to support legislation that will protect this resource, the businesses that depend on the resource, and the people who live in the coastal zone.”ⁱ

Lake Erie is one of, if the greatest natural resource in Ohio. It is the 12th-largest lake in the world (by area) and, together with the other Great Lakes, holds 20% of the world’s fresh surface water. The land area that drains into Lake Erie covers 22,720 square mile (58,800 square kilometers) and the counties surrounding the Great Lakes shoreline have the highest average population per mile (3,835) for a major coastal area in the United States.ⁱⁱ

Ohioans Support Lake Erie Protection

Since 1984, every Ohio governor, both Republican and Democrat, has echoed the “Statement of Principle Against Oil Drilling in the Great Lakes” which stated, in part, that “this precious resource [the Great Lakes] should not be vulnerable to oil drilling and its attendant dangers.”ⁱⁱⁱ

Governor Taft spoke of his dedication to the Great Lakes on November 14, 2003:

“Last year, I signed an Executive Order to ban drilling in Lake Erie along Ohio's coastline...the fact is that there are other energy sources...Lake Erie is a unique ecological treasure, and the risk of damaging our precious water resources is simply not worth the potential gain... We hold a great treasure in trust for our children and grandchildren. To the extent that it has been damaged, we must restore it. Where it retains its original value, we must preserve it. We can enjoy this precious resource today, even while acting in concert to safeguard the ecosystem for future generations.”^{iv}

US Senator and former Governor George Voinovich has stated during previous debates regarding the preservation of Lake Erie that he is “dismayed that the issue [drilling in Lake Erie] would be discussed.”^v

The U.S. Congress has also taken steps to protect this essential natural resource through the Energy Policy Act of 2005. Sec. 386 titled the Great Lakes Oil and Gas Drilling Ban strictly prohibits any State or Federal leasing of lands for new oil and gas slant, directional, or offshore drilling in or under any of the Great Lakes.

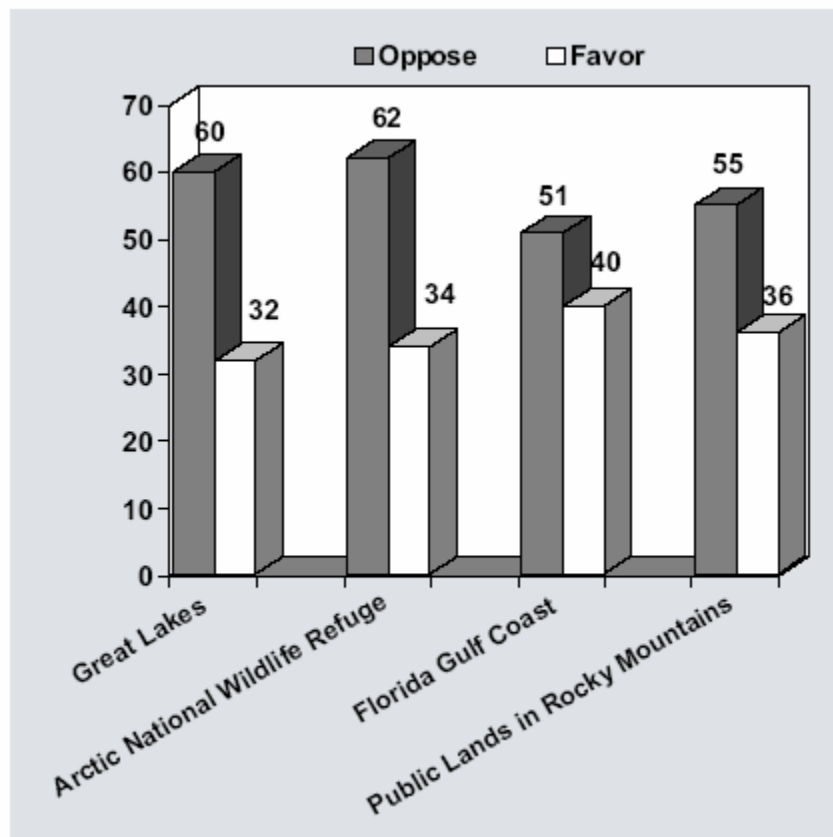
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Energy Policy Act of 2005 (Enrolled as Agreed to or Passed by Both House and Senate)

SEC. 386. GREAT LAKES OIL AND GAS DRILLING BAN.

