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Offshore wind energy development in the exclusive economic zone: Legal and policy supports and impediments in Germany and the US

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ABSTRACT

The development of renewable energy as a major component of efforts to combat climate change serves as the impetus for the location of energy production facilities in coastal ocean space. Yet, while many coastal nations see offshore renewable energy development as an important way forward, the speed and manner in which these efforts take shape vary dramatically. This paper assesses the role of coastal nations' domestic legal and policy frameworks in the siting of offshore renewable energy facilities in areas under federal jurisdiction. It focuses on two nations—Germany and the United States. Both have articulated their interest in renewable offshore energy, but while Germany has approved many offshore sites, recent US proposals have for the most part stalled. Based on a review of legal and policy documents, laws and regulations, academic literature, and interviews, this research identifies and compares factors that figure most prominently for the development of offshore renewable energy policies. Comparisons are organized under four categories: the regulatory framework, the public's role in siting, targeted economic mechanisms, and indirect mechanisms. The paper concludes with observations about prominent supports and impediments and suggestions for further research.

1. Introduction

As one of the greatest challenges of our time, global climate change merits collective action by many levels of government and among nations. Recent assessments point to the type and rate of energy consumption as key drivers leading to problems associated with climate change (HM Treasury, 2006; IPCC, 2007). While some multilateral efforts to address the causes of climate change via international agreements have fallen short in gaining acceptance, many nations have embarked on efforts to address causes within their own borders. This fits well with individual nations' desire to gain energy independence from reliance on foreign and politically complex sources of conventional fossil fuels.

Germany is a leader in Europe on shifting from conventional to renewable sources of energy. As its land-based sites of wind energy are built to capacity (Ohlhorst et al., 2008; BMU, 2008c), Germany looks to the sea for further production possibilities. In the United States, industry and government have also been looking offshore for opportunities to develop relatively clean and renewable domestic energy production. What can the United States and other nations learn from Germany? Are there political, economic, and regulatory lessons from the United States that may be valuable for Germany and others?

A comparison of the US and German policies relating to offshore renewable energy development highlights promise as well as problems and can be an invaluable informative step in policy formation. While there is literature critiquing US policy on development of offshore renewable energy (e.g., Martin and Smith, 2004) and calling for efforts to learn from previous, especially European, experience (e.g., Santora et al., 2004; Watson and Courtney, 2004; Offshore Wind Collaborative Organizing Group, 2005), few authors explore national policies using systematic comparative analysis.

This paper compares policy factors that influence the US and German approaches to offshore wind farm development. It is based on a review of relevant laws and regulations, policy documents, academic literature and interviews.[1] Our research addresses how each country's legal and regulatory principles and

[1] The authors conducted interviews with legislative aides, development proponents, and officials of regulatory agencies involved in permitting of offshore wind installations. These interviews were conducted in a number of cities in the north of Germany and in New England in the US between May 2008 and March 2009.

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institutional mechanisms at the federal level support or impede the siting and development of offshore renewable energy. As such, it is a comparative assessment of *policies*. Although in the discussion section we briefly mention aspects of state (federal-state or *Länder*) policies or approaches that are influencing the offshore energy sector, we focus on the use of each country's exclusive economic zone (EEZ)[2] and resources under federal (i.e., national) jurisdiction.[3] Offshore renewable energy can be generated from various sources such as waves, tides, and temperature differentials, but because in Germany these types of projects are exclusively wind farms, the focus of this analysis is on policies related to offshore wind.

In this paper, Section 2 describes the German and US national renewable energy contexts. Section 3 outlines and compares the policies of each country highlighting major differences and similarities. Section 4 assesses, synthesizes, and summarizes observations about prominent supports and impediments and concludes with suggestions for further research.

2. National contexts

2.1. Germany

Recent data highlights Germany's success in meeting its ambitious goals for renewable energy production. Renewable energies achieved a share of 14.2% of gross electricity consumption in 2007—one-fifth more than the previous year. Wind energy supplied the largest share of the electricity generated from renewable sources. A significant amount was also generated from biomass, which – together with landfill and sewage gas and the organic share of municipal waste – overtook hydropower for the first time. Together renewable energies supplied about 222 terawatt hours (TWh) in the electricity, heating, and fuel sectors in 2007 (BMU, 2008a).

Renewable energy consumption in Germany surpasses the European-level target for 2010 set at 12.5%. As an economic factor, the importance of renewable energies in Germany is increasing; turnover from the installation and operation of renewable energy production facilities in the country rose by nearly 10% in 2007 and now employs about 249,000 people (BMU, 2008a).

Germany's success is largely due to policies promoted under the Renewable Energy Sources Act of 2004 (EEG) that also lays out the goals for renewable energy production through promotion of wind power, hydropower, geothermal energy, landfill gas, solar power, and the use of biomass. Germany's federal goal is to achieve 30% of its electrical power generation from renewable sources by the year 2020 with a long-term goal of 50% by 2050 (Fischedick, 2004; Freshfields Bruckhaus Deringer LLP, 2008).

A great part of this vision is to be achieved by expanding wind power capacity. In 2007, Germany had approximately 22,250 megawatt (MW) of installed wind power capacity, all on land (BMU, 2008a). Achievement of the specified goal of 25% of generation from wind by 2025 (BMU, 2008b) will require erecting some new on-shore wind farms and installing new technology in existing ones (repowering)[4], augmented by the construction of offshore wind farms (Pehnta et al., 2008). Germany foresees about 15% of the renewable energy mix coming from offshore wind farms by 2020 (Fischedick, 2004) and aims to increase the share of offshore wind energy in electric power consumption to 25% by 2025 (BMU, 2002).

2.2. The United States

The US generates approximately 20% of the global total of greenhouse gas emissions (Stephens et al., 2008) but has been disinclined to join global efforts such as the Kyoto Protocol to reduce emissions. Despite adoption of some policies that support development of renewable energy sources at the federal, state, and local levels of government, many impediments to moving in the direction of renewable energy production remain (Gan et al., 2007). Between 2002 and 2007, generation from renewable sources in the US actually declined from 355 billion kilowatt hours (kWh) to 351 billion kWh. Most source contributions have stayed relatively stable, except hydropower, which decreased due to drought conditions in important resources areas, and wind power, which rose from 11 billion to 32 billion kWh generated. In 2007 about 7% of electricity consumed in the US came from renewable sources including solar, hydroelectric, geothermal, biomass, and wind. Wind constituted approximately 5% of the renewables mix, or approximately one-third of one percent of total US electricity consumption (Energy Information Administration, 2008).

While the United States does not have a national goal to promote renewable energy production, there are some federal initiatives that strive for the use of renewable energy. The Energy Policy Act of 2005 (EPAct) called on federal agencies to increase their proportion of renewable energy use beginning in 2007. A number of presidential executive orders also highlight the need to expand the role of renewables in the federal government's energy portfolio (e.g., Executive Order 13423—Strengthening Federal Environmental, Energy, and Transportation Management, 2007). Yet the EPAct and the executive orders are couched in terms that are better characterized as aspirational than mandatory. The former employs qualifying phrasing such as "to the extent economically feasible and technically practicable" (Energy Policy Act of 2005, § 203(a) codified at 42 USC. 15852(a)).

