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Behavioral approaches to environmental policy analysis: A case study of offshore wind energy in the North American Great Lakes

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Abstract

Behavioral economics, including prospect theory, offers new approaches to environmental policy analysis. The utility of behavioral approaches to environmental policy analysis is illustrated using a case study of offshore wind energy policy in Michigan, USA. Michigan has attempted to clarify the permitting process for offshore wind energy but those efforts have failed. Prospect theory suggests that Michigan legislators are, for the most part, risk averse to policy reforms as the state emerges from its "one-state recession" and into a gains domain. Legislators from some coastal districts perceive offshore wind development as a threat to coastal quality of life, are risk-seeking for policy reforms, and have introduced bills banning offshore wind energy. Framing the discussion from a loss perspective (losing out to competing states) may be an effective strategy for passing offshore wind policy reforms. Results suggest behavioral approaches have utility for other environmental policy challenges, such as climate change.

Keywords: offshore wind energy; Great Lakes; Michigan; prospect theory; behavioral economics

Introduction

Offshore wind energy, though well-established in Europe and gaining traction in Asia, is only taking tentative steps in North America. The US Department of Energy identified cost and permitting uncertainties as two critical roadblocks that must be overcome for offshore wind to be competitive with other energy sources (Beaudry-Losique *et al.* 2011). The US federal government, particularly the Bureau of Offshore Energy Management, Regulation, and Enforcement (BOEMRE) has clarified and streamlined the permitting process for offshore wind energy development in the federal waters of the outer continental shelf. BOEMRE, however, has no jurisdiction in the US waters of the North American Great Lakes – these are left, primarily, to state governments.

Michigan, like most other Great Lake states, lacks a clear permitting process for offshore wind energy development. Michigan's offshore wind resources could support as much as 36,000 MW of generating capacity after accounting for suitably shallow waters and a shoreline buffer (Adelaja *et al.* 2012) and even more if the potential for deep-water floating turbines is included. The permitting uncertainty also causes anguish among lakeshore community residents, some of whom would rather not see such development at all. A promising start to regulatory clarification in Michigan has bogged down into policy paralysis. Understanding the underlying causes of the policy paralysis is a necessary first step toward the appropriate regulation of this energy resource in Michigan, other Great Lakes states, and the Canadian province of Ontario (which shares jurisdiction of the Great Lakes). Behavioral approaches to

environmental policy, such as prospect theory, may be appropriate tools for understanding, and breaking through, the policy paralysis on offshore wind energy and other environmental challenges.

My goal in this paper is to understand, using prospect theory, how policy processes may become paralyzed. I use the example of offshore wind energy in Michigan, USA, as a case study in the causes of policy paralysis and the means to advance the process. The paper begins with an introduction to prospect theory followed by a summary of the current state regulations, why they are insufficient, and the outcomes and recommendations of an expert panel convened. The section also includes relevant actions at the federal level. Next, I use prospect theory to analyze two proposed bills: one facilitating offshore wind energy and the other banning it. I suggest options to move the policy process ahead including those suggested by other authors. Finally, I move out of the case study to look at the broad implications for using behavioral approaches to understand environmental policy challenges more broadly, such as climate change and hydraulic fracturing ("fracking") for natural gas.

Behavioral approaches to environmental policy analysis

Behavioral economists have shown that people often deviate from the actions expected under rational choice theory and make decisions that, on the surface, appear less than optimal. Over the last twenty years, prospect theory has both illuminated the limitations of the rational choice model and provided more refined insights into human decision-making. What follows is a brief summary of prospect theory and its application to governmental choices.

Prospect theory, as first described by Kahneman and Tversky (1979), presents an alternative approach for analyzing decision-making behaviors. Prospect theory

> "posits that individuals evaluate outcomes with respect to deviations from a reference point rather than with respect to net asset levels, that their identification of this reference point is a critical variable, that they give more weight to losses than to comparable gains, and that they are generally risk averse with respect to gains and risk acceptant with respect to losses" (Levy 1992 p. 171).

These three concepts of prospect theory – the reference point or frame; the idea that "losses loom larger than gains" (Kahneman and Tversky 1979); and risk averse behavior are described in more detail below. Kahneman and Tversky's work was summarized well in *Thinking, Fast and Slow* (Kahneman 2011). According to prospect theory, people are sensitive to *changes* in wealth – gains, losses and neutral outcomes – rather than *states* of wealth. The theory also suggests that the pleasure of a gain is weaker than the pain of a loss of an equivalent amount. For example, a purely rational actor would accept a bet in which a coin toss of heads won her $150 and tails lost her $100 – the expected value of the coin toss is a win of $25. However, experiments show that the pain of losing $100 is greater than the pleasure of winning $150 and the bet is often rejected. This anomaly to rational expectations is called loss aversion (Kahneman 2011).

Because losses loom larger than gains when people are faced with choices, they tend to stick with the status quo. Moving away from the status quo involves some risk. People tend to fear the pain of the

downside risk more than they enjoy an equivalent degree of upside risk. This "status quo bias" can prevent people from making choices that may otherwise be beneficial. Levy describes the status quo bias as follows:

> "If an individual frames a choice problem around the existing status quo, she will treat the costs of moving away from the status quo as a loss and the benefits of moving away from the status quo as a gain, overweight the former relative to the latter, and consequently demonstrate a tendency towards remaining at the status quo" (Levy 1992, p 222).