No Federal or State permit or lease shall be issued for new oil and gas slant, directional, or offshore drilling in or under one or more of the Great Lakes.

In 2000, a national poll, which included voters in Ohio, demonstrates that Americans strongly support increased protection of our environment in general and our precious natural treasures in particular. Americans indicated their opposition to oil or gas drilling in the Great Lakes by an almost two to one margin. In the same poll, Americans also indicated their belief that stronger environmental laws are necessary for a healthy, productive economy.^{vi}



OIL AND GAS DRILLING TECHNOLOGIES

The oil and gas industry relies on a variety of tools and methods for the exploration, production, and transmission of oil and gas. Two broad categories of drilling – offshore and directional – would potentially impact Lake Erie, given the location of the resources under the bed of the lake. While both processes produce roughly the same types of drilling wastes, other impacts are quite different.

Offshore Oil and Gas Drilling

Offshore oil and gas drilling requires the use of seismic testing or other surveys to find potential oil or gas reserves. Once located, during the drilling process, support vessels ferry to and from the drilling rig, delivering pipe, chemicals, fuel, drilling fluids, and other materials. In all cases, impacts to bottomlands may occur in the area of an offshore natural gas well operation because the drilling takes place in the water and takes up to 9 months to complete. This danger arises because the drilling takes place in the water and on the bottom of the lake, so any negative impact will take place directly in the water. Not only does the actual drilling of the well require up to nine months of operation, the exploratory and production drilling are only one of many potential impacts to the bottomlands. After completion, the wellhead must be connected to pipelines that transport the natural resources from the well to processing, storage, and transportation facilities.

Directional Oil and Gas Drilling

Directional drilling begins onshore as a traditional vertical well. The well is then angled under a formation such as a lakebed, allowing access to oil and gas held in deep geologic formations.

Water Quality Impacts from Oil and Gas Drilling

Placing the wellhead onshore (as does directional drilling) does not remove the threat of water contamination. Soil and water contamination at onshore wells within the Lake Erie watershed will lead to contamination of the lake itself. Directional drilling still carries with it the same blowout risks as conventional drilling techniques, but places that risk closer to densely populated areas. Directional drilling sites frequently use up to two acres for the drilling rig, well, and support infrastructure.^{vii} As a result, directional drilling causes significant soil erosion, soil loss, and sediment contamination of surface waters during the preparation and development of the drilling site.

Land Use Impacts from Oil and Gas Drilling

ODNR has estimated that peak production from Lake Erie would require up to 2,000 natural gas wells.^{viii} The average onshore directional well can impact up to 2 acres of land. If all 2,000 sites reach the average onshore drilling impact size of two acres, the total land affected would be over 6.25 square miles – or an area larger than 3,000 football fields. This wasteful land use would be unavoidable; would take place in a densely populated portion of the state; and would impact the Lake Erie shoreline, which is a web of fragile wetlands, beaches, and other lakefront ecosystems.