Despite the lack of federal mandates, some governmental sectors recommend increasing the share of renewables in the energy mix, specifically wind energy and offshore renewables. The US Department of Energy recently published a plan for achieving 20% of the nation's electricity from wind energy by 2030. Approximately one-sixth of the total 305 gigawatts (GW) from wind generation needed to meet this scenario would be from offshore installations (US Department of Energy, 2008a).

While there is still great potential for wind energy development on land where construction, operation, and maintenance costs may be cheaper, two factors support offshore wind energy in the US: (1) the public nature of the seabed and (2) the great resource potential (Musial and Butterfield, 2004; Offshore Wind Collaborative Organizing Group, 2005). Winds blow stronger and more consistently offshore. Musial and Butterfield (2004) estimated that about 183 GW of energy is available at 30–60 m depth offshore of the US.

2.3. Context distinctions

Germany's limited possibilities for erecting wind farms on land, coupled with its commitments to European and national renewable energy goals, support the development of offshore wind production facilities in the German EEZ, the area from the 12 nautical mile outer limit of German sub-national (coastal state)

[2] According to the United Nations Conventions on the Law of the Sea of 1982, the EEZ starts at the coastal baseline of each country and extends 200 nautical miles (370 km) out into the sea, perpendicular to the baseline. Federal jurisdiction in German and U.S. waters begins at 12 (22.2 km) and 3 nautical miles (5.5 km) from shore, respectively; landward of that distance coastal states in each federation have jurisdiction.

[3] For a case-study overview of the regulatory framework in the US state of Massachusetts, see Santora et al. (2004, pp. 148–151).

[4] Repowering means the replacement of wind turbines of the first generation with new ones of higher capacity.

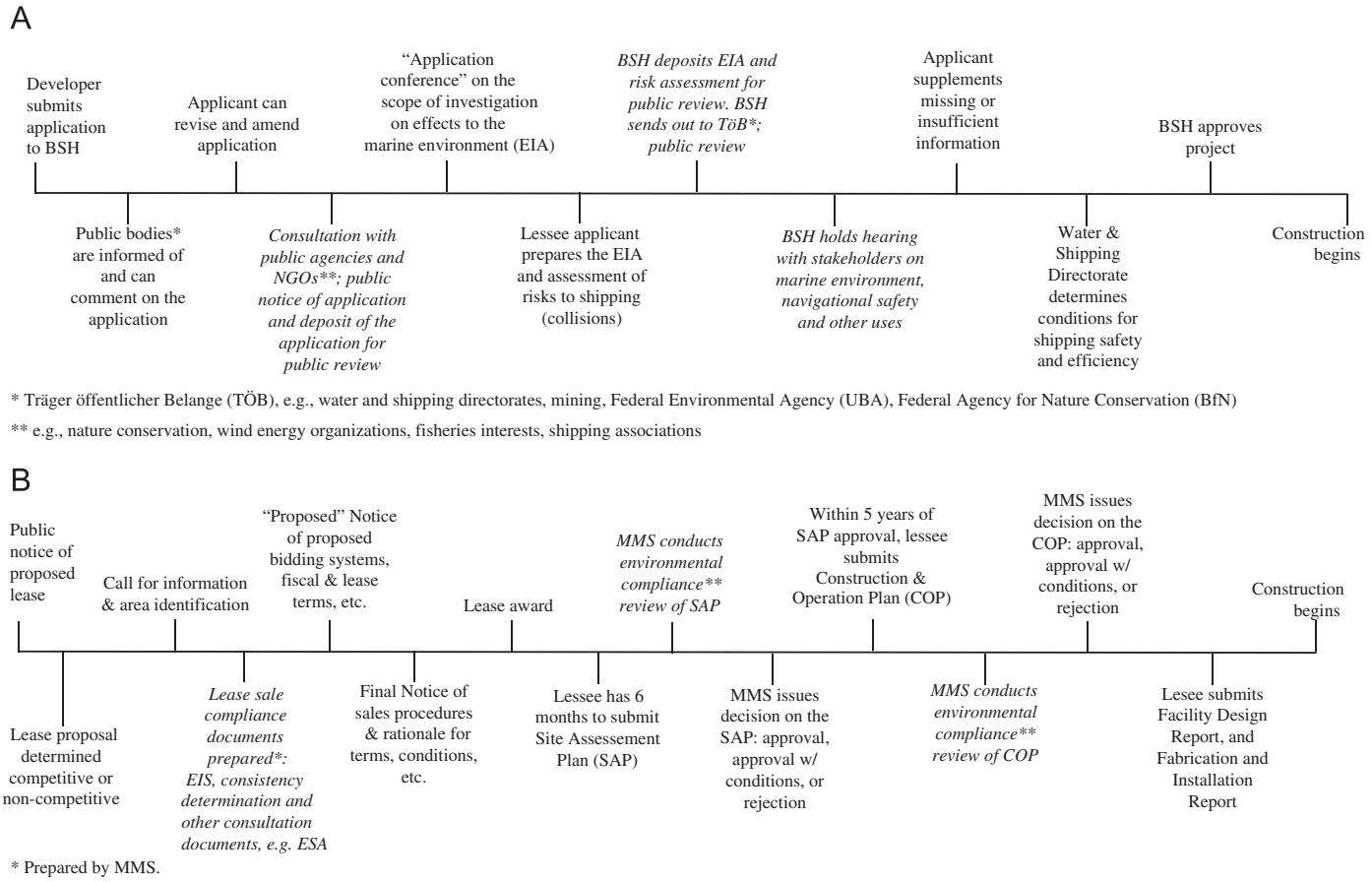

Fig. 1. Timelines for approval of offshore wind farm: (A) Approval procedures for wind parks in the German EEZ according to the Marine Facilities Ordinance (SeeAnlV) and (B) Proposed approval process for US competitive commercial lease (i.e., for full development and power generation). Italicized text shows main points of public participation.

jurisdiction to 200 nautical miles from shore. Conversely, in the US, substantial land remains available for wind energy production, albeit at varying distances from energy demand areas, and the type of national commitment articulated by Germany has been lacking.

Given these underlying motivational differences, it is perhaps understandable that the German offshore renewable enterprise outpaces US planning and development in this sector. Notwithstanding these factors, interest in using US ocean space for renewable energy production is rising as evidenced by recent proposals for wind farms offshore of Delaware, Massachusetts, New York, New Jersey, Rhode Island, and Texas.

3. National policies

In this section we identify factors that figure most prominently for the development of offshore renewable energy policy under the following categories: the regulatory framework, the public's role in siting, targeted economic mechanisms, and indirect mechanisms. These categories, largely adapted from other recent renewable energy policies studies (Enzensberger et al., 2002; Menz, 2005; Gan et al., 2007; Bruns et al., 2008), serve as an organizational heuristic.

3.1. Regulatory framework

Germany and the US have parallel legal and regulatory mechanisms for authorizing offshore renewable energy installations (see Fig. 1) and for environmental impact assessments (EIAs) related to site approvals (see Fig. 2). These regulatory frameworks provide the means to balance conflicting uses and mitigate adverse environmental effects. Outstanding differences and similarities provide important points for comparison and can help inform the debate about how policies support or impede development in the offshore wind energy sector. The main differences between the frameworks employed by the two countries relate to certainty of administrative authority, program completeness and standards development, and differences in the decision-making powers of lead agencies.