Another reason for status quo bias is what Richard Thaler (1980) called the endowment effect. People evaluate changes from a reference point and people are less willing to part with something they already have than are willing to make a purchase to obtain it.

Prospect theory also illustrates the consequences from the way in which the choice is framed. That is, changing the reference point can alter a person's preference. In one experiment using a hypothetical disease outbreak, respondents chose between conservative (risk averse) and aggressive (risk seeking) disease mitigation options. The options were variously presented in terms of how many people would survive or how many would die, even though the death rate in both scenarios was identical. When presented with the survival frame, more respondents chose the more conservative (risk averse) program but chose the more aggressive approach (risk seeking) when presented with the mortality frame (Kahneman 2011). Businesses use the framing effect when offering, for example, cash discounts rather than credit card surcharges (Levy 1992).

The elements of prospect theory combine into a "fourfold pattern" of decision making under risk and uncertainty. Decision outcomes (Table 1, Boxes 1-4) can be grouped according to whether their risk (high or low probability) and the type of outcome (gain or loss). Table 1 describes an actor's likely decision-states (risk averse or risk seeking) relative to a hypothetical $10,000 bet. The alternative choice (B) in each case is a guaranteed outcome that is the expected value of Choice A (e.g. $95\% \times \$10{,}000 = \$9{,}500$). The rational decision-maker should be indifferent between the choices because the expected outcomes are identical. However, behavioral economists have shown that people predictably deviate from this rational expectation. Box 1 explains why some litigants accept less favorable settlements even though they are almost sure to win. Box 2 explains the popularity of lottery tickets. Box 3 explains why gamblers continue to make risky bets when they are down. Box 4 explains why people buy insurance (Kahneman 2011).

[Insert Table 1 approximately here]

Policy reforms involve risk and uncertainty, losses and gains, and reference points. Prospect theory, therefore, can provide some guidance on how the actors make or do not make these reforms. Vis and van Kersbergen (2007) applied prospect theory to the workings of political actors.

Vis and van Kersbergen (2007) predict that "policy makers avoid risks as long as they consider themselves in the domain of gains, that is, they see their current situation as still acceptable or tolerable" (p. 159). That is, the policy maker is in Box 1 in Table 1 and is in a risk-averse setting. When

presented with the options of a) preserving the status quo (no reform) or b) a reform that has an overall positive expected value but does involve some smaller risk of loss, then the policy maker is likely to be risk averse to gains and choose the status quo. Policy makers will choose the risky reform when they perceive themselves in a loss domain and "are confronted with a choice between (a) the status quo (no reform) and (b) some gamble (reform) with both an expect value of *further loss* (further electoral loss) and some smaller prospect for improvement (an electoral reward smaller than the expected loss)" (Vis and van Kersbergen 2007, p. 159). This position aligns with Box 3 in Table 1.

Vis and van Kersbergen (2007) also applied the logic of prospect theory to voters. Like their policy maker counterparts, voters in a gains domain and choosing between the status quo and an uncertain but likely positive reform will opt for the status quo (Box 1). Voters in a loss domain choosing between the status quo and an uncertain but likely further loss – but a small opportunity for improvement – will be risk seeking and opt for the reform (Box 3).

Behavioral economics, including prospect theory, is increasingly being applied to environmental policy analysis. Pollitt and Shaorshadze (2013) described how behavioral economics affected household energy consumption habits, energy efficiency investments, and pro-environmental behavior. Venkatachalam (2008) reviewed some of the behavioral anomalies that plague environmental policy-making and implementation, such as the endowment effect, gaps between willingness to pay and willingness to accept for environmental goods and services, and time-inconsistent behavior. Most of the behavioral critiques of environmental and energy policy, including those above, focuses on the individual consumer. Environmental and energy policy analysis can benefit by incorporating behavioral approaches such as prospect theory, as demonstrated in this paper.

Tentative steps toward offshore wind policy: 2008-2010

The Permitting "Dry Run" and the Michigan GLOW Council

In 2008, the Michigan Economic Development Corporation convened a workshop to assess the legal barriers to permitting offshore wind energy development in Michigan's portion of the Great Lakes. The offshore turbines can access the lakes' outstanding wind resources and thus can produce more electricity but they require specialized foundations and vessels and pose challenges for operations and maintenance in bad weather – all of which increase project costs. Given the tedious (now completed) permitting process for the Cape Wind offshore wind project in Massachusetts, it was believed that Michigan's untested regulatory process could inhibit prospective developers. The "dry run" was an attempt to explore the existing permitting and bottomland leasing process, identify shortcomings and uncertainties, and develop proposals to make Michigan "development ready" for offshore wind energy.

The dry run used two hypothetical offshore wind proposals to assess which state and federal agencies would be involved, which legal statutes would be invoked, and how the public would be involved. The dry run itself, however, did not include public participation though the conveners recognized that such participation would be an essential component of any permitting process. The details of the dry run can be found in the project's final report (Klepinger 2008).

