# The Potential Role for Technology Demonstration Projects in Clean Energy Planning: The Case of Offshore Wind
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## Introduction

In July 2008 Al Gore challenged U.S policymakers and technical experts: create a new electricity system that is completely climate-neutral within 10 years. Gore's Repower America initiative has been compared to the Apollo project in both its scope and its potential, but numerous technical, regulatory, and political obstacles stand between today's power system and the one that Gore envisions. What Gore's challenge underscores, however, is the urgency of the global warming problem and the limited time frame available to change course (IPCC 2007). While a 10-year time horizon might be impossibly ambitious, one success of the Repower America program is that it has moved the debate beyond the *need* for a renewable energy system, to a focus on how long it will take to build it.

What it already clear is that any future electricity system in the U.S. must include significant amounts of clean, renewable power and that will require among other things, the construction of offshore wind energy facilities. While the U.S. as a whole is fortunate to possess a diversity of domestic renewable resources, including small-scale hydropower in the northwest, agricultural biomass in the Midwest, and solar and geothermal in the west and south, the country's expansive coastline means the offshore wind resource is one of the most abundant. The estimated "developable" wind resource is approximately 900 GW -- just under the current generating capacity of the entire U.S.

electricity grid (Musial 2005).[1] For many regions of the country, especially coastal states in the northeast, offshore wind is one of the most promising technologies from a technical standpoint.

Yet, despite a history of state support for renewable energy (the first state renewable portfolio standard was enacted in 1994) and 18 years of experience with offshore wind in Europe (Pfeister 2009) there is not a single operational offshore wind project in the United States. The most well known attempt is the Cape Wind project in Massachusetts' Nantucket Sound, but several other projects have also been proposed. The offshore wind project most likely to reach completion first is Delaware's Bluewater Wind Park (in 2012) (Svenvold 2008). The delay in construction of off-shore wind energy facilities has not been caused by a lack of technological know-how. Rather, public opposition and political hesitancy, in the context of a planning and regulatory system that is not equipped to manage coastal development at the speed and scale that the climate change problem requires, are to blame. The current patchwork of federal, state, and local regulatory processes has effectively blocked renewably energy technologies. Rethinking the current regulatory system may be a necessary step for offshore wind deployment to occur in the near term (Watson 2005).

We suggest that offshore wind demonstration projects might be a valuable tool for overcoming public opposition, political hesitancy and the flaws in the existing regulatory process. The use of technology demonstrations in advance of full-scale wind projects

[1] This estimate of offshore wind capacity includes deepwater sites as well as offshore wind technology for deepwater applications which is still maturing. "Developable" sites refers to acceptable locations that remain after shipping lanes, avian migratory routes, and other protected areas have been accounted for.

could be a way of ensuring more meaningful public participation in ocean management, coastal zone development and energy planning processes. By increasing the opportunities for joint fact finding and, particularly, by revealing more about the impacts and operation of various new technologies, demonstration projects can promote public learning. Currently, the federal and state regulatory regimes that control the siting of offshore wind projects make no distinction between a demonstration turbine and a full-scale permanent wind installation. At the present time, a single temporary turbine, constructed for the purpose of testing and generating public input, must go through the same lengthy regulatory review process as a wind farm on the scale of Cape Wind. We don't assume that demonstration projects won't be contentious, especially given the current climate of heightened public concern about the impact of offshore wind development on ocean environments and the view from the shore. On the contrary, some underlying conflicts might be triggered by demonstration projects. Nevertheless, demonstrations projects will increase the opportunities for feedback and technology adaptation. This is especially important for new technologies that will be deployed in ecosystems that hold important economic, environmental, and cultural resources.

**The Current Regulatory System for Offshore Wind**

Offshore wind is an emerging technology that holds the potential to reform our current energy supply infrastructure. It will also bring unfamiliar changes to coastal landscapes. The existing regulatory framework for managing energy projects and coastal development is ad hoc and not equipped to deal with the "big picture" planning

questions raised by offshore wind development. Most state and federal regulators realize this, but they have been forced to consider the current round of off-shore wind projects within the existing regulatory context. This transitional time, however, offers an opportunity to move beyond the current system, to design new regulatory and public enagement learning processes that are better suited to the country's urgent need to increase its supply of renewable energy.

