WOODS HOLE OCEANOGRAPHIC INSTITUTION

LEGAL AND REGULATORY FRAMEWORK FOR SITING OFFSHORE WIND ENERGY FACILITIES

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EXECUTIVE SUMMARY

This study is designed to help clarify national and local decisions about the siting of wind power generating facilities in the US coastal ocean. Our objectives are to: (1) assess the extent to which existing systems for managing ocean wind siting in foreign jurisdictions and for managing public lands and resources in the United States provide lessons to be applied to the problem of providing *access* for (siting) wind power in the US coastal ocean; (2) identify and characterize those common features of a land and resource management system that are appropriate for the siting of wind power in the US coastal ocean; and (3) characterize in qualitative terms the implications for economic efficiency of the adoption and implementation of each of these features.

To meet these objectives, we have (1) identified 21 common features of an access system and characterized them in terms of their utility and efficiency; (2) developed a database of the details of each of these features within 25 different access systems in the United States and abroad; and (3) developed a policy analysis framework for decision-making concerning allocations of ocean space. The policy analysis framework is rooted in economics, and we identify areas where it can be applied to allocation decisions, such as nonmarket valuation of seascapes, in our discussion of access system features.

We summarize briefly our main findings here.

Study Focuses

- In the context of wind farming, the relevant resource to be allocated is not wind but ocean space. Ocean space may be characterized by its average wind speed, wind consistency, distance from electrical transmission facilities, distance from electrical consumers, and exposure to adverse weather conditions, among other qualities. The existence of quality differences across ocean areas implies that, like good cropland, ocean space with the right qualities may be a scarce natural resource. As a consequence, ocean space useful for wind farming can have economic value.
- In this study, we assume that the maximization of resource rents from the use of ocean space is the overriding policy goal. We focus on the allocation of ocean space for wind farming as the primary use, but one that is not necessarily exclusive of other uses. Where relevant, we discuss other uses to the extent that there may be opportunity costs from the allocation of ocean space for wind farming. We analyze the generic features of an access system from the perspective of their potential effects on economic efficiency.
- The existence of institutions to establish legal interests in ocean space for wind farming and to provide a means for enforcement against any infringement of these interests is critical. There is no private market for ocean space. Specialized institutions must be devised, if they do not yet exist, for allocating ocean space. A system of access to ocean space is necessary for the development of wind farming as a productive industry.
- We analyze the generic features of an access system from the perspective of their potential effects on economic efficiency. Impediments to the realization of economic efficiency as a policy goal are numerous. They include the uncertainties involved in assessing rents, imperfections in existing institutions, historical patterns of uses and the political influence

wielded by users, and the very real possibility of the adoption of other social goals that might be accorded equal or greater weight in policy decisions.

Policy Analysis Framework

- Economic analysis is a useful tool to guide allocation decisions; and it is particularly helpful in the pursuit of an economically efficient outcome. But it does not by itself provide a complete answer to all allocation problems, which often are fundamentally political in nature and arguably should be settled by a political process. Uncertainty in future costs and benefits, and the possibility of policy goals other than maximizing resource rents (for example, maintaining traditional fishing practices), suggest that while economic analysis should guide the allocation decisions, it is not the only consideration. Still, to the extent that this political process incorporates economic considerations, it is more likely to result in an efficient outcome.

- In simple terms, the economic framework for analyzing ocean space allocation decisions for wind farming is as follows: an area of ocean space should be allocated to wind farming if the resource rents from wind farming in that area exceed the opportunity costs associated with other uses that are excluded or diminished by wind farming.

- Wind farming is not necessarily an exclusive use of ocean space. It is necessary to determine first which other uses are compatible with wind farming and which are excluded or diminished. For example, some types of aquaculture and recreational fishing may be compatible with wind farming, while certain kinds of commercial fishing (dragging) and the use of the area as a certain kind of aesthetic seascape may be diminished.

- It is relatively easy to estimate resource rents associated with commercial activities, and progressively more difficult for uses that are further removed from markets, such as recreation, aesthetics, and ecosystem services. As a result, the opportunity costs of allocating areas for specific uses or for specific combinations of uses can be uncertain. Similarly, there is uncertainty about the non-market values of modifications in seabird or subsea habitat when a wind farm is sited. Even the opportunity costs of displacing commercial uses, such as shipping and fishing, can involve uncertainty in their calculations.

- It is important for a disinterested party to apply these economic techniques. Although stakeholders may wish to conduct or sponsor their own analyses, there is the clear possibility of bias built into assumptions and hidden in the results. Ideally, the government would conduct the policy analyses or contract for the analyses to be undertaken by independent analysts. Although arguably more credible than analyses conducted by stakeholders, the government, however, may not be a completely disinterested party. Therefore, the results of the analysis should be subject to a scientific peer-review.