3.1.1. Certainty of administrative authority

Energy production projects depend, in part, on a reliable understanding of which government agency, or group of agencies, has authority and how it employs such authority. The construction and operation of installations in the German EEZ are subject to approval by the Federal Maritime and Hydrographic Agency (BSH) in compliance with Art. 2 of the Marine Facilities Ordinance (SeeAnlV).[5] BSH has been the lead agency since the promulgation of SeeAnlV in 1997. In the US it only became clear in 2005 *which* federal agency would lead the authorization process

[5] The BSH's responsibilities in this regard are defined in Art. 5 of SeeAnlV and through Art. 1 Sec. 10a of the Federal Maritime Responsibilities Act (SeeAufgG-*Gesetz über die Aufgaben des Bundes auf dem Gebiet der Seeschiffahrt*).

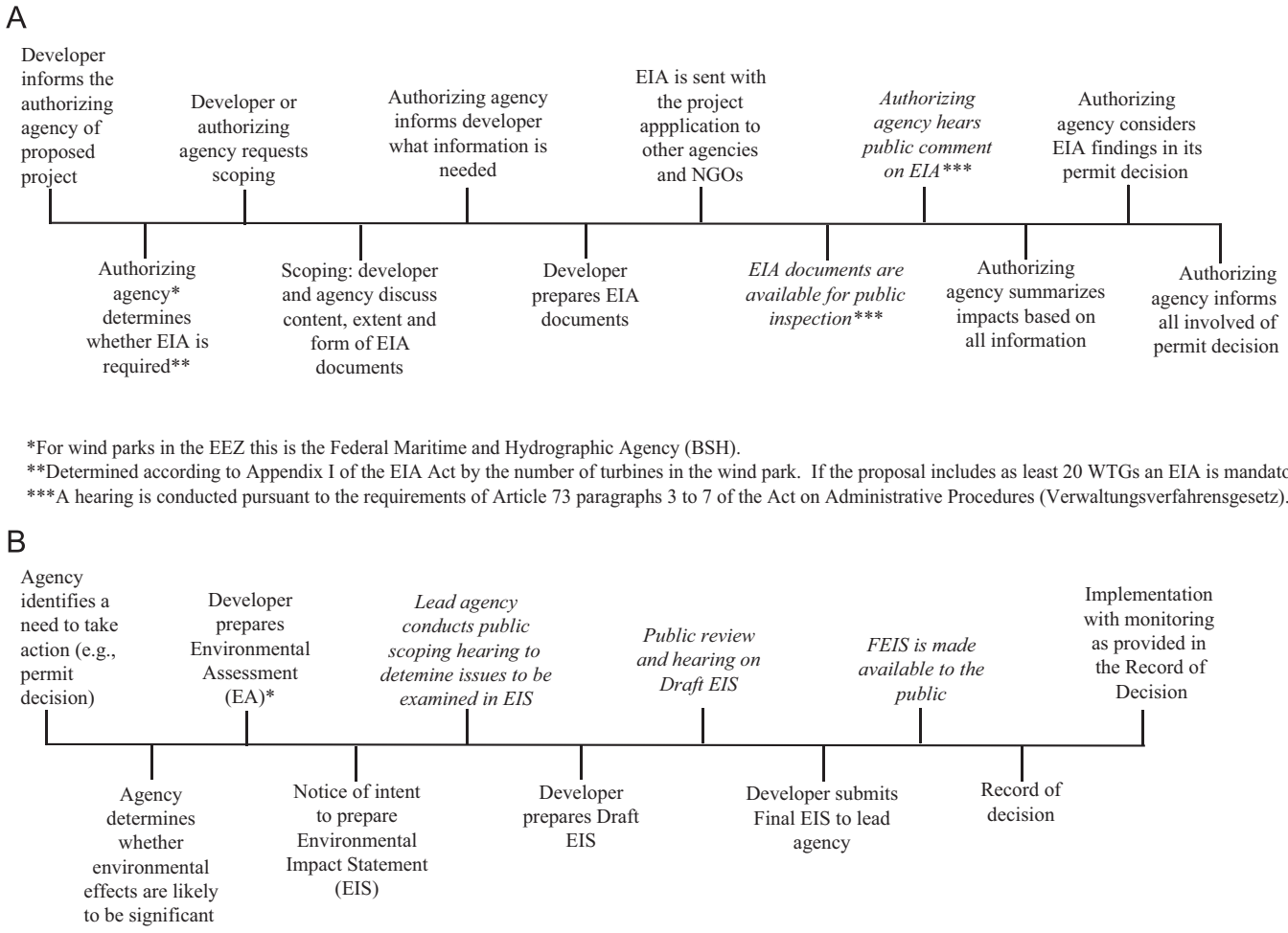

Fig. 2. Timelines for environmental impact assessment: (A) German EIA procedure according to the EIA Act of 1990 (UVPG) and (B) The NEPA process (adapted from Council on Environmental Quality (2007)). Italicized text shows main points of public participation.

for alternative energy facilities located in federal waters (beyond the three nautical mile outer limit of US coastal state authority) and the manner in which it employs that authority is still not finalized. This lack of clarity has resulted in uncertainty for developers, regulatory redundancy,[6] and delayed authorization.

The US Congress designated the US Department of the Interior's Minerals Management Service (MMS) as the lead agency for the authorization of offshore renewable energy facilities in federal offshore areas, four years after the first offshore wind farm (Cape Wind) had been proposed. The Energy Policy Act of 2005 (EPAct) (43 USC. 1337(p)) amended the Outer Continental Shelf (OCS) Lands Act giving the MMS authority to issue a lease, easement, or right-of-way on the OCS for the production, transportation, or transmission of energy from sources other than oil and gas (Energy Policy Act of 2005, §388(a) codified at 42 USC. 15801). The US OCS roughly coincides with the submerged lands, subsoil, and seabed lying between the seaward extent of the coastal states' jurisdiction and that of federal jurisdiction which, like the EEZ, has a seaward limit defined as 200 nautical miles seaward of the baseline from which the breadth of the territorial sea is measured. For areas where the continental shelf can be shown to exceed 200 nautical miles, seaward limits farther from shore can be established (MMS, 2008c). In any case, while international law allows countries to claim continental shelf areas that exist beyond the EEZ, renewable energy development projects that depend on continental shelf foundations are likely limited to EEZ space. The energy resources to be harvested by them are in the superjacent water and air column space areas capable of being claimed under EEZ principles but not capable of being claimed under continental shelf principles.

In 2007, MMS prepared a programmatic environmental impact statement (EIS), in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 USC. 4321 et seq.), to evaluate the establishment of a comprehensive alternative energy and alternate use (AEAU) program for authorizing activities on the OCS through rulemaking. MMS issued a decision based on that assessment to: (1) establish the AEAU Program for the issuance of leases, easements and rights-of-way for alternative energy activities in the OCS, and (2) promulgate rules to govern the program (MMS, 2007).

3.1.2. Program completeness and standards

German offshore wind farm approvals are granted using existing laws and statutes, namely the SeeAnlV of 1997 and Federal Maritime Responsibilities Act of 2002. BSH is leading the process for developing standards for wind farm authorizations, operations and decommissioning in an on-going fashion; the

[6] An Environmental Impact Statement for the Cape Wind Energy Project was first prepared through a process led by the US Army Corps of Engineers and then prepared a second time when MMS became the lead authorizing agency. The Cape Wind Energy Project Final EIS was issued by the MMS on January 16, 2009.

agency has made significant progress in developing standards based on on-shore wind experience, the experience of other countries, and German government supported research and development efforts focused on offshore wind (BSH, 2005; Bruns et al., 2008; Ohlhorst et al., 2008).