The dry run and subsequent Great Lakes Wind (GLOW) Council report found that the state's current review process "would prove inadequate and would likely lead to confusion within government agencies as well as for the applicant and the public" (Klepinger and Public Sector Consultants 2009, p. 4). The dry run participants found that the main permitting tool – the so-called Joint Permit – as currently written is not suitable for regulating offshore wind energy. The Joint Permit is administered jointly by the Michigan Department of Environmental Quality (MDEQ) and the US Army Corps of Engineers (USACE). The Joint Permit process allows applicants to file a single permit request for various construction activities in Great Lakes waters or on the bottomlands. The process was written with coastal and near-shore activities in mind, such as wharfs and marinas, and therefore only riparian landowners may file for a joint permit. Offshore wind developers presumably are not riparian owners (though they could be) and thus would be ineligible for a Joint Permit (Klepinger 2008, Mausolf 2012).

The Michigan Natural Resource and Environmental Policy Act (NREPA) Part 325 regulates the Great Lakes submerged lands. Michigan's Great Lakes bottomlands are held in public trust and as such the state has an obligation to "preserve and protect the interests of the general public in the lands and waters described" and "shall provide for the sale, lease, [or] exchange" of bottomlands whenever the public use of those lands and waters is not substantially affected or the public trust in the state will not be impaired (M.C.L. 324.32502). Compliance with the law is detailed under Administrative Rule 322.1001 *et seq*. The USACE derives its regulatory authority on the Joint Permit from the Rivers and Harbors Act of 1899 (Section 10.33 U.S.C. §403) and the Clean Water Act (33 U.S.C. §1344 and §1251) (Klepinger 2008).

NREPA also provides the Michigan Department of Natural Resources (DNR) with some regulatory authority regarding activities related to offshore wind energy development including, but not limited to, endangered species protection (Part 365), wildlife conservation (Part 401), commercial fishing (Part 473), and marine safety (Part 801) (Klepinger 2008). Other state and federal agencies have coordinating roles, such as the Federal Aviation Administration (FAA), US Coast Guard (USCG), US Environmental Protection Agency (EPA), Federal Energy Regulatory Commission (FERC), Michigan Department of Transportation (MDOT), Michigan Public Service Commission (MPSC), and local planning and zoning boards under the Michigan Zoning Enabling Act (MZEA). These directives are summarized in Table 2 and the complete list can be found in the dry run report (Klepinger 2008).

[Insert Table 2 approximately here]

Recommended legal changes

In 2008 Governor Jennifer Granholm convened an expert panel (the Great Lakes Wind (GLOW) Council) to analyze the permitting issues around offshore wind energy, identify most suitable areas for offshore wind energy development, and recommend offshore wind policy reforms. The GLOW Council, in its 2010 final report, recommended that new legislation be adopted to specify the permitting criteria, the bottomlands leasing and public compensation structure, and the public engagement process for offshore wind energy. The final report included the following recommendations:

- "An acknowledgement that the existing Part 325, Great Lakes Submerged Lands, of Michigan's Natural Resources and Environmental Protection Act of 1994 (PA 451) does not regulate offshore wind energy facilities
- A process for identifying sites for offshore wind energy leasing
- A detailed set of requirements for site assessment plans, development plans, construction plans, operation plans, and decommissioning plans
- A process for public involvement in decision making, including notice and comment opportunities throughout the auction, site assessment, and development processes
- A framework for collecting lease payments and operation royalties and for distributing those funds to administer the regulatory program, to foster renewable energy production and energy efficiency, and to monitor the impacts of offshore wind facilities and offset any impacts through habitat protection and improvements in the Great Lakes" (Klepinger and Public Sector Consultants 2010).

The GLOW Council also drafted a map of most favorable, conditional, and categorically excluded areas for the leasing processes (Figure 1). The most favorable areas were constrained by 22 environmental, economic, and social criteria and limited to bottomlands that are greater than six miles from shore and less than 45 meters in depth (Klepinger and Public Sector Consultants 2010). Technology continues to evolve, particularly floating turbines designed for deep-water applications. For example, Glosten Associates is testing a tension-leg floating wind turbine platform designed for use in depths greater than 40 meters (Moon and Nordstrom 2010). Though the GLOW Council's mapping criteria reflected the time's deployable technology, it is becoming outdated as the years pass and available technology rapidly advances. Once the GLOW Council's reports were submitted, it was left to the state legislature to take up the recommendations.

[Insert Figure 1 approximately here]

Policy coordination at the federal and regional levels

As Michigan debated the GLOW Council recommendations, the federal government and Great Lakes states explored a regional approach to permitting. In 2012 several federal agencies and five of the eight Great Lakes states signed a memorandum of understanding (MOU) to create a Great Lakes Offshore Wind Energy Consortium. The purpose of the consortium is to "support the efficient, expeditious, orderly and responsible review of proposed offshore wind energy projects in the Great Lakes by enhancing coordination among federal and Great Lakes state regulatory agencies" (White House Council of Environmental Quality *et al.* 2012). The participants include Illinois, Michigan, Minnesota, New York, and Pennsylvania as well as the following federal agencies:

- White House Council on Environmental Quality
- Dept. of Energy
- Dept. of Defense
- Dept. of the Army
- Advisory Council on Historic Preservation

- Coast Guard
- Environmental Protection Agency
- Fish and Wildlife Service
- Federal Aviation Administration
- National Oceanic and Atmospheric Administration

The MOU clearly defines each participant's roles and responsibilities for the regulation of offshore wind energy as well as the statutes from which each derives this authority. The participants agreed, among other things, to create a "regulatory roadmap" that clearly articulates the regulatory review process and the information needed for such a review. The participants agreed to publish the roadmap within 15 months of signing the MOU (in March 2012) but as of this writing (January 2014) the roadmap has not been released.