Air Quality Impacts from Oil and Gas Drilling

Directional drilling and offshore drilling techniques also require extensive use of gas or oil powered drilling equipment on the lakeshore area. In fact, the potential for air quality degradation is higher for directional drilling than for conventional drilling activities.^{ix}

Air quality impacts result from drilling machinery, injection and production pumps, and processing machinery. Fugitive emissions (dust and other small particles) from the wellhead and

support infrastructure could occur. Directional drilling along Lake Erie would have a significant impact on local air quality during the drilling process.^x

Quality of Life Impacts from Oil and Gas Drilling

Because directional drilling sites can be very close to populated areas, noise pollution is also an area of concern. The pumps, drills, generators, and support apparatuses of directional drilling all produce an unpleasant level of noise pollution. The aesthetic effects of placing directional or offshore drilling sites in close proximity of populated areas could also be expected to lower quality of life.^{xi}

THE CANADIAN DRILLING EXPERIENCE: A WARNING FOR OHIO

The proponents of drilling have stated, on innumerable occasions, that Ohio can safely drill in Lake Erie because the Canadians have done so with no problems for years. This claim has gone unchallenged by the press largely due to the difficulty of obtaining evidence about Canadian drilling in Lake Erie. But, research into the Canadian Lake Erie drilling experience clearly shows that this has not been the case. The report released by Ohio PIRG in 2002, *Dirty Drilling*, shows, for the first time, the unacceptable record of Canadian oil and gas sector accidents and spills in and along Lake Erie.^{xii}

In order to obtain information regarding the environmental and public safety of oil and gas drilling on the Canadian side of Lake Erie, Ohio PIRG utilized Freedom of Information requests from the Ontario Spills Action Centre, Sarnia MCTS Centre, Ontario Ministry of Natural Resources, and Environment Canada. Ohio PIRG staff also interviewed personnel at those ministries.

Summary of Findings

- Between 1997 and 2001, there were 51 documented natural gas leaks directly associated with gas drilling operations in Canada's portion of Lake Erie.^{xiii} Lake Erie was also impacted by 83 petroleum spills between 1990 and 1995 (the last year for which data was made available at the time of the report). In those spills, only 45% of the contaminants were cleaned up.^{xiv}
- Companies and Canadian government officials have had a difficult time cleaning up these spills. Between 1993 and 1995, only 45% of spills were fully cleaned up, while 35% were not cleaned up at all – a dismal record. The impact of spills on the environment was also significant. Over 40% of spills report associated property damage; over 35% report vegetation damage; and almost 5% report a fish kill.^{xv}
- The routine, long-term discharge of drilling waste in Canada's portion of Lake Erie represents a significant environmental hazard. These direct discharges into Lake Erie have subjected aquatic organisms to immediate and long-term health effects risks, ranging from localized fish kills to damage to developing wildlife. These risks are exacerbated by the routine usage of toxic chemicals during oil and gas drilling.^{xvi}
- The Ontario Ministry of Natural Resources, which is charged with regulatory oversight of oil and gas drilling, has failed to include regulated environmental considerations in its permitting.

The Ministry was severely criticized for its failure to implement the Ontario Environmental Bill of Rights, effectively thwarting citizen access to and involvement in environmental decision-making.

- The Canadian National Pollutant Release Inventory (NPRI), which tracks the use and disposal of toxic chemicals in Canada, expressly excludes oil and gas drilling operations from its reporting requirements. There is no publicly available information about the toxic chemicals routinely used and discharged from Canada's drilling in Lake Erie.
- There is a lack of data about the cumulative negative impacts of the Canadian oil and gas drilling operations in the Great Lakes. Neither Canadian nor American governmental agencies have investigated the impacts of existing drilling operations over the past 20 years. Despite this lack of readily accessible data, information about the number and impact of petroleum spills was pieced together from the Canadian Coast Guard, the Ontario Ministry of Natural Resources, and the Ontario Ministry of Environment.

As these findings indicate, the Canadian drilling experience has not proved to be environmentally benign, as claimed by oil and gas industry interests. In point of fact, drilling in Canada's portion of Lake Erie has been an accident-ridden and understudied source of pollution.