General Management Features

- Regional planning refers to a management process that considers the implications at a broad geographic scale of allocating areas of the ocean for specific uses, such as ocean wind power. There are at least two primary concerns that motivate the need for regional planning. The first pertains to the geographic extent of external effects from specific uses in relation to the existing pattern of political jurisdictions. Specifically, a government agency might sanction a use

that has effects that occur beyond its geographic authority. The second concern pertains to the value of anticipating changes in the distribution of human uses and ecosystem characteristics in the future.

- The OCS 5-year leasing program attends to the two concerns motivating regional planning: the geographic extent of external effects, and the need for planning for uses in the future, albeit over a short time horizon.

- The development of ocean wind power presents a different set of external effects than offshore oil and gas development. The most salient issues in the case of ocean wind power include the potential for aesthetic impacts and changes in habitat for birds, fish, and wildlife. The former is an issue that is characterized by a local scale (the distance a structure can be viewed from land), whereas the latter may be characterized by a regional, national, or even international scale (for migratory species). If regional planning is to be successful, it will need to be appropriately tailored to the geographic scale of these problems. This tailoring may require a modification of the existing planning areas for OCS oil and gas leasing to accommodate the provision of access for ocean wind power.

- Policy objectives refer to the public purposes for establishing a method of regulating access to develop and to use a natural resource and for controlling its side-effects. Some policy objectives pertain directly to the provision of access to the resource, others represent complementary or even competing or conflicting objectives. Where multiple policy objectives are identified, the potential may exist for objectives to conflict. In particular, objectives to promote economic efficiency often may not be aligned completely with objectives to promote fairness to one or more stakeholder groups. In order to satisfy multiple objectives, only one of which might involve economic efficiency, resource rents may need to be given up or traded away.

- Policy objectives for US offshore ocean wind development have been specified in the US Energy Policy Act of 2005. Two of these policy objectives, which relate to the prevention of interference with other "reasonable" uses and the consideration of other uses of the sea and seabed, appear to require the Interior Department to assess the opportunity costs of siting ocean wind facilities. It is critical that the economic value of these other potentially displaced uses (and non-uses) be compared to the value of ocean wind power development. Such a comparison is needed especially where renewable energy has been selectively subsidized.

- The amount of interagency coordination and the number of approvals that offshore wind access systems require has been blamed for retarding the growth of the offshore wind industry. A 2002 study of offshore wind power developments in eight European countries, identified "one-stop shopping" as the most significant of several "best practices" that governments could adopt to advance the development of offshore wind.

- At least some stakeholders in offshore wind farm siting processes do not see a reduction of jurisdictional complexity and bureaucratic delay, however efficiency-enhancing for developers, as translating to a net benefit for the public if other benefits of equal or greater value, such as tourism, fishing, or aesthetic preservation, for example, are sacrificed in the process.

- Agencies with a functional orientation, such as wind energy development, are more likely to focus on promoting the development of the particular industry or technology in question. Combined with a primary policy objective that is expressed in terms of specific targets

for increasing the share of renewable energy sources in the nation's energy mix (as in the European Union member countries), such an agency focus is likely to give priority to maximizing such performance objectives as total energy output and reliability over economic efficiency.

- A lead agency with a "place-based" orientation is more likely to allocate access to and manage the area under its jurisdiction within a framework of multiple-use planning that takes the opportunity costs of alternative uses (including non-use) into account. Thus such an agency is better suited, at least in principle, to advance a complex mix of policy objectives, such as (in the case of the United States) energy diversification, environmental protection, resource conservation, and a fair return to the public, among others.

- Resource assessment is a process for measuring or estimating resource quantity, quality, location, economic rents, and other parameters. In most cases, it is an ongoing or recurring activity that spans all phases of resource development. A primary purpose of resource assessment is to enable government managers to estimate the net benefits to the public of a particular resource development or use, and to receive fair market value for the entitlements they authorize. Resource assessment also supports environmental and other analyses required under NEPA and other applicable laws, and it plays an important role in area selection, the process by which discrete areas are selected for resource development or use.

- Resource assessment typically begins with the government undertaking or sponsoring an initial survey of resource quantity, quality, and distribution at a very general level. The results of an initial resource assessment are used to identify general high-resource areas for more detailed examination and potential development.

- The economic and environmental information generated by the resource assessment process is important for deciding where offshore wind farms will be sited. Before these types of information come into play, however, there is another set of factors that largely determine *how* siting decisions are made and at what stage of the resource assessment process. These are institutional factors, such as the relevant laws and procedural traditions of the jurisdiction in question, along with the specific policy objectives that the proposed development is intended to serve. Laws that designate specific areas for special protections or particular uses are one such institution.