Any offshore wind energy development in the Great Lakes will trigger an environmental impact statement under the National Environmental Policy Act. Agencies can use programmatic environmental statements (PEIS) to analyze the broad landscape, regional, or cumulative effects of regulated activities to reduce the need to redundantly analyze the broad impacts at the project-specific level (National Environmental Policy Task Force 2003). The Great Lakes Wind Collaborative (a multi-sectoral group for which the Great Lakes Commission serves as the secretariat), the State of Ohio, the Council of Great Lakes Governors, and the Michigan Great Lakes Wind Council have all suggested or formally requested that the White House Council on Environmental Quality (CEQ) initiate a PEIS to identify the up-front issues and impacts that would be common to all Great Lakes offshore wind projects, look at the cumulative effects of multiple projects, and encourage the Great Lakes states to proactively develop common standards and practices (Great Lakes Commission 2010). As of January 2014, no PEIS has been conducted and the reason for the lack of progress is unclear.

In September 2013, the Great Lakes Commission – whose membership includes all eight Great Lakes states (Ontario and Quebec have associate membership)– formally adopted a resolution stating that "the Great Lakes Commission believes a small-scale demonstration or pilot project is the most direct means of assessing the potential environmental impacts, and evaluating economic viability and opportunities for job creation involving offshore wind projects in the Great Lakes" (Great Lakes Commission 2013). The Commission's Great Lakes Wind Collaborative published an economic impact analysis of offshore wind energy development in the Great Lakes. A low-deployment scenario of 1,000 MW of Great Lakes offshore wind energy by 2030 could result in 12,500 full-time equivalent (FTE) construction jobs and 750 FTE long-term jobs. Under a high-deployment scenario of 5,000 MW by 2030, the construction phase FTEs climb to 121,700 and 3,900 FTE long-term jobs. The high-deployment scenario capital cost is $4,642/kW (Loomis 2013) which translates to a levelized cost of energy of approximately $0.20/kWh (US National Renewable Energy Laboratory 2013). Though this levelized cost is higher than currently deployed onshore wind energy and fossil fuel generation, technological innovation, experience with pilot projects, and saturation of lower-cost onshore sites may close the cost gap. The difference between the low- and high-deployment scenarios, and their economic impacts, is

whether state and federal policies are in place to facilitate the orderly development of offshore wind energy in the Great Lakes region, including Michigan.

Proposed legislation: 2010-2012

Bills that incorporated the GLOW Council recommendations were introduced at the end of the 2010 legislative session by Representative Dan Scripps (Democratic Party) (HB 6564) and Senators Patricia Birkholz and Gerald Van Woerkom (both from the Republican Party) (SB 1591). Each bill was referred to its respective committees but neither was brought to the full chamber for a vote. Both bills were introduced in the lame duck session after the 2010 elections in which Rep. Scripps was defeated. Senators Birkholz and Van Woerkom were term limited and left office at the end of 2010. Since then no legislator has introduced a bill with the GLOW Council recommendations. The 2010 state elections mirrored the national trend with several winners self-identifying as members of the "Tea Party" conservative wing of the Republican Party. Some of these new legislators, such as Ray Franz (who defeated Rep. Scripps), ran on anti-offshore wind platforms (Stanton 2010). Offshore wind energy became a highly controversial issue along the Lake Michigan coast in 2010 as a Norwegian developer proposed an offshore wind farm in the area even without the regulatory clarity of the recommended legislation (the project was later shelved).

In 2011 and again in 2013, Representative Franz and other Republican colleagues introduced HB 4499 (2011) and HB 7778 (2013) which would have modified Part 325 of NREPA to prohibit the MDEQ from permitting or leasing land for activities, including research, related to offshore wind energy. The bills failed to move out of committee and were not enacted, but the opposition to offshore wind energy in Michigan's Great Lakes remains strong in some constituencies. This bill also failed to move out of committee (Disclosure: the author conducts offshore wind energy research that would be banned under such a bill).

Renewable energy advocates campaigned for expanding Michigan's 10% renewable energy standard which will be met in 2015. In 2012, voters were given the choice, through a proposed constitutional amendment (Proposal 3), to increase the state's RPS to 25% by 2025. The ballot initiative did not directly address offshore wind energy. The proposal was rejected with only about one-third of votes in favor of raising the RPS standard (Anders 2012). Governor Snyder continued the energy conversation in 2013 through his "Readying Michigan to Make Good Energy Decisions" program. The Michigan Public Service Commission (MPSC) hosted a series of public energy forums around the state and released four reports: renewable energy, electric choice, energy efficiency, and additional areas. The MPSC found that renewable energy targets of up to 30% are achievable and none of the scenarios evaluated included offshore wind energy. The report discussed several non-technical barriers to renewable energy adoption, including policy barriers, but the lack of offshore energy policy was not addressed (Quackenbush and Bakkal 2013).

Policy paralysis: a case of risk aversion?