Drilling Accidents in Canada

As can be seen in Appendices Two and Three, there were 83 documented petroleum spills in Lake Erie between 1990 and 1995.^{xvii} The total volume discharged was not known for 39% of the spills, due to causes as diverse as the source of the spill and lack of real-time monitoring of the spill. For the remaining spills the total volume discharged was up to 5,000 liters of petroleum products. To place this in perspective, one liter of crude oil can contaminate up to 2 million gallons of drinking water and produce an oil slick up to 2 acres in size.^{xviii}

The source or cause for these spills were primarily pipeline leaks, overflow, and unknown causes. Reasons for petroleum sector spills range from corrosion, equipment failure, and human error. The majority of crude oil spills occur at the stage where the crude is still mixed with brines –i.e., during the exploration and production phase of drilling. This data clearly indicates that drilling is routinely dirty and environmentally dangerous. Spills in the production field are the most frequent sources of pollution for our of the top five reasons for spills: equipment failure, corrosion, material failure, human error, and storm or flood.^{xix}

Drilling Muds and Cuttings in Canadian Drilling

Drilling muds are the toxic semi-solid waste produced by drilling. Drilling cuttings are the bits of rock, soil, and debris removed from the well hole. Together, drilling muds and cuttings pose an extreme risk to Lake Erie habitat. Canadian drilling operations utilize a closed-loop drilling system, which is designed to contain drilling muds during the drilling process. The drilling cuttings are separated from the muds and continuously discharged directly to the bottom of Lake Erie.^{xx}

A single Canadian well may produce as much as 6000 cubic meters of cuttings and mud discharge.^{xxi} These discharges can endanger an environment up to 300 meters from the point of release. This practice poses extraordinary environmental risks for bottom dwelling organisms. Burial of bottom dwelling organisms often takes place over a long distance from the site of the drilling rig, depending on the strength of underwater currents at the time of discharge. This burial

causes the death of aquatic species in the affected area. Because drilling muds and cuttings contain a variety of toxic chemicals, direct discharge of these materials into Lake Erie is of concern. Evidence shows that the quantity of fish on the Canadian side of Lake Erie is noticeably smaller than their American counterparts.

Pipeline Development and Safety

Corrosion is the primary and ultimately unavoidable cause of pipeline leaks. Corrosion of exposed pipelines under the lake cannot be avoided because of the nature of pipeline material, which will always be susceptible to the elements. For example, the most common cause of pipeline corrosion in Lake Erie is abrasion by gravel and sand at the bottom of the lake. Wave movement in the lake causes the abrasion of pipelines. Stress corrosion cracking, tiny cracks that develop on pipelines as a result of environmental conditions, has been the subject of Canadian governmental and private sector investigations since 1977. This type of corrosion is very difficult to detect, but can create significant environmental and public health hazards. For example, a 4-inch crack in a Canadian-U.S. pipeline resulted in the release of 222,000 gallons of crude oil and an undetermined amount of natural gas. The resulting natural gas leak caused the evacuation of 400 Michigan residents. As this example indicates, the environmental and public health impacts of pipeline leaks are quite extensive.^{xxii}

Economic Impacts of Drilling in Ohio's Lake Erie

Oil and gas drilling could have widespread net negative effects on the economy of the Lake Erie region in particular and the state of Ohio in general. Please note that the information in the following sections is collected from Ohio PIRG's report produced in 2002, *Dirty Drilling*,

- The annual value of oil and gas drilling is equal to only about three weeks of tourism revenue. Drilling costs to Ohio's \$1.5 billion dollar per year tourism industry far outweigh potential revenues from oil and gas.^{xxiii}
- The cost of each beach closing has been estimated to be \$3.75 million dollars during the tourism season.^{xxiv}
- Oil and gas drilling is a short-term job creator that is frequently undertaken by national companies that use non-Ohio laborers. As such, lost local and state revenue from tourism money would not be recouped from oil and gas drilling activities.
- The peak tourism season and the oil and gas drilling season overlap, leading to an increased likelihood that drilling accidents and routine operations would have a negative effect on Lake Erie tourism.
- Beach users clearly indicate that the quality of Lake Erie waters is a significant determinant of future visits to the lake. Oil and gas drilling could lower water quality, both through routine operations and accidental leaks and spills.^{xxv}
- Every \$100 invested in charter boating multiplies into an additional \$162 dollars for other area businesses. Each lost dollar of charter boating revenue actually removes \$2.62 from the local economy.^{xxvi}