Developers have followed mandatory guidelines based on BSH's 2003 standards related to geological and geophysical exploration of the seabed, basic environmental analysis and operation-related monitoring (e.g., the duration of radar-measure of bird migrations, or the sampling of fish), and specifications for different phases of construction of offshore wind farms, from design to decommissioning. Two additional standards are currently being prepared: risk analysis of ship collisions, and safety and security standards governing, among other aspects, lighting mechanisms and waste management protocols (Dahlke, 2008a).

In the US, the AEAU Program takes a distinctly less standardized approach than that in Germany. The Programmatic EIS for the AEAU program identifies best management practices (e.g., mitigation measures) that may be adopted within the next five to seven years (MMS, 2008a). This will undoubtedly lead to better standards and procedural requirements but will take some time, perhaps longer than it has in Germany, because the physical marine environments in the US are much more varied and there has been less public financing dedicated to developing such standards thus far.

3.1.3. Decision-making powers

The German offshore wind farm approval process is strikingly different from the process under the US system. Under German law, approval is a non-discretionary administrative act whereas the US approval is dependent on authorization through a process of bidding and leasing.

Article 3 of Germany's SeeAnlV specifies that the approval of offshore renewable energy projects is a non-discretionary administrative act (*gebundene Entscheidung*). As such, the presumption is in favor of approval that is rebuttable only by specific reasons of a limited nature (e.g., impairment of safety and/or efficiency of navigation or threat to the marine environment) (Article 3, SeeAnlV). And even then, BSH will not deny approval if suitable prevention or mitigation measures can be employed to offset impairments or threats. Accordingly, wind farm project applicants have legally valid expectations that their projects will be approved (BMU, 2003). Following completion of all stages of the approval process – usually after two to three years (Dahlke, 2008a) – BSH reviews whether the substantive requirements for granting approval have been met. In accordance with Article 6 of the SeeAnlV, BSH can grant approval if the regional Waterways and Shipping Directorate has granted consent and confirmed that the project does not impair the safety and efficiency of navigation.

Under the proposed AEAU Program rule, the MMS will administer two types of leasing through a competitive or non-competitive process: (1) commercial leases with long-term access rights for full-scale commercial energy development, site assessment and technology testing, and (2) limited leases for site assessment or to test new alternative energy technology. The commercial lease grants the holder full rights to produce, sell, and deliver power on a commercial scale for up to 25 years, in addition to a five-year site assessment term, and may be renewed. The limited lease grants only operational rights to activities that support alternative energy (such as site and technology assessment and testing) but do not result in energy production. Limited leases may be renewed after five years, but cannot be converted into a commercial lease. Before a lease is issued, the MMS will consult with relevant federal agencies, the governor of any affected state, and the executive of any affected local government. In addition to the leases, MMS may issue rights-of-way and rights-of-use and easement grants to lay cables, pipelines, and appurtenances on the OCS (MMS, 2008a).

3.1.4. The regulatory framework—EIA

While a full description of the EIA systems in the US and Germany is beyond the scope of this paper, the respective EIA processes present important points of comparison. Major differences have to do with the scope and extent of topics addressed in EIAs and how findings of an EIA can influence the final decision to approve a wind farm in the EEZ.

3.1.5. Decision influence

NEPA requires that every federal agency prepare an in-depth study of the impacts of "major federal actions significantly affecting the quality of the human environment" (42 USC § 4321et seq.). The European Union Directive (85/337/EEC) promulgated in 1985 initiated the use of an EIA in Europe. In accordance with this directive, the Bundestag adopted the German *Gesetz über die Umweltverträglichkeitsprüfung* in 1990, hereafter "the EIA Act", which together with SeeAnlV mandates an EIA of proposed offshore wind energy facilities based on project type. While in the US, an EIS is a requirement of NEPA and separate from other legal provisions, under the European system, an EIA is an integrated part of the development consent procedure (Petts, 1999; Köppel et al., 2004).

As the lead federal agency in licensing offshore wind farms in federal waters, the MMS must first comply with NEPA requirements. To do so, the MMS conducts a preliminary environmental assessment (EA) in order to determine whether significant environmental impacts could result from a proposed action. If significant environmental impacts are likely, NEPA requires the development of a much more detailed EIS. Additionally, NEPA often applies on a "tiered" basis—an EIS may be required for the development of a program that affects the environment, while subsequent planning and site evaluation would call for additional EISs. At each 'tier' the assessment is conducted at the appropriate level of detail (See B in Fig. 2).

According to MMS' proposed rules, all three phases of activity leading up to the final site-specific authorization of a US offshore wind farm in a particular place (the Site Assessment Plan, Construction and Operations Plan, and a General Activities Plan) would be subject to NEPA review and would require at least an environmental analysis (for screening purposes) or a full-blown EIS. The outcome of the US EIS for an offshore wind farm – the Record of Decision – would relate to the leasing agreement or parts thereof. The Record describes the lead agency's decision, identifies the alternatives considered, including the environmentally preferred alternative, and discusses mitigation plans, including any enforcement and monitoring commitments (Council on Environmental Quality, 2007). The final agency decision and any conditions imposed for lease issuance that constitute project approval, will be largely based on the findings of the EIS, the adequacy of which can be challenged in court and can prevent or stall project authorization.

According to the German EIA Act, an EIA is mandatory for wind farms of more than 20 wind turbine generators (WTGs) with a height over 50 m. The result of an EIA does not contain a decision on the realization of a project but an administrative assessment of the estimated environmental impacts (Gassner and Winkelbrandt, 2005; Peters and Balla, 2006). Legal challenges to project approval cannot directly result from litigation challenging the EIA (Dahlke, 2008b). SeeAnlV mandates a refusal of authorization if the marine environment is endangered and endangerment cannot be mitigated, but this threshold is ambiguous and lacks concrete

definition in either SeeAnlV or the EIA Act, leaving much to the discretion of the lead agency (Köller et al., 2006).

3.1.6. Scope and extent

Topics covered in EIAs for German offshore wind farms are determined during a scoping process when such guidance is requested by either the developer or BSH, who as the authorizing agency also leads the EIA process. For this purpose, other authorities, experts and third parties may be consulted; but BSH determines the scope, including direction on the type and content of documents that must be produced by the developer. These must focus on topics relevant for decision making (Bond and Wathern, 1999; Petts, 1999), i.e., the assets worth protection listed in the EIA Act (Article 2 paragraph 1 and 2) and specified in the BSH's Standards for the Environmental Impact Assessment published in 2007.

In contrast, NEPA mandates a broad and open-ended scoping process that includes considerable public participation. Topics are not limited and all issues raised during the scoping process may be considered for inclusion in the EIA. Such unrestricted scoping is often criticized in literature on an EIA (Ross et al., 2006; Snell and Cowell, 2006). The more focused EIA means that this stage is less of a hurdle for project approval in Germany than it is in the US. Of note however, is that such a system does not benefit from the advantages of public involvement in scoping (Mulvihill and Baker, 2001; Portman, 2009) such as broad inclusion of important topics and building of trust among stakeholders (Wood et al., 2006).

3.2. The public's role in siting

In the United States and Germany, offshore areas are generally considered public space, which makes offshore renewable energy development public in nature. Both countries' laws require proponents of offshore development to communicate their proposals to the public and to engage stakeholders (see Figs. 1 and 2). While the two countries have parallel public notification requirements, the manner and opportunities for involvement in decision making through proposal review, comment, hearings, and through the court systems differ.