Has offshore wind energy become the "third rail" of Michigan politics? The following section usaes prospect theory to examine why, three years after the GLOW Council submitted its recommendations, Michigan still lacks a clear policy for regulating offshore wind energy.

One of the key elements of prospect theory is whether the decision is being made from a gain or loss domain. The State of Michigan was in a "one-state recession" for the first decade of the 21st century (Darga 2011). Michigan, particularly the state government and many unemployed and underemployed voters, perceived itself in a loss domain. Offshore wind energy development presented an opportunity for Michigan to become the leader in this emerging technology. No full-scale offshore wind turbines had been constructed in North American waters (as of January 2014), though the University of Maine deployed a 1/8-scale, grid-connected floating wind turbine prototype in June 2013 (Viselli 2013). The technology was, and is, more expensive than other clean energy options but the hope was that a clear regulatory pathway could spur innovation and investment and drive costs down in the future. In this context Governor Granholm convened the GLOW Council in 2008 and supported its recommendations for policy reform in 2010. The actual likelihood of attracting offshore wind energy investments, particularly in the near term, were low but the status quo in which further losses were likely was untenable – that is, Michigan found itself in Box 3 of Table 1. In this sense, the risk-seeking policy reform of the GLOW Council recommendations was a reasonable course of action even if the likelihood of Michigan becoming the offshore wind energy manufacturing and logistical hub for the Great Lakes was low.

Prospect theory also explains the timing and authors of the GLOW Council-recommended reform bills introduced in 2010. The bills were introduced during the lame duck session by Rep. Scripps, who had been defeated but had not yet left office, and Senators Birkholz and Van Woerkom, both of whom were unable to run for re-election because of term limits. All of these legislators, therefore, can be described as being in a loss domain (Table 1, Box 3) in which they are risk-seeking toward policy reforms. Each of these legislators had a strong record on environmental issues so it not surprising that they proposed the reform bills. It does suggest, however, that future bills implementing the GLOW Council recommendations may similarly come from legislators who find themselves, for one reason or another, in a loss domain.

One plausible, but not exclusive, explanation for why the GLOW Council recommendations were not enacted and why the 25% renewable energy initiative failed is risk aversion. By late 2010, Michigan's economy was improving (Darga 2011). Legislators and their constituents may have perceived themselves to be in a gains domain and thus more averse to risky policy reforms. Other factors have been noted as reasons why the 25% renewable energy initiative failed, such as it being an amendment to the state constitution. Of the six initiatives on the 2012 ballot for voter approval, none passed.

The Michigan government, and its citizens, is not a monolithic actor. The legislators represent diverse constituencies and not all of them experienced the "one-state recession" equally. The Michigan GLOW Council held a series of public meetings in 2009-2010. A disproportionately large number of attendees (24%) reported being able to see the Great Lakes horizon from his or her primary residence. Additionally, 62% of the attendees reported owning a second residence and about one-third of them

had a view of the Great Lakes horizon (Klepinger and Public Sector Consultants 2010). It is plausible that residents of lakeshore communities, particularly those with homes on the coast, perceived themselves in a gains domain. That is, their particular economic conditions were tolerable under the status quo (no reform). Prospect theory predicts that the lakeshore voters and their legislators should be risk averse with respect to reform (the GLOW Council recommendations). The legislators who sponsored the ban on offshore wind energy represent some of the coastal regions where offshore wind energy has been controversial. Additional evidence from the GLOW Council's stakeholder meetings supports this view. Coastal residents who attended the meetings expected offshore wind turbines to "strongly harm" aesthetics and coastal property values – the potential losses loom large. Inland residents, on the other hand, expected offshore wind farms to neither benefit nor harm these aspects (Five-point Likert scale, median=5 (coastal) vs. 3 (inland), Mann-Whitney U $p<0.05$). These results were not drawn from a random sample so the conclusions cannot be generalized to the whole population.

Framing (the reference point) is an important component of prospect theory and plays a role here. In the discussion above, the status quo is presented an uncertain regulatory framework that inhibits (though does not outright prevent) offshore wind energy development. Reform is presented as the GLOW Council recommendations that would rationalize the permitting and lease process while protecting scenic amenities, spawning habitats, and other locations.

Another frame can be applied to the problem. Offshore wind is currently legal but the permitting process is uncertain and untested (status quo). An alternative policy reform is to ban offshore wind energy from Michigan's Great Lakes altogether. In this case, lakeshore property owners can see an uninterrupted horizon. Any development that might disrupt that view, no matter how far or visible it might be, is perceived as a loss. Peer-reviewed economic analyses of the property value impacts of wind turbines have consistently failed to find a meaningful loss of value from wind turbines (e.g. Hoen *et al.* 2011; see Isely *et al.* 2013 for review). Property owners, however, have often voiced concerns that the visual impact of offshore wind energy could cause lakeshore property values to decline (Nordman *et al.* 2013a, Klepinger and Public Sector Consultants 2010; see also Phadke 2010). From this perspective, lakeshore property owners are in Box 3 in Table 1 and are risk seeking as voters for reform that would ban offshore wind energy. That is, coastal residents are risk seeking toward reform to prevent losses but risk averse toward reforms that seek additional gains.