Environmental Impacts of Drilling in Ohio's Lake Erie

At every stage of the drilling process the environment around the drilling site is bombarded by toxic chemicals and threatened by accidental leaks and spills. These environmental Impacts are described in detail in Ohio PIRG's *Dirty Drilling* Report (additional sources for this information can be found at www.ohiopirg.org).

- Natural gas and oil leaks and spills can have extremely negative effects on the natural environment, both on and off shore. Past safety records from drilling sites across the country indicate that such accidents will take place – it is a matter of when it will happen, not if it will happen.
- The potential for accidental or intentional release of drilling wastes into the environment is alarming. Releases can occur through containment failure, run-off, pipeline accidents, and direct discharge.
- Routine drilling wastes, such as drilling muds, cuttings, and produced waters, contain both profuse and varied toxic chemicals. These risks to wildlife include developmental defects, shortened lifespan, and numerous cancers.
- Many of the toxic chemicals associated with oil and gas drilling can accumulate and magnify in the food chain. This poses a risk to aquatic organisms higher in the food chain, such as fish and birds. Many of the chemicals associated with oil and gas drilling tend to persist in the environment, leading to long-term, chronic exposure for aquatic and terrestrial organisms.
- Destruction of wildlife habitat also represents a serious threat from oil and gas drilling. The land area that would be impacted to accommodate the 2,000 wells necessary to achieve peak production would be greater than 3,000 football fields. This is the vital natural habitat necessary for animals as diverse as the bald eagle, the great blue heron and endangered snakes.

Human Health Impacts of Drilling in Ohio's Lake Erie

Oil and gas drilling in Ohio's Lake Erie would take place in one of the most densely populated portions of the state. In fact, counties surrounding the Great Lakes shoreline have the highest average population per mile (3,835) for a major coastal area in the United States.

- Routine drilling wastes, such as drilling muds and cuttings, contain a host of toxic chemicals that are known to be hazardous to human health. Accumulation of toxic chemicals in local and regional Lake Erie ecosystems represents one primary threat to human health.
- As pollutants from oil and gas drilling build up in the food chain, people who consume fish from Lake Erie will be at serious risk of health problems such as genetic defects and cancer.
- Routine discharges and accidental spills of toxic chemicals from drilling sites can also contaminate the water of Lake Erie, thus contaminating a primary drinking water source for millions of Ohioans.

- Some oil and gas drilling discharges, such as air emissions and run off, are an unavoidable consequence of oil and gas drilling. Discharge need not occur in the water to impact the lake's water quality.
- While the human health impacts of leaks and spills are primarily local in nature, placement of wells on shore puts human health at greater risks from accidents, as well as from routine pollution and discharges.

Policy Recommendations

Lower Heat And Electric Bills By Making Natural Gas Go Farther:

Opportunities for using natural gas more efficiently – doing more with less – abound and are cost effective. The state should aggressively promote efforts to make our homes, businesses, industries and government buildings more energy efficient. Those who take action will save the most money, but all Ohio consumers will benefit from the downward pressure that conservation efforts exert on natural gas prices.

Require Utilities to Establish Energy Efficiency Programs for Consumers

- Adopt natural gas energy efficiency legislation to stimulate well-funded, effective gas utility demand-side management (DSM) programs, encourage industries to undertake cost-effective gas energy efficiency projects, and provide grants for natural gas energy efficiency projects.
- Direct electric utilities in the state to establish energy efficiency programs for their customers along with electricity savings requirements. Co-ops and municipal utilities should manage their own programs but report to the Public Utilities Commission of Ohio annually on their actions toward efficiency.