3.2.1. Involvement in decision making

Most public participation in Germany takes place as part of the permitting of offshore wind farms, according to the SeeAnlV. In the US, public participation occurs mostly as part of the EIA process, according to NEPA. This latter situation causes objection to a project to center on its perceived merits, a broad set of topics defined during the public scoping process and not necessarily limited to those specifically related to the project approval or even to the environment.

Although participation is frequently cited as a means of reducing conflicts and engendering support for final decisions (e.g., Rowe and Frewer, 2000), controversy has characterized this process for the Cape Wind project over a period of more than seven years at the time of this writing. Opposition has taken the form of concerns expressed during periods of public comment on the EIA on a myriad of topics. As an example, many oral comments at a public hearing on the Draft Environmental Impact Statement for Cape Wind in March 2008 were generally "for" or "against" the project and tangentially related to the impacts of the project on the environment.

EIS hearings in the US are open to the public, while BSH maintains two distinct sets of hearings—one similar to that described by Arnstein (1969) as "consultation" and another that is a three-way communication process (Portman, 2009). During the latter, members of the public, experts, and agency officials have the opportunity to exchange information and learn from one another. BSH goes through what it calls "rounds of participation" (BSH, 2005). The first is with a small circle of government authorities and public bodies (TÖB–*Träger öffentlicher Belange*) that mostly excludes individual members of the public. The second round includes a wider circle that includes some additional nongovernmental organizations (NGOs) and associations who can comment on the application documents, after which the applicant can revise and amend the documents. Following any such revisions, BSH notifies the public. Members of the public can review the revised documents at the BSH offices, but hearings are restricted to members of qualified groups.

The procedural requirements of NEPA revolve around how the public will be: (1) notified of federally supported or permitted activities that may significantly affect the environment and (2) provided with opportunities to comment on those activities as EIAs are conducted. The lead agency accepts extensive public comment at three stages in the NEPA process: scoping, draft, and before final decision. It notifies the public about the preparation of documents and availability for reviewing, and accepts oral or written testimony either in person (at hearings), through mail, electronically, or even by phone. Based on NEPA practice, the public has an expectation that agencies are engaged in informed decision making, that the public has been integrated into that decision-making process, and that a range of alternatives provides context for a decision. Nonetheless, NEPA itself does not provide the public with the requisite legal 'standing' to assure that those expectations are met.

3.2.2. In the courts

"Standing" is the term characterizing a claimant's right to bring a cause of action before a court for adjudication. Without standing, an individual's participation in a public agency action or decision ends when the public participation process ends. There are differences between German and US standing criteria that merit mention due to their influence on offshore wind farm development.

Under Germany's Environmental Appeals Act (*Gesetz über ergänzende Vorschriften zu Rechtsbehelfen in Umweltangelegenheiten nach der EG-Richtlinie 2003/35/EG*) certain organizations are recognized by the German Federal Environmental Agency (UBA) as environmental protection proxies. The criteria for such proxy status include: (1) sufficiently articulated interest in encouraging environmental protection, (2) record of environmental protection activity for at least three years, (3) assurance of performance of its stated duties, (4) promotion of public benefit objectives (per German tax code), and (5) open membership (Environmental Appeals Act, Article 3, December 7, 2006).

Such organizations effectively have standing to appeal certain governmental environment-affecting decisions as defined in Germany's EIA Act. In addition to the criteria noted above, an organization must demonstrate that: (1) it showed sufficient interest in the type of environmental matters at issue, (2) it participated in the particular EIA procedure in question, and (3) the act or decision being disputed "affects [the organization's] field of activity" related to environmental protection. Finally, a recognized association's range of arguments on appeal will be limited to objections raised during the original EIA procedure. This approach limits an organization's right to contest a decision in Germany and in this regard is more focused than the standing hurdle facing organizations in the United States.

Under Article III of the US Constitution, standing requires that a claimant demonstrate an "injury in fact" and a connection between that injury and the defendant's action. Certain environmental statutes state objectives that indicate the "zone of

interests" that will be governed by the law and, as a result, a plaintiff must demonstrate that their interests fall into such a zone. NEPA does not contain such a provision but the Administrative Procedure Act (APA) allows "[a] person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute" to seek judicial review of that action. (Administrative Procedure Act, 5 USC. § 702). As a result, members of the public claiming a NEPA *procedural* violation make that claim via the APA's standing provision. Similarly, the APA provides legal access to the courts for individuals who can claim an injury to an interest related to an agency's violation of a *substantive* environmental law (such as the Rivers and Harbors Act (Appropriations Act of 1899, 33 USC. § 403)).

In 2003, the Alliance to Protect Nantucket Sound invoked the APA to contest the US Army Corps of Engineers' grant of a permit to place a data collection tower in Nantucket Sound, claiming that the agency violated both NEPA and the Rivers and Harbors Act. This permit was a preliminary step towards offshore wind energy development in federal waters off the coast of Massachusetts. While the Alliance ultimately failed to prevail in that case, the presiding judge, in a somewhat prescient statement, noted that this was a "skirmish in what may prove to be a protracted struggle over the construction of a wind energy plant in Nantucket Sound." (Alliance to Protect Nantucket Sound v. US Army Corps of Engineers, 2003).

The prediction has been borne out. The Alliance has continued to contest other substantive decisions and procedural actions related to the project into 2009 (Alliance to Protect Nantucket Sound, 2009). The fact that the NGO has standing to bring the legal cases and continues to robustly engage the public comment process manifests the public's right to be involved in the project via the courts. Such involvement results in significant time, energy, and money being devoted to defending agency actions.

3.3. Targeted economic mechanisms

The development of offshore energy facilities takes place in an economic as well as a legal and physical environment. When market conditions do not support such development, public policies in the form of economic approaches (e.g., through taxes, subsidies, and transaction systems) make offshore wind energy production more attractive. Economic approaches are frequently used as a means of achieving mandated quotas (Gillenwater, 2008) or in conjunction with other coercive regulatory instruments (Enzensberger et al., 2002; Mulder, 2008).

In Germany, the goals set at the national level are supported by public policies directed towards the supply side (supply-push) of energy production, such as feed-in tariffs and the national distribution of grid and network costs. In the US, individual states employ policies designed to create demand (demand-pull) for electricity generated from renewable sources, through mandates requiring utility companies to offer a certain percent of such "green power" to consumers. Whether targeted towards supply or demand, these mechanisms are based on the premise that certain investments – in this case, in renewable energy – are non-competitive (Mulder, 2008) and must be encouraged through public policies.

3.3.1. Achieving quotas

The main mandate (quota) programs that affect renewable energy development in the US are renewable portfolio standards (RPSs) frequently coupled with renewable energy certification that allows the creation of a separate market for the "renewable attribute" of qualifying generation (see below). While several attempts have been made to employ a federal RPS system in the US, none have succeeded thus far. State RPS systems are generally constrained by the renewable resources contained in a particular geographic area (Chupka, 2003). Twenty-seven US states have mandatory RPSs, 16 of which are coastal states (DSIRE, 2008) with marine renewable potential.