Moving forward

This leaves offshore wind at a legislative impasse. Legislators from coastal communities who are concerned about the potential (though unlikely) property value and aesthetic effects of offshore wind will continue to press to ban offshore wind energy technology even if the bill has little chance of passing. On the other hand, there is little incentive for any particular legislator, especially one not facing defeat or term limits, to sponsor a bill embracing the GLOW Council recommendations. The lesson from previous elections is to sponsor the bill only if you are a lame duck, otherwise you may find yourself touching the "third rail" of Michigan politics. This section presents some options for overcoming the policy gridlock on offshore wind energy in Michgian.

Working from a loss domain: fear of missing out

While Michigan still struggles with higher than average unemployment and weak growth, its "one state recession" was declared at an end in 2011 (Darga 2011). Prospect theory predicts that a government may be more likely to take a chance on a reform when it perceives itself to be in a loss domain. As Michigan's economic climate improves it may find itself moving toward a gains domain in which the appetite for reform is weaker. While this is undoubtedly a positive economic trend, it does seem to be closing on an opportunity to reform the permitting process for offshore wind energy development. There are other factors that could shift Michigan from a gain to a loss frame such as if other states made notable progress on offshore wind energy. For example, if Lake Erie Energy Development Corporation's (LEEDCO) "Icebreaker" 18 MW offshore wind farm in Lake Erie off of Cleveland, Ohio were to move forward as planned, Michigan may fear being "left behind" and missing out on attracting the manufacturing and shipping industries associated with offshore wind energy. External developments like that could change Michigan to a domain that is more favorable to reforming the permitting process. Proponents of the GLOW Council reforms may consider framing the issue from such a loss perspective in which Michigan is losing out to its neighbors.

Strategic positioning as the Great Lakes energy hub

If Michigan is in a gains domain, reform is best approached as an opportunity to obtain a large gain – an incremental gain is unlikely to overcome the risk of disproportionately looming losses. For offshore wind energy, this might be portraying Michigan as the offshore wind energy hub for North America. The offshore wind sector, still in its infancy in North America, lacks an industrial hub. Michigan has an opportunity to strategically position itself as the industrial hub for offshore wind energy manufacturing, logistics, and deployment for the entire Great Lakes region, but only if it acts in a coordinated, timely manner.

Michigan, with coasts on four of the five Great Lakes, lies at the center of a region that includes 10 percent and 31 percent of the US and Canadian populations, respectively (US Environmental Protection Agency 2012). Michigan also has skilled workers with experience in manufacturing. Other regions have leveraged their human resources, natural capital, and infrastructure to become hubs for offshore wind energy, namely the North Holland region of the Netherlands. North Holland is home to several energy research and development organizations, including the Energy Centre Netherlands, the European Commission Joint Research Centre-Institute for Energy, the Wind Turbine Materials and Construction Knowledge Centre, and the Royal Netherlands Institute for Sea Research. This spatial concentration of skills and expertise, combined with a long history in North Sea oil and gas development, public comfort with a working seascape, and suitable coastal conditions, enabled the Netherlands to become a leader in offshore wind energy (Nordman et al. 2013b). The Netherlands plans to increase its offshore wind capacity to more than 4,000 MW by 2023 from about 1,000 MW installed or currently under development (Bakewell 2013).

For Michigan to become the industrial hub of Great Lakes offshore wind energy development would require more than permitting legislation. It would require comprehensive industrial policy to leverage

the knowledge of Michigan's world-class universities, the skills of its renowned private manufacturing sector, and the expertise of the regulatory agencies to spur investment. Amassing the human, physical, and financial capital required is unlikely to occur without comprehensive public policy. Michigan does have the required capital to do this, but it is not concentrated in one small geographic area as it is in North Holland. The automotive industry, the closest analogue to offshore wind manufacturing, is concentrated in Detroit but parts suppliers are located throughout the state. The broad spatial distribution may limit the opportunity for knowledge spillovers across sectors and companies, it may help build statewide support across many constituencies.

Waiting for a lame duck session

In a risk-averse climate, prospect theory predicts that reform legislation will more likely be introduced during lame-duck sessions. This was the case in 2010, but no GLOW Council reform bills have been sponsored since then either in the lame duck or general session. It remains to be seen if the issue will be taken up during the lame-duck session in November 2014.

Compacts and regional approaches

Other scholars have offered ideas to move the process forward. Saks (2011) encouraged harmonized regional approach that fosters collaboration among the Great Lakes states and with the federal agencies, as has happened with the MOU. This would be especially relevant if proposed sites spanned state jurisdictions such as in southern Lake Michigan or western Lake Erie. Conger (2011) proposed forming a multi-state offshore wind energy compact similar to the Great Lakes Basin Compact and its implementing agency, the Great Lakes Commission. A multi-state offshore wind energy commission could serve as a lead agency for the harmonized permitting process. A regionally uniform permitting process – perhaps even in coordination with Ontario provincial regulations – in consultation with the appropriate federal agencies might better attract offshore wind energy investment to the region more broadly (Conger 2011). Pressure from neighboring states could put Michigan in a position of "losing out" on the industry and thus in a frame that is more amenable to offshore wind energy policy reform – in this case, relinquishing some permitting authority to a multi-state regulatory body.