Although a lot of attention is usually paid to the federal regulatory process, offshore wind development is actually both a state and federal issue. The federal government has a control over any actions within the exclusive economic zone, which extends 200 nautical miles from shore, while states hold title to all the lands up to three miles out from the coastline. The Submerged Lands Act of 1953 gave states legal right to manage these waters, provided their actions don't conflict with commerce, navigation, national defense, or international affairs.[2] States also have some regulatory jurisdiction over components of project erected in Federal waters (i.e., transmission lines that must make landfall at some point). State permits are required for all construction within state waters, such as the transmission cables, and also the onshore grid connection infrastructure (Vann 2008). Also, the 1972 Coastal Zone Management Act (CZMA) is a federal law that assigns states responsibility for managing and protecting resources in coastal waters.[3] Each eligible coastal and Great Lakes state (other than Illinois) has created its own CZMA plan, and states have authority to insist that projects in federal waters adhere to CZMA stipulations (Vann 2008).

[2] US Code 43 Public Lands, §1314(a)
[3] US Code 16 Conservation, §1451-1464

The Cape Wind project is proposed for federal waters off the coast of Massachusetts' Nantucket Sound. In addition, the strongest offshore wind resource is past the three-mile jurisdictional boundary, so many proponents have been looking to federal waters as the site for future deepwater development. For these reasons, the federal permitting process has attracted more attention than individual state reviews. The Army Corps of Engineers took initial jurisdiction over the Cape Wind environmental impact assessment (NEPA) process, based on authority granted by the River and Harbors Act. Several lawsuits filed by the Alliance to Protect Nantucket Sound challenged this authority. The 2005 Energy Policy Act (EPACT) prompted clarification (Vann 2008). Section 388 of the 2005 EPACT clarifies some jurisdictional questions regarding development on the outer continental shelf, and puts the Interior Secretary in charge of crafting a federal regulatory regime for offshore wind. The Minerals Management Service (MMS) has assumed the lead role, and in consultation with other agencies such as the Corps and the Federal Energy Regulatory Commission, has pursued rulemaking for "Alternative Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf" (MMS 2008). The proposed regulations have received extensive public comment, and a final version is expected sometime in 2009 (Bornholdt 2009). The federal government is working towards the goal of a consistent and predictable regulatory framework, but it is important to ask what this goal leaves out.

There are three important features of existing and proposed federal and state regulation that hinder a holistic approach to clean energy planning. First, existing federal (EIS) and

state (EIR) environmental assessment guidelines do not consider proposed projects in the context of the larger regional energy planning questions at stak, including the tradeoffs involved when other possible locations and/or other types of energy solutions are possible. Second, the existing federal model for licensing offshore energy projects is based on a long history with oil and gas drilling. There are numerous reasons why this is an inappropriate model for renewable energy facilities. Third, the existence of overlapping federal, state, and local permitting systems undermines the continuity of renewable energy planning, which ought to be considered at the regional level. Not all of these issues are specific to offshore wind development, but we explore them below in that context.

Federal and state EIA processes are meant to gauge the site-specific impacts of individual projects. For that reason, they are inadequate to assessing proposed project in the context of larger and long-term regional resource development strategies (Wickersham 2004). This broader context is a crucial consideration as governments confront the task of making significant changes to their existing energy system, while simultaneously planning for climate change adaptation, especially in coastal regions. The EIA process requires that “alternatives” to all proposed projects be used to compare outcomes. This approach works when the facility involves is a new bridge. Alternatives designs can be compared, including different highway routes as well as strategies to mitigate local impact. However, the planning process for offshore wind really needs to consider a combination of very different locations, as well as a mix of radically different technologies. Each would require the preparation of a traditional EIA.

They can not be compared in the same context using slightly modified base line forecasts. In addition, many of the “alternatives” to offshore wind are other energy technologies, some of which exacerbate climate change. It would very difficult to compare environmental impacts of very different kinds in a single EIA. Ultimately, the overarching public policy goals for offshore wind development should assessed first which site specific and technology specific decisions should be reviewed within that framework (Wickersham 2004).

Since there is no existing policy framework for offshore wind development (since integrated ocean management plans do not yet exist), federal permitting is going forward as if we were considering oil and gas development. This is, at best, an imperfect fit (Martin and Smith 2004). The new federal regulations governing offshore energy development were developed based almost entirely on the way we permit oil and gas drilling (under the jurisdiction of the MMS). The differences between offshore oil and gas development and the development of offshore wind turbines are substantial. For starters, oil and gas operations create possible environmental impacts during and after construction (because of the possibility of oil spills), and in general are more “active” during operation, since people and supplies must come and go. Wind turbines, in contrast, are fairly passive once they are constructed, aside from occasional maintenance requirements. Second, offshore wind is an emerging technology whereas the design and operation of offshore oil platforms are well established. And finally, while public concern about oil and gas operations centers primarily on ecological impacts, the public opposition to wind currently concerns economic costs, aesthetics and effects on

radars. Since the EIA provides the main public forum for debate, it is the setting in which all objections are raised (even though environmental impact assessments do not focus very effectively on cultural, aesthetic, and electronic considerations).