The EEG of 2009 set German federal mandates legislatively with a goal of 30% of electric power supply being produced by renewable energy technologies by 2020. This replaced the EEG of 2004 that had goals of 12.5% by 2010 and 20% by 2020. In addition, Germany is directed at the European level by the RES-Directive (2001/77/EC)[7] that aims to increase the share of electricity produced from renewable sources to 22.1% in 2010 (Gan et al., 2007). Traditionally, German policymakers considered supply and demand-side approaches to promoting renewable energy incompatible (Wüstenhagen and Bilharz, 2006). The preference for supply side mechanisms is evidenced by reliance on mandated infrastructure support obligations and feed-in tariffs to encourage offshore wind development.

3.3.2. Infrastructure support obligations

The buildup of Germany's wind energy enterprise depends decisively on its Renewable Energy Sources Act of 2004 (EEG 2004). The EEG and its forerunner, the 1991 Act on the Sale of the Electricity to the Grid (*Stromeinspeisungsgesetz*), are considered model laws for other European countries, even when Germany has not been the pioneer (Reiche, 2002; Bechberger and Reiche, 2007). Changes brought about by the EEG of 2009 address feed-in and grid management for wind turbines with new and stricter obligations for grid operators. The high connection costs for German offshore wind facilities have been one of the main factors affecting project profitability and are therefore a major impediment to development (Nunneri et al., unpublished manuscript; Ohlhorst et al., 2008). The new EEG and previously mandated policies directed towards production cost sharing will ease the financial burden on developers and even out higher costs for consumers due to costly network upgrades, especially for the influx of energy produced far from load centers in the EEZ.

Germany's Infrastructure Planning Acceleration Act (*Gesetz zur Beschleunigung von Planungsverfahren für Infrastrukturvorhaben*) passed in 2006 obligates network operators to take over the costs of connecting offshore wind farms to the on-shore grid, a provision that lowers the investment costs for wind farm developers considerably[8] (Bruns et al., 2008). By law, network operators can pass the connection costs on to the consumers. By having all aspects of grid connections in their hands, network operators can also take future needs into account at the planning stage, thus consolidating connections, keeping costs and environmental interference down to a minimum (DENA, 2008).

The uneven distribution of grid connection cost burdens throughout Germany led to the development of a nationwide settlement system under the EEG. Under this system, the local grid operators can transfer the costs of their EEG payments to the next higher (regional or national) level. At the high voltage transmission-line level costs are balanced out across Germany (Wüstenhagen and Bilharz, 2006). This is particularly important for offshore wind since all of it will be in the extreme north of Germany in the North and Baltic Seas.

[7] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.

[8] For example, for the Butendiek offshore wind farm on the Baltic Sea, this obligation implies a 20% cost decrease for the wind farm developer (Butendiek, 2006).

A loosely comparable support for renewable energy facility owners in the US is the power purchase agreement (PPA). This is a long-term contractual agreement between a power seller and a power buyer typically sought when a project is financed with a great amount of debt. A secure source of revenue from production must be guaranteed for a period necessary to repay the loan. PPAs normally include a development timeline, an effective date, a duration period, an output estimate, and a specified delivery point for the power. Although not mandated by law, they benefit both the power buyer and the producer. In the case of an offshore wind farm proposed in Delaware state waters, experts describe the PPA as "the most critical precondition for the project, because it confirms the stream of payments needed to borrow money to build the project" (University of Delaware's College of Marine and Earth Studies, 2008).

3.3.3. Subsidies and tax relief

Germany's feed-in tariffs have been successful at encouraging on-shore renewable energy development, and they include "bonus" amounts for offshore wind, a direct result of lobbying by the wind industry and an acknowledgment of the higher costs of moving into the offshore environment (Stubner, 2008). Projects producing offshore wind energy by 2016 will get a €2 cent starting bonus for a total guaranteed rate of €15 cent/kWh (EEG of 2009).

US federal economic incentives consist of tax treatments that benefit renewable energy production in general, i.e., without special provisions for offshore wind. The two main incentives have been: (1) production tax credits and (2) allowance for accelerated depreciation for capital equipment. The first of these, the production tax credit (PTC), available under Section 45 of the Internal Revenue Code, remains the principal federal incentive for wind energy development (Duffy, 2008). Simply stated, a PTC gives a per kWh tax credit[9] to production facility operators. Since their initial time-limited enactment as part of the Energy Policy Act of 1992, PTCs have been extended several times (Welch and Venkateswaran, 2008). A recent extension made them available until December 31, 2008 when they were due to expire. As late as October 2008, renewable energy developers were concerned that they would not be further extended. However, they were extended for one year as part of the Emergency Economic Stabilization Act of 2008 (Public Law 110-343), also known as the "Bailout Bill". As part of this extension, Congress specifically made marine and hydrokinetic renewable energy eligible for the PTCs. Most recently, in February 2009, through the American Recovery and Reinvestment Act of 2009 (Public Law 111-5), Congress acted to provide a three-year extension of the PTC through December 31, 2012 to wind projects placed in service on or before that date (American Wind Energy Association, 2009).

Accelerated depreciation allows developers to write off capital equipment for tax purposes faster than the rate at which they would normally depreciate. Normally a plant depreciates its capital equipment for tax purposes on a straight-line method over 20 years. The owner of offshore wind turbines may take a five-year double-declining balance schedule, a generous form of the Modified Accelerated Cost Recovery System available in federal tax law. This means that the owner can deduct more than half of his investment in the first two years and all of it within five years. This benefit allows owners to invest capital in other endeavors. It is a time-sensitive provision to encourage early development. For example, under the Economic Stabilization Act facilities placed in service in 2008 can be depreciated by 50% for that year (Duffy, 2008).

[9] This has been 1.5 cent/kWh in adjusted 1993 dollars for the first 10 years of a plant's operation.

US tax treatments have not provided sufficient certainty to developers. Their on-again, off-again status has contributed to a boom-bust cycle of development whereas developers experience a strong push to get projects approved during the period leading up to the PTC's expiration. Lapses in the PTC then cause a dramatic slow down in the implementation of planned wind projects. When the PTC is restored, the wind power industry takes time to regain its footing, and then experiences some short-term growth until expiration dates are close again (Union of Concerned Scientists, 2008).

The US federal government has provided funding for R&D and for renewable demonstration projects (Menz, 2005), but these have not included any significant funding for offshore renewable energy development. Countering any available financial incentives and supports, the US public expects a fair return to public coffers for use of submerged lands (Martin and Smith, 2004).

3.3.4. Leasing fees and royalties

Germany does not require its offshore renewable energy producers to pay leasing fees or royalties. While having considered such charges, German policymakers decided that they would undermine existing subsidies, such as guaranteed feed-in tariffs (Stubner, 2008). Some might characterize the forbearance of a lease fee or royalty charge as a further subsidy in light of the government transfer of 'free' use of public space to engage in commercial activity. This again speaks to the high public priority given to achieving Germany's aggressive goals for renewable energy production and the understanding that offshore renewable energy has significant economic challenges as it is. The US federal law instructing the MMS to devise a program to govern offshore wind projects specifically noted that such a program must garner a "fair return to the United States for any [such] lease, easement, or right-of-way" (EPAct of 2005). MMS acknowledged that requirement in its 2008 set of Proposed Rules (73 Fed. Reg 39377 (July 9, 2008)).

Offshore oil and gas developers have been subject to royalties and leasing fees for years. According to the 2008 proposed rules, MMS will require bonds, acquisition fees, rental/leasing fees, and operating fees. For leases issued through a competitive bidding process, payments would be the amount of minimum bid established in Final Sale Notices for leases or Auction Notices for grants. Using the formula taken from the proposed rules, a 150 MW offshore energy facility with an anticipated capacity factor of 0.35, operating in a region with an average retail power price of $65 per MWh and a fee rate of 2%, would pay $0.6 million/yr—a significant amount on top of other development costs (MMS, 2008b).