Encourage Local Governmental and School Systems to Take Action Toward Efficiency

- Require larger cities and counties with populations of more than 50,000 residents to update their building energy codes at least once every three years. This will ensure that new buildings are energy-efficient. The state's Office of Energy Efficiency should provide training and technical assistance to builders and to local jurisdictions (building code inspectors) so they can readily comply with and enforce the codes.
- Establish energy savings goals for state government, as well as technical and financial assistance for state and local governments and schools to make energy efficiency investments. Agencies should submit annual reports on their progress and the Office of Energy Efficiency should continue assisting agencies on improving energy efficiency. Local governments and school districts could establish the same goals; if they do, the state should offer technical and financial assistance so they can achieve their goals and cut their energy bills.
- Provide incentives to local governments to encourage them to increase their energy efficiency. One option would be to tap a portion of oil and gas severance tax revenues and establish a competitive grants program for local governments. The grants program could be administered by the Department of Natural Resources.

Enlist PUCO To Take An Active Role In Energy Efficiency

- Make PUCO a leader in promoting energy efficiency to benefit Ohio consumers. Utilities across the country are experimenting with a number of innovative ideas for creating incentives for using energy smarter. PUCO should be at the forefront of those efforts. Through legislation that requires utilities to adopt inverted block rates (the more you consume, the more you pay per kWh), time-of-use rates, and demand response pricing, along with dissemination of energy savings enabling technologies such as price-responsive thermostats, as long as such pricing schemes are cost-effective.

Increase Our Energy Independence By Using More Renewable Energy

To guard against supply disruptions and dramatic fuel price hikes, Ohio can shift to clean, renewable energy sources like wind, solar, and clean biomass. All are becoming economical, and when incorporated in a smart energy strategy, save consumers money. I encourage the Public Utilities and Energy Committee to seek the advice of experts in the fields of solar, wind, biomass and geothermal power. Other states have taken steps forward to promote renewable energy based on the potential in their states. According to an article in the Providence Journal, yesterday, Rhode Island has a larger demand for solar panels than they can supply, and therefore the State Energy Office and the Community College of Rhode Island are planning a training course for electricians on solar-powered technology.

Develop a Renewable Energy Standard

- Create a Renewable Energy Standard (RES) of 20% by 2020 and to 25% by 2025. A portion of the standards (10%) would be set aside for locally- and community-owned projects.

Provide Financial Incentives to Jump Start Renewable Energy

- Provide *tax incentives* for residential-, commercial- and industrial-owned renewable energy systems;
- Provide a *sales tax exemption* for residential- and commercially-owned renewable energy systems (Nevada already does this);
- Establish a renewable energy property tax exemption so that the value added by a renewable energy system could be subtracted from the assessed value of any residential, commercial or industrial building for property tax purposes (Nevada also does this already);
- Establish a *rebate program* for residential- and commercially-owned renewable energy systems like the one in Nevada;
- Provide an *income tax credit* for residential- and commercial-owned renewable energy systems (Utah has such a program, and the 2005 federal energy bill provides a federal tax credit);
- Promote *property tax reform* for renewable resources (as is done in Minnesota).

Require the PUCO to Support Renewable Transmission

- Require the Public Utilities Commission of Ohio to support transmission planning to anticipate wind development, as is done in Minnesota and Texas.

Conclusion

Oil and gas drilling in or under Lake Erie pose unacceptably high environmental, economic, and public health risks. Many of these risks are inherent to the oil and gas drilling process and, as such, are unlikely to be mitigated by regulatory changes or management practices.

Ohio should permanently protect Lake Erie and our public natural and recreational areas from oil and gas drilling. Rather than relying on short sited and unsustainable drilling practices to meet Ohio's energy demands, the state should invest in a cleaner, smarter energy future by promoting energy efficiency programs and renewable energy. By investing in energy efficiency and renewable energy, Ohio can permanently protect Lake Erie, and our few remaining wilderness areas, and save Ohioans money.