The current EIA system has made the federal government a major player in what is centrally a regional or state planning question. Technology and public preference seem to be pushing potential offshore sites farther from the coast (out of sight), into federal water. While there are important planning and coordination efforts that need to take place among federal agencies, it seems inappropriate to suggest that regional energy planning take place in a federal forum. In the case of Cape Wind, the primary public forum has been the federal EIA process now managed by the MMS. Delaware's Bluewater Wind project lists 18 federal regulations, permits, and reviews applicable to the project, including the Federal Aviation Administration, the Migratory Bird Treaty Act, and the Abandoned Shipwreck Act (Bluewater Wind 2009). Yet, the majority of benefits and impacts of offshore wind are local. For starters, the availability of electric power is determined by decisions made at the regional and sub-regional scale. Residents of Massachusetts, for instance, have different renewable resource options open to them depending on whether they live in the western or eastern part of the state. Also, the economic costs or benefits of different energy choices are felt primarily at the local level. And finally, many cultural and socioeconomic considerations are primarily local. At present, state ocean planning efforts are underway, but state and federal coordination remains a major issue.[4]

[4] Greg Watson, Personal Communication 2/23/09.

It is hard for current discussions about offshore wind development in the U.S. to shake off the contentious legacy of Cape Wind. A combination of factors, including the scale of the proposal and the site location, pushed the early dialogue about the future of the northeast coastal resource development into an open dispute (Williams 2008). The environment for discussion has often been adversarial, and opponents have taken a litigious approach to stopping the project. Interior Secretary Ken Salazar acknowledged these circumstances when he stated recently "these should not be partisan issues, but issues that we approach with balance and careful planning" (Salazar 2009). This litigious legacy reinforces the desire for predictability in the permitting approach, since flexible rules can be challenged too easily. Unfortunately, this cuts against the need to plan for adaptation in locally appropriate ways.

In short, many features of the existing regulatory framework for offshore wind are inappropriate for the comprehensive energy and climate planning effort that is needed. The challenge is to create a regulatory system that embraces the developmental nature of offshore wind, especially given the need for climate change adaptation. [add citation] As our knowledge about the ecological impacts of offshore wind evolves, a planning framework based on real-world demonstrations can provide a more adaptive planning process and lead to more locally appropriate energy solutions. We suggest that this goal could be better achieved through a state and regional permitting process that emphasizes demonstration projects.

**Moving Beyond the Current System**

States have recently been leading the policy push for renewable energy expansion in the U.S., mainly through legislated renewable portfolio standards (RPS) and incentive for clean energy development (Parenteau 2008). Federal promotion of renewable technologies has lagged in recent years. And despite very recent political political moves in this direction, the federal government's ability to promote specific installations is limited. At the other end of the spectrum, local governments can use their zoning power to set aside land for energy facility development. They don't have the financial or jurisdictional power, however, to make a significant impact on energy supplies in the United States. States, on the other hand, have the jurisdictional authority to manage the permitting process along with the power and resources to create a favorable climate for investment in renewable energy.

As of late 2008, eighteen states in the coastal or great lakes regions had initiated a formal process to develop offshore wind resources (US Offshore Wind Collaborative 2008). These include very preliminary steps such as general education and outreach, as well as much more substantial commitments such as issuing RFPs for specific site development, or initiating ocean "zoning" efforts to set aside areas for wind farms. Five states in the Northeast and Mid-Atlantic are currently engaged in integrated ocean management efforts: Massachusetts, Rhode Island, New York, New Jersey, and Delaware. These states are seeking to identify the most favorable sites for offshore wind development by balance of resource availability, environmental protection, and the need to site or maintain compatible uses as well.