3.4. Indirect mechanisms

Policies and initiatives of various types indirectly influence development and siting of offshore renewable energy facilities. They include such mechanisms as research and development funding, market deregulation and green power purchasing, and marine spatial planning (MSP).

3.4.1. Research and development funding

The German federal government has taken a very active leadership role in financing science and technology for wind energy development compared to the US federal government. Both in Germany and the US, federal funding programs are implemented through direct funding at national laboratories, grants and cooperative agreements with universities, and various forms of financial and technical assistance to industry partners (Energy Information Administration, 2005).

In 2007, the German government dedicated €34.6 million for new research and development on wind energy, two-thirds of which is for offshore wind energy (BMU, 2008a). Led by the Federal Environment Ministry and using some of this funding, the government launched a public–private partnership program in July 2005 – the Offshore Wind Energy Foundation – comprised of representatives of the offshore wind power industry, power utilities, financiers, NGOs, as well as representatives of the coastal states and the other federal ministries. The short-term goal of the foundation is to develop the first offshore wind farm in the North Sea. To this end, the foundation started constructing a test bed near the isle of Borkum with twelve 5 MW turbines (Ohlhorst et al., 2008).

In FY 2007, the US government appropriated $48.6 million for wind energy research, which included support for offshore wind that the Department of Energy (DOE) claimed essential for "enhancing the competitiveness of wind energy in densely populated electricity markets" (US Department of Energy, 2007). DOE's budget proposal for 2009 did include specific requests for offshore wind energy, differentiating it from requests of previous years, but DOE itself defines these as "limited resources" ($2.8 million). Activities will focus on obtaining and evaluating the information needed to allow a programmatic go/no-go decision in FY 2009 or FY 2010 regarding future offshore wind technology development (US Department of Energy, 2008b).

3.4.2. Deregulation and green power choices

Market structures in Germany and the US are hard to compare due to differences in scale, but both Germany and the US market deregulation, coupled with certified renewable energy choices for consumers, have played a role in renewable energy development and will undoubtedly affect the offshore sector. At this point, Germany functions like a "recovering" deregulated market system reverting back to a more regulated system. The US power markets are deregulated on a state-by-state basis. Some states with deregulated utility markets coupled with green power choices for consumers are making great gains in converting to renewables (e.g., LeBlanc, 2008), but such achievements are inconsistent throughout the country (Chupka, 2003).

Market liberalization in Germany that began in 1998 created opportunity for development of renewable energy over the long term. Within the first few years, mergers and acquisitions led to the number of large players being halved from eight to four. Ironically, one of the only competitive innovations that survived these changes has been a number of green electricity marketers. Voluntary demand for clean, renewable sources of power has been significant in Germany (Gillenwater, 2008). In 2006, more than 135 marketers supplied 1700 GWh of "green" power to an estimated 490,000 consumers, a market share of about 1.3% of residential customers (Wüstenhagen and Bilharz, 2006). Currently, a European Energy Certificate System is being developed to register and track an environmental commodity called Guarantees of Origin that will replace the existing renewable energy certificates (RECs) (Gillenwater, 2008).

Following the market liberalization of 1998, the German government passed a law to phase out nuclear energy and it announced in 2004 the introduction of a market regulator to bring back competition (the *Energiewirtschaftsgesetz* and the *Bundesnetzagentur-Gesetz*, respectively). These measures enabled new coalitions and the homogeneity of established associations (Wüstenhagen and Bilharz, 2006). Arguably, deregulation helped the German Wind Energy Association amass considerable lobbying power enabling them to get the increased feed-in tariffs included in the EEG of 2009, particularly those for offshore wind.

More than 30 US states have initiated deregulation which, together with certified "green" power choices, fosters competition and promotes renewable energy. In the US, renewable energy certificates are frequently used to track and trade the benefits of green power. RECs are created when one (net) megawatt hour of electricity is generated from an eligible renewable energy resource. States differ in their approaches but usually the consumer can choose a generation supplier and can prefer renewable sources (i.e., voluntarily purchased "green power") (Welch and Venkateswaran, 2008). Compliance systems also use RECs, as several states allow or require load-serving entities to use tradable RECs to meet a quota for the amount of their delivered electrical load that must be met by renewable generation (Gillenwater, 2008).

Carbon offset trading markets are developing on a regional basis in the US (e.g., the voluntary Chicago Climate Exchange). A first-ever mandated offset trading market in the US, the Regional Greenhouse Gas Initiative, began functioning on January 1, 2009 by agreement among northeast and mid-Atlantic states. Either in voluntary markets or compliance systems, RECs can be expected to have a market demand effect and thus a role in promoting offshore wind farm development.

3.4.3. Marine spatial planning

One of the most interesting facets of offshore wind energy development has been its connection to marine spatial planning. Both in Germany and the US, governments have accelerated marine spatial planning efforts as a response to developers' interest in using ocean space for wind farms. States are leading the way in this effort both in Germany and in the US.

Marine spatial planning, sometimes likened to marine zoning, is based on the premise of "a comprehensive and integrated area-based marine governance system" and an ocean governance policy implemented by regulators who "must manage marine public trust resources in the best long-term interests of the larger community" (Sivas and Caldwell, 2008). Proactive determination of which areas of the sea are most suited to wind farm development by considering environmental constraints and other conflicting planned or existing uses, aids proponents. Developers will know what to expect and can plan accordingly, a huge factor when investing in new projects.

Germany has made significant progress in spatial planning for the EEZ. Germany adopted a Spatial Planning Act (*Raumordnungsgesetz*) in 1965. An amendment to this law (in 2004) mandates spatial planning offshore. In addition to efforts of its own accord, Germany is directed to conduct this planning by the EU Directive that establishes a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive 2008/56/EC)[10] and by the EU's Roadmap for Maritime Spatial Planning (European Commission, 2008). This progress includes the development of marine spatial plans for the EEZ and in *Länder* territorial waters where offshore wind farm proposals have served as a catalyst, especially in the Baltic Sea (Heinrichs, 2008).

BSH began such a planning process for the EEZ of both the North and Baltic Seas in 2005. It deposited the proposed plans for public review in mid-2008. The Strategic Environmental Assessment Act of 2005 requires conducting assessments for plans and programs. In accordance with the EIA Act, strategic environmental assessments (SEAs) must include steps similar to those for EIAs from screening to the development of measures for the minimization and compensation of negative effects of development

[10] Annex VI(3) calls for spatial and temporal distribution controls which are management measures that influence where and when an activity is allowed to occur.

(Schomerus et al., 2006; Arbter, 2007). Providing important environmental impact information early on can also be helpful later in preparing site-specific EIAs.

Comprehensive MSP in US federal waters is unlikely in the near future, but some studies conducted by MMS provide information that can lay the foundations for proactive siting of offshore renewable energy facilities. The programmatic EIS for the AEAU Program is designed to identify conflicts of use and areas suitable for development or protection on the outer continental shelf—an area that, as stated, roughly coincides with the US EEZ. Since MMS began implementing its alternative energy program (pursuant to an interim policy in November 2007 pending promulgation of AEAU final rules) it has reviewed 45 nominations identifying areas for renewable energy projects in the OCS and has identified 16 areas for priority consideration. In April 2008, MMS published the priority areas in the *Federal Register*, as required by the EPAct.