I would like to thank Mr. Chairman Hagan and the Public Utilities and Energy Committee for considering this information, and I encourage you to continue in your efforts to develop these efficient and sustainable methods to reduce the burden of increased natural gas prices that we will bear this winter, so that our children and grandchildren do not have to have this same hearing in 30 years.

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- ⁱ Testimony of Dr. Jeffrey M. Ruetter, Director of Ohio Sea Grant, before the Ohio State House of Representatives, Agriculture and Natural Resources Committee. 16 May, 2001
- ⁱⁱ Dirty Drilling: The Threat of Oil and Gas Drilling in Lake Erie, Bryan Clark, January 2002
- ⁱⁱⁱ Governor Taft's actions on the issue of Lake Erie drilling appear to have been limited to a few statements opposing drilling to media at press meetings that were not open to the public. See, for example, "Taft Stresses Opposition to Great Lakes Oil Drilling." *Toledo Blade*, April 11, 2001.
- ^{iv} Remarks by Governor Bob Taft, Keynote for Conference on "The National Water Crisis: Beneath the Surface" University of Toledo College of Law - Legal Institute of the Great Lakes November 14, 2003.
- ^v Letter from George Voinovich to Governor Bob Taft, 12 March 2001.
- ^{vi} *American Voters Place a High Priority of Environmental Protection, Despite Concerns About Energy and the Economy*. League of Conservation Voters Ed Fund, 2001.
- ^{vii} Interview between Bryan Clark, Ohio PIRG and Tanya Cabala with the Lake Michigan Federation.
- ^{viii} Ohio Department of Natural Resources, as quoted in sponsor for Senate Bill 96 by Senator Daniel Brady, Ohio State Senate, Energy and Natural Resources Committee.
- ^{ix} *Estimating Externalities of Natural Gas Fuel Cycles*. Oak Ridge National Labs and Resources for the Future. January 1998. p. 81.
- ^x *Ibid.*
- ^{xi} *Ibid.*
- ^{xii} Clark, Bryan "Dirty Drilling: The Threat of Oil and Gas Drilling in Lake Erie." Ohio PIRG Education Fund, Jan. 2002
- ^{xiii} Sarnia Marine Communications and Traffic Services, Canadian Fisheries and Oceans, Canadian Coast Guard.
- ^{xiv} Cabala, Tanya "Lake Michigan Oil and Gas Drilling: Worth the Risk?" Lake Michigan Federation, 2001
- ^{xv} *Ibid.*
- ^{xvi} *Fisheries News – Lake Erie. Summer 2001*. Ontario Ministry of Natural Resources, Lake Erie Management Unit.
- ^{xvii} Spills Action Center, Canadian Ministry of the Environment.
- ^{xviii} *Ibid.*
- ^{xix} *Ibid.*
- ^{xx} Interview with Rudy Rybansky, Ontario Ministry of Natural Resources (19 Nov. 2001).
- ^{xxi} <http://www.yen.library.ns.ca/georges/www/explorat.htm>
- ^{xxii} *Lake Michigan Drilling: Worth the Risk?* Lake Michigan Federation. 2001
- ^{xxiii} Ohio EPA. *Lake Erie Protection & Restoration Plan*.
- ^{xxiv} Sohngen, Brent; Lichtkoppler, Frank; and Bielen, Mary. "Valuing Water Quality Advisories and Amenities in the Great Lakes." http://www-agecon.ag.ohio-state.edu/Faculty/bsohngen/beach/summ_and_paper.htm
- ^{xxv} Sohngen, Brent; Lichtkoppler, Frank; and Bielen, Mary. "The Value of Lake Erie Beaches." Columbus, Ohio: Ohio Sea Grant, 1999.
- ^{xxvi} Clark, Bryan "Dirty Drilling: The Threat of Oil and Gas Drilling in Lake Erie." Ohio PIRG Education Fund, Jan. 2002