Implications beyond Michigan offshore wind

This case study of Michigan's offshore wind energy policy paralysis illustrates how prospect theory can be applied to understanding environmental policy challenges. The results of the Michigan case study add to the growing body of literature using behavioral approaches to environmental policy (see, for example, Pollitt and Shaorshadze 2013; Shogren *et al*. 2010; Venkatachalam 2008). Most of this literature has focused on choices of individuals in a market context. We have, following the example of Vis and van Kersbergen, have extended the behavioral approach of prospect theory to the policy process itself.

Our findings suggest that prospect theory may be a suitable tool for analyzing other environmental policy challenges. For example, the United States has struggled to produce a comprehensive federal energy and climate policy. If, as our results suggest, policy reform is more likely to be successful when

framed from a loss domain, then a future in which climate-related losses (such as “Superstorm” Sandy in 2012) are increasing becomes less tolerable. In such a loss frame, policy-makers may be more risk-seeking in their approach toward reform, making energy and climate legislation more likely.

Prospect theory may also have utility in explaining attitudes toward hydraulic fracturing (“fracking”) of natural gas and oil. Oil and gas development, including fracking, is legal and regulated. In some cases, however, the regulations for new fracking techniques are not as strict as some would prefer. Opponents of fracking are concerned about the environmental risks, especially those to groundwater (Krupnick and Siikamäki 2013). That is, they approach the problem from a loss domain and are risk-seeking toward reform of fracking regulations. There is evidence to support this idea: a recent study found that environmental NGO messages which highlight the risks of fracking (loss frame) elicited a higher willingness to pay for risk reduction compared to neutral and industry messages (Krupnick and Siikamäki 2013). Both of the examples above are superficial analyses of complex challenges that deserve more detailed investigation. Our results suggest that future studies of these and other environmental and energy policy challenges may benefit from using a behavioral theoretical lens.

Conclusions

Behavioral approaches to environmental policy analysis are gaining traction. Though the standard rational choice model of policy actors, including consumers, works well in most cases, environmental economists and policy analysts have catalogued “behavioral failures” in which actors do not make optimizing choices. While the research focus so far has been on consumers of environmental goods and services, behavioral approaches, including prospect theory, can apply to the actions of policy-makers as well. We have illustrated the utility of the behavioral approach to environmental policy analysis using a case study of offshore wind energy in Michigan’s Great Lakes. Our results also suggest that behavioral approaches may be useful for analyzing other environmental policy challenges, including climate change and fracking.

Michigan has outstanding offshore wind energy resources but lacks a clear policy framework through which the private sector can access the state-owned lake bottomlands. While offshore wind energy is not prohibited, the regulatory uncertainty provides a strong disincentive toward such infrastructure investments. Attempts to clear the regulatory hurdles have failed to pass through the state legislature and there seems to be little enthusiasm to sponsor a bill that would facilitate offshore wind energy development in Michigan. On the other hand, several bills have been introduced that would ban offshore wind energy development from Michigan’s Great Lakes. Prospect theory can explain some aspects of this policy paralysis. The benefits of offshore wind energy – particularly in reducing air pollution from other generating sources – accrue to a broad range of residents inside and outside Michigan, while the potential, but uncertain and relatively smaller, property value and aesthetic impacts accrue to a particular constituency. There is little incentive for a legislator to advocate for offshore wind energy policy and strong incentives for particular legislators to advocate a ban. Prospect theory’s emphasis on risk aversion, status quo bias, and framing add to the explanation and offer ways forward.

We offer several approaches for moving the policy discussion forward. Framing the issue from a loss domain – such as losing out to neighboring states on an emerging industry – could encourage voters and legislators to be more open to the regulatory reform needed to facilitate offshore wind energy development in Michigan's Great Lakes. Framing the policy reform from a gains domain requires the potential for a large, rather than incremental, benefit. The reform would need to go beyond simply permitting to perhaps an industrial policy aimed at making Michigan the Great Lakes hub for offshore wind energy. Regional collaborative approaches, from a federally coordinated MOU to a multi-state compact, could encourage Michigan to adopt a coherent, basin-wide offshore wind permitting system. A ban on offshore wind energy (and associated research) has been proposed but does not, at the moment, have much support. However the uncertainty surrounding Michigan's offshore wind energy permitting system discourages investment and the status quo may be as good as a ban.

The behavioral turn in environmental policy analysis is just beginning. Additional empirical evidence is needed from natural and laboratory experiments to advance the field. Our research, as well as that of others, suggest that prospect theory holds promise for understanding how individuals, whether consumers, citizens, or policy-makers, make decisions under conditions of uncertainty. The 20th century generation of energy infrastructure was built largely without much public input. The 21st century transition to low-carbon, distributed energy systems is happening with a large degree of public input, making the need for a behavioral approach to policy analysis that much greater.

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Table 1: Prospect theory's fourfold pattern (adapted from Kahneman 2011). The option (A or B) in **bold** reflects the outcome predicted by prospect theory.