A often overlooked component of a comprehensive state energy planning effort is the need to make technology demonstrations possible. Small scale offshore wind energy demonstrations at this early stage of technology deployment may be the key to winning public support and figuring out how best to mitigate the undesirable impacts of winde energy facilities. The current conflicts over possible environmental, visual, noise and other impacts is hard to resolve because neither side has sufficient evidence to prove their points conclusively. While demonstration projects will not settle all these debates, they could provide experience-based information that would put some of these questions to rest in a way that overseas examples have not..

When designed properly, demonstrations provide opportunities for joint fact finding (JFF). [cite JFF article in LS et. al] JFF involves proponents and opponents in purposeful efforts to structure small scale experiments. These can be monitored jointly to produce crucial information about impacts or the merits of alternative technologies or management systems. While “scaling up” the results of small scale experiments may generate some disagreement, it is a lot easier to work through competing claims with evidence generated in an entirely transparent and jointly planned fashion.

Stakeholders would collaboratively establish the pertinent unknown scientific information, the data requirements and measurement techniques, how to deal with risk and uncertainty, and how to choose the affiliation(s) of the participating researchers (Ozawa 1996, Ehrmann and Stinson 1999). Under this model, the scientist, like the

planner, is a facilitator with technical expertise, and does not necessarily have decision-making authority.

Demonstration projects, or other efforts at public learning, have not been pursued in the energy planning context in the northeast. Test platforms, for example, including a fixed base with a grid interface allowing different turbine designs to be swapped in and out, have not been built.[5] One advantage of such an arrangement is the permitting process for a seabed anchor would happen once, but numerous turbine designs could be tested. From a public learning perspective, this could increase familiarity with different technologies and allow shoreline resident to appraise the actual aesthetic impact of off-shore facilities. , State energy planning efforts in Maine are still in their early stages, but they have moved the farthest in trying to incorporate demonstration projects into their regulatory regime. In February 2009, the Regulatory and Permitting Subcommittee of Maine's Ocean Energy Task Force released a report entitled, "An Act to Facilitate Testing of Offshore Wind Energy Technology." They have suggested that a single turbine installation would be exempt from the usual permit requirements if it meets certain criteria, including location in a designated offshore wind energy test area and prior written agreement to remove the turbine at the State's request (Maine OETF 2009). The intent is to provide an opportunity "so wind developers can get to know Maine, and we can get to know them" (Perkins 2009).

**Potential Conflicts Within the Current Planning Framework**

[5] Greg Watson, Personal Communication, 2/23/09. Policymakers in Massachusetts have discussed this idea, but it hasn't been formally pursued.

At present, there is no way to bild an offshore demonstration projects in federal waters without going through a full-scale environmental and regulatory review. A small scale, temporary facility would be subject to the same costly multi-year regulatory review as a permanent installation. Under the circumstances, it is hardly worth the effort. However, as part of the integrated ocean management process that some states have underway, low sensitivity areas could be identified as possible demonstration sites eligible for streamlined permitting. Especially in regions where the public debate about offshore wind energy development is still underway, near-term demonstrations of different types of technologies could be extremely beneficial.

Most states are pursuing renewable energy within the context of their renewable portfolio standards (RPS) – legislative mandates to ensure that a minimum percentage of all electricity comes from renewable sources by 2020. In New England, all the states have RPSs. The structure, resource eligibility, and timelines differ, but the general requirements vary from Maine's obligation to meet 10 percent of new capacity by 2017, and Massachusetts', Rhode Island's, and Connecticut's obligations to meet between 15 and 20 percent of sales by 2020 (DSIRE 2009). These obligations are motivating a desire to proceed with large-scale installations. They also create more pressure to use existing technologies, as opposed to emerging technologies that may have an long-term advantages, but are still in their R&D phase (Hogan 2008). Unless demonstrations of emerging technologies become easier, most states will go with existing technologies even if the are not nearly as beneficial. This is especially true for a small state like

Rhode Island, which has been referred to as a "one-project state" (Wissemann 2009). While Rhode Island's Special Area Management Plan sets out a long time horizon, it is lkely given the state's offshore wind capacity, and its renewable energy obligations, that Rhode Island will license just a single project (Rhode Island Government 2008).

It is not obvious how the permitting process for a demonstration should differ from the process used to review a full-scale project. A single, temporary turbine clearly poses much smaller environmental and aesthetic risks. , Regulators in Maine believe that such an experimental facility should be exempt from all permit requirements, as long as meets certain conditions. However, given that demonstrations would constitute some of the early and unknown experience with offshore wind, a more precautionary approach would call for a closer look at the potential impacts, and require a more stringent permit process.[6] It is possible to address these issues within the context of state ocean planning processes. Massachusetts is pursuing an integrated ocean management effort that is both location- and performance-based, using principles of ecosystem-based management (Babb-Brott 2009). Appropriate uses will be designated geographically and/or by certain performance standards. Therefore, some near-term indications of both where and how demonstrations could be conducted, on a limited scope, could be accomplished within this context.