As noted above, the regulatory framework in the United States governing ocean energy projects in the EEZ is still developing. While MMS strives to complete the final rule for permitting on the OCS, states have made varying degrees of progress in initiating ocean planning in state waters (US Offshore Wind Collaborative, 2008). No state or territory, to date, has zoned all of its marine waters, although approximately 12 states have developed plans on an area-based (e.g., watershed) scale (Gopnik, 2008). A few of these, namely Rhode Island, Massachusetts, and New York, recently initiated spatial planning in the entirety of their territorial waters as responsive actions, due in part to proposals for offshore wind farms.[11]

4. Discussion and conclusion

Comparative policy analysis, as used in this research, is a well-accepted approach for developing and examining alternatives (Weimer and Vining, 1999). In their paper on comparative approaches to policy design, Schneider and Ingram (1988) critically observe that the informal policy design process is characterized by "indiscriminately copying policy based on prevailing fashion or limited knowledge and experience." They argue that the "pinching" of ideas needs to be formalized through policy analysts' efforts at comparative analysis with emphasis on appropriateness of policies for different locales in different contexts. This comparative study serves as a first step in such an effort aimed at offshore renewable energy.

Germany's policies are designed to strengthen investor confidence, namely feed-in tariffs and mandated grid connection and cost-sharing provisions. The expectation is that the feed-in tariffs will work for offshore wind, as they have for the on-shore sector, provided public support for them continues at least until German industry solves its particular challenges—namely constructing and maintaining turbines far out to sea, in relatively deep waters that can withstand harsh conditions, particularly in the North Sea.[12] An important factor designed to expedite offshore wind farm siting was the development and communication of permitting processes as soon as the German government proclaimed its support for the sector. German regulatory agencies quickly developed facility specifications and standards. Publicly funded test sites and research provide baseline data to inform the EIA process and to improve standards.

In contrast, US efforts to approve facilities have been stymied by regulatory uncertainty and political obstacles in addition to some of the economic and financing impediments shared by both countries. Opponents of projects have employed NIMBY (Not in My Back Yard) attitudes via the public participation processes and standing in court disputes. Certain public policy support mechanisms such as economic incentives in the form of tax credits and accelerated depreciation have appeared and disappeared over relatively short periods of time, and a slow-moving bureaucracy is taking several years to finalize the regulatory framework for site approval. (See summary of main points of comparison in Table 1).

Both in Germany and the US, coastal states have taken a prominent role in supporting offshore wind development (e.g., by establishing renewable portfolio standards and initiating marine spatial planning). Furthermore, coastal states' interest in offshore wind energy facilities is driven by technological and cost advantages because areas within state jurisdiction are generally shallower and closer to shore and to load centers. Nevertheless, MMS indicates that states (e.g., Oregon, Washington, Virginia, Georgia, and South Carolina) have been partners for development of offshore renewable energy projects submitted for federal approvals (MMS, 2008b). In Germany, the Wadden Sea National Park precludes power plant development offshore of the coastal state of Lower Saxony, so such development can only take place off the coast of Schleswig-Holstein on the Baltic Sea. Here, wind farm consideration has certainly been a catalyst for marine spatial planning (Heinrichs, 2008) as it has been in the US. For wind farms proposed in areas under federal jurisdiction, both the US and German coastal states are involved as stakeholders early in the permitting process to ensure cooperation in cable authorization (e.g., Dahlke, 2008b) and other related infrastructure such as preparation of large on-shore staging areas needed during offshore construction (Watson, 2009).

Compared to the US government, the German government has moved more deliberately and quickly with many resources dedicated to offshore wind power development in the EEZ. Germany's success in building up its on-shore wind power capacity helps it position itself for an international leadership role in this sector. Even so, despite approvals for 16 offshore wind farms in the German EEZ since April 2007, none are operational and construction progress lags, causing some disenchantment with offshore wind energy compared with countries such as the UK and Denmark.

A comparative assessment of US and Germany approaches to offshore wind development highlights how two countries develop policy in light of evolving uses of offshore space and resources. In some cases, new laws, regulations, and procedures are outgrowths of demand for the use of ocean space in new ways. In other cases, the push for renewable energy development at sea has hastened otherwise slowly occurring processes of regulatory change. This catalytic relationship is exemplified by Germany's accelerated marine spatial planning in the EEZ to avoid some of the conflicts expected from competing uses offshore and to provide developers with more certainty. A US federal example is the EPAct that gave MMS authority to develop the AEAU Program in response to the prospects of ocean renewable energy.

This comparative analysis focuses primarily on existing and proposed policies; it would be helpful to review these policies from a historical-contextual perspective looking more closely at how each developed. Examining the German policies in the context of European directives would also be particularly

[11] Coastal Zone Management Act of 1972, 16 U.S.C. § 1452, Sec. 303 (3) defines a "special area management plan" as a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone.

[12] The Wadden Sea National Park along the German North Sea coast precludes the possibility of building wind farms close to shore so wind turbine installations must be relatively far out to sea in waters considered deep by current technological standards. For these sites to be profitable each turbine must be of a high 5 MW capacity.

Table 1
A comparison of the significant policy factors supporting and impeding offshore energy development in Germany and the US.

Policy area	Policy tools/ mechanisms	Supports[a]		Impediments[a]	
		Germany	US	Germany	US
Regulatory framework	Authorization	Non-discretionary, "bound" decision	Lack of standards increases flexibility in planning	Standards may not fit all cases	Lead agency unclear until 2005
	EIA	Legal claims cannot be based on EIA	Mandated scoping may result in more thorough EIA	Limited public involvement and focused EIA may leave some topics out	Extensive public participation is resource intensive (time and money)
The public's role in siting	Public participation; legal recourse	Fewer junctures for public participation might save time	Public involvement elicits public support and learning from local knowledge	Fewer opportunities for learning from public	Public can use procedural claims to stop or stall project deployment
Targeted economic mechanisms	Use of public land	No leasing and royalty fees	Fair market return engenders public support	No return for use of public resources	Leasing and royalty fees
	Grid connections	Grid operators responsible and can pass costs on to public	Power purchase agreements	Far out to sea; require new technology and great expense	Require separate permits
	Production subsidies (supply push)[b]	Feed-in tariffs	Production tax credits	Feed-in tariffs may not be high enough considering costs	Tax credits are short-term and inconsistent
	Demand creation (demand pull)[b]	Strong goals and commitments	Renewable portfolio standards (state level)	Centralized control and planning necessary	No federally mandated goals
Indirect mechanisms	Science and technology leadership	Government funded research and development; public-private partnerships	State level funds available	High public (taxpayer) costs	Limited federal funding has been available for research and development
	Marine spatial planning	EEZ marine spatial planning will provide planning security	Some programmatic planning by MMS	May restrict offshore wind development	No MSP – uncertainty for developers

[a] In this table, the terms "supports" and "impediments" refer to policies that would expedite approval and encourage development or tend to do the opposite, respectively. This does not refer to what is necessarily environmentally safer or more precautionary.
[b] See Enzensberger et al. (2002, p. 795).

informative. By exploring the gamut from the regulatory framework to developer and consumer-oriented policy designs, the intent of this paper is to inform the debate and encourage further study of this evolving policy sector, especially other studies using comparative approaches.

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