		Level of risk	
		High probability	Low probability
Type of outcome	Gain	*Box 1: Risk Averse* A: 95% chance of winning $10,000 5% chance of winning nothing **B: 100% chance of winning $9,500** Reason: Fear of disappointment	*Box 2: Risk Seeking* **A: 5% chance of winning $10,000** **95% chance of winning nothing** B: 100% chance of winning $500 Reason: Hope of large gain
	Loss	*Box 3: Risk Seeking* **A: 95% chance of losing $10,000** **5% chance of losing nothing** B: 100% chance of losing $9,500 Reason: Hope to avoid large loss	*Box 4: Risk Averse* A: 5% chance of losing $10,000 95% chance of losing nothing **B: 100% chance of losing $500** Reason: Fear of large loss

Table 2: Key permitting actions, actors, and statutes regulating offshore wind energy development in Michigan's Great Lakes.

Action	Major Actor	Statute	Coordinating actors
Review and issue Joint Permit	MDEQ	NREPA Part 325	MDNR
	USACE	R&HA, CWA, NHPA	
Issue bottomland lease	MDEQ	NREPA Part 325	MDNR
Conduct EA/EIS	USACE	NEPA	EPA
Issue Notice of Proposed Construction	FAA and MDOT	MI Tall Structures Act, FAA 14 CFR 77	
Issue Permit for Private Aids to Navigation	USCG	33 CFR 64, 66. 67	USACE
Issue Certificate of Public Conveyance and Necessity	MPSC	PA 30 of 1995	FERC
Issue zoning permit for onshore transmission	Local planning and zoning boards	MZEA	

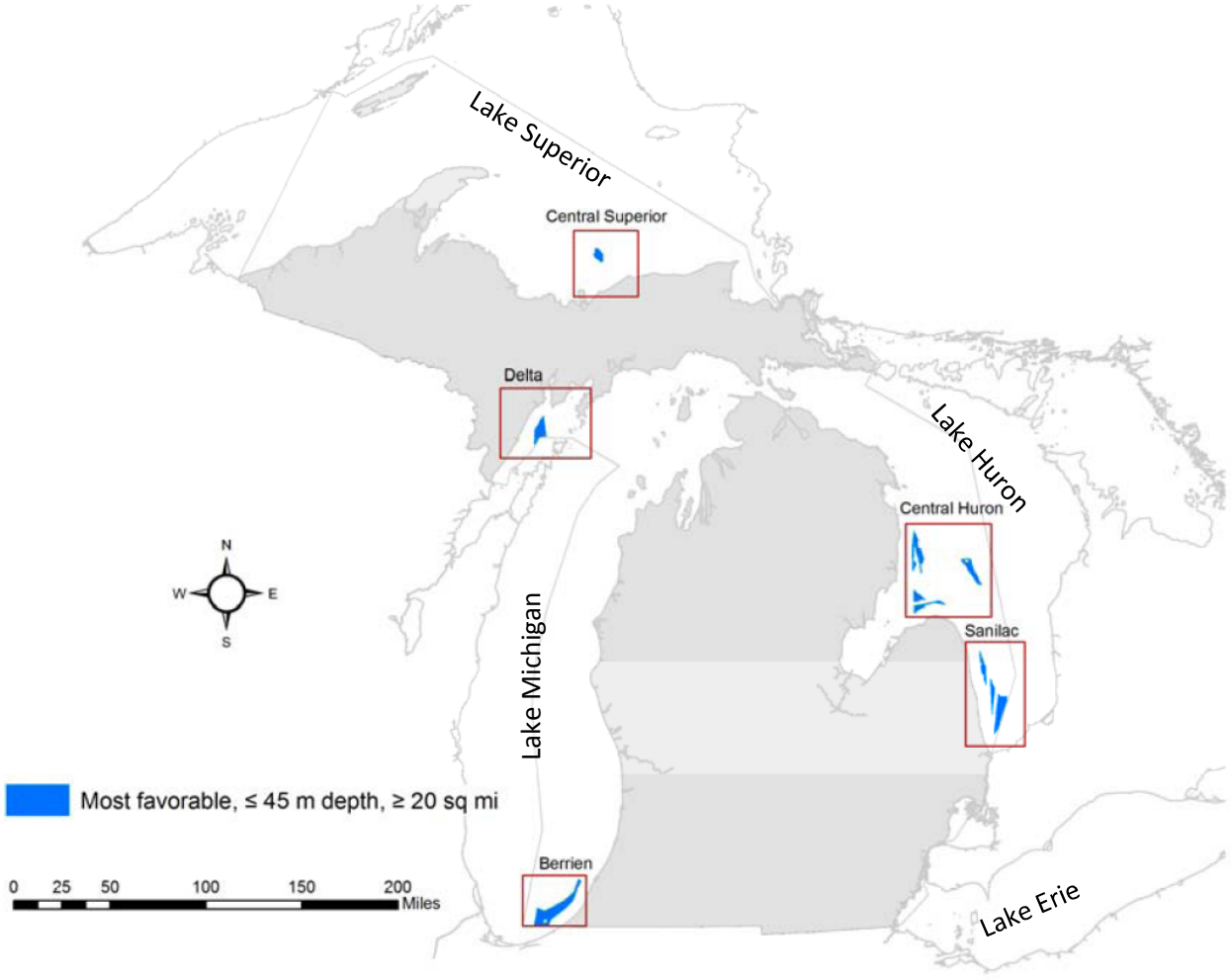

Figure 1: Most favorable areas for offshore wind energy development in Michigan's Great Lakes, based on GLOW Council mapping criteria (Klepinger and Public Sector Consultants 2010).