Another potential barrier is public concern over the temporary nature of these installations. The public is sure to believe that once a structure has been erected it will be difficult to undo the action, especially if a new administration is elected in the interim.

[6] Greg Watson, Personal Communication, 2/23/09

In this instance, policymakers could provide legal guarantees about dismantling temporary structures, mandating the timeframe within which structures must be removed and requiring developers to post a bond sufficient to cover dismantling and restoration efforts. [footnote Wheeler and Bacow, Environmental Dispute Resolution, Plenu, 1983? on liquidating bonds.]

Cost is another potential barrier to demonstration projects. The cost to erect an offshore wind turbine is substantially more than what what it costs to bind an onshore turbine., This financial commitment must be borne by a developer as part of their research and development budget  before they know whether they will be a guaranteed revenue stream from power sales. The cost and uncertainty of undertaking numerous demonstration projects may be prohibitive. So, public money to help underwrite demonstrations may be necessary.  This will raise questions, though, about the public availability of proprietary technology information. Balancing transparency in joint fact finding process with the need to protect competitive information will require careful attention.[7]

**Considerations for Demonstration Project Design**

Designing a demonstration project is no small task. As policymakers consider the possibility of fast-tracking or exempting offshore wind demonstration projects, there are four policy considerations that we think are most important.

[7] Don Perkins, Personal Communication, 3/25/09; Greg Watson, Personal Communication, 2/23/09

- (1) Find a way to expedite demonstration projects. This acknowledges that a single, temporary turbine will have minimal impacts. There can still be standards imposed regarding both locational and performance considerations. The construction impacts of one or two turbines do need to be reviewed, but, there ought to be a way to do this via “one stop” state level review (without simultaneous or sequential local and federal reviews as well). A demonstration turbine won’t involve the transmission connections that an operational wind farm requires, so these impacts can be excluded from the demonstration review process.

- (2) Require a joint fact finding plan as part of a request for a fast-track review of a proposed demonstration. A key objective of a demonstration is that it can provide an opportunity for public learning. Based on the results, certain design characteristics can be reworked based on actual environmental, visual, or noise impacts.. Broad stakeholder involvement is appropriate in figuring out what types of information to collect and how monitoring efforts should be designed and managed.

- (3) Create a transparent and publicly accessible system for data sharing. A web-based interface that allows stakeholders real time access to system performance would be best. This could serve an educational purpose, and enhance public trust in the facility developer. Tools such as a live web cam, a real time “carbon savings” calculator, or footage of local wildlife activity are the types of information that could be displayed on the web site.

- (4) Ensure that the construction impacts during the demonstration phase are temporary and reparable. Demonstration projects will not have zero impacts, but

these impacts should not be permanent and they should be minimal. Demonstrations need not be mounted in sensitive areas, but those areas should not be targeted for permanent development in any case.

**Conclusions**

States and localities are under growing pressure to make decisions about how to respond to the risks of climate change. They need to put mitigation and adaptation measures in place fairly quickly. These includes altering their energy supply mix to emphasize cleaner, ideally renewable, power source and figuring out how to adapt to volatile environmental conditions, especially in coastal areas. The flaws in the existing federal planning framework are obvious, and on-going efforts to promote integrated ocean planning are an valuable remedy to these defects. These state level efforts provide an immediate opportunity to encourage demonstration projects that will enhance public learning and make it easier to experiment with renewable energy technologies that will provide the greatest long-term benefits.

Offshore wind will inevitably be a central part of the energy supply in some regions of the country, particularly in the Northeast. The technology, however, is still emerging. That means there are substantial opportunity to alter the likely impacts of off-shore wind technology. A handful of temporary, adaptable, educational installations that can be constructed in the near term can inform long-term public decision-making. Although demonstration projects themselves may be controversial and raise some of the same

concerns as full-scale installations, a transparent and flexible joint fact finding approach to data collection and assessment can address these concerns. Ultimately, the quickest way to develop offshore wind energy is to turn the tide of public support strongly in favor of this approach to providing renewable energy. The best way to do that, from our standpoint, is to make it much easier to pursue carefully designed demonstration projects.

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