- The need for methods of resolving multiple use conflicts arises from the recognition that allocation decisions may result in opportunity costs in terms of displaced uses, including such "non-uses" as habitat protection or the supply of ecosystem services. This need is a reflection also of the absence or incompleteness of property rights for alternative uses of ocean space as a public resource.

- Notwithstanding the inertia embodied in traditional non-integrated management, most modern access systems incorporate methods of resolving existing or potential conflicts among alternative uses. All of the access systems in our database incorporate provisions for consideration, at some level of detail, of alternative uses of the ocean in areas where ocean wind power facilities might be sited.

- All of the European access systems for offshore wind power include some requirement for a NEPA-like environmental process, and a few have a *threshold* provision that reduces the number of individual installations that must undergo a full-blown EIS review. While

such schemes may enhance the cost profiles of small-scale projects, they do nothing to promote a meaningful consideration of alternatives that is perceived by many participants in the NEPA process to be lacking in the United States.

- Suggested improvements to the NEPA process include concurrent review (both an EIS and a public participation process would be launched when a project is first proposed) and negotiated rule-making. Both suggestions can be implemented under existing laws and regulations. They may be especially well suited to the new program for alternate energy-related uses of the US outer continental shelf, where the law mandates coordination and consultation with interested and affected parties in a number of areas, including the involvement of certain federal agencies and affected state governors in the development and implementation of regulations.

Allocation of Legal Interests

- Legal interests can be given away on a first-come, first-served (FCFS) basis, assigned according to the discretion of the managing agency, or sold competitively. FCFS allocations offer resource rents to the first claimant. If resource rents are significant, the FCFS method of allocation can result in inefficient levels of prospecting and exploration, as potential claimants compete for claims. Where rents are thought to be small or nonexistent, the potential for a rush to explore and develop also is small. In many areas of the ocean, where the economic feasibility of ocean wind power generation is uncertain—implying that rents are small—FCFS allocation methods have been established already. An FCFS allocation method also makes sense when a resource is abundant, again implying that rents are small, and the potential for a rush is minimal.

- The sale of legal interests in ocean space for specific uses is an alternative method for allocating the resource. Competitive auction sales theoretically are capable of allocating ocean space in an efficient manner for specific uses. With an auction, the government collects the resource rent in the form of a bonus. Competitive allocation methods may be administratively costly, however. These methods are more effective where there is significant demand for the legal interests to utilize a resource.

- In the early stages of interest in a potential resource, the existence of resource rents may be difficult to determine. Government can and should develop economic models of the operations of a wind farm in different locations to estimate the potential for rents. A second means of testing for the existence of rents can be obtained through a nomination process, in which private firms are asked to identify areas for potential lease. A third way to see if rents exist is to hold a competitive lease sale and see if any bidders show up. All three methods can be used in combination: areas for which no nominations are made can be held for the future; areas in which only one firm expresses an interest might be offered non-competitively; areas in which multiple firms express an interest can be allocated competitively.

- The overall efficiency of resource allocations can be improved if all potential uses are considered simultaneously. For example, if other "stakeholders" have access to a competitive auction for ocean space, then they may be willing to purchase rights in order to preclude specific types of development that lead to lost opportunities for their preferred use. In such an allocation, environmental groups could compete with energy producers for the legal right to "occupy" areas of the ocean and to use them for their own specific purposes. Although such a comprehensive

allocation method would appear to be ideal from the standpoint of economics, it is unlikely to be implemented given the current legal status and array of political interests that favor either "open-access" or "ocean zoning" allocations that are determined through discretionary or political processes.

- With respect to the design of an access system, the managing agency may need the flexibility to decide on a case-by-case basis the most appropriate size of wind farm entitlements. This kind of administrative discretion is found in BLM's wind power policy for the US public lands. The policy states that a "reasonable amount of land" should be allocated to support an application for a wind energy development project. Similarly, facilities for the production of geothermal energy on the US public lands are not to exceed "acreage determined by the Secretary [of the Interior] to be reasonably necessary for the proposed purpose."

- The potential costs of limiting tenure may be reduced through policies that grant rights holders a priority to renew their rights after an administrative review. Many of the access systems in our database allow for the continuation of entitlements as long as they are being productively used. For example, there is no explicit limit on tenure for both onshore and offshore hydrocarbon entitlements in the United States as long as oil or gas is produced in "paying quantities."

- A potentially useful institution for managing legal interests by adjusting tenure is known as a Townsend-Young "evergreen lease." An evergreen lease allows the terms of a lease to be renegotiated before the tenure has expired. Typically, an evergreen lease is renegotiated after approximately one-half of the tenure has been completed: say at ten years on a 20-year lease. Such negotiations for an ocean wind power lease might involve an increase in royalty payments, in line with the sequencing of a resource rent tax. A lessee would benefit from an extension of the lease for another 20 years. If the lessee disagrees with the increase in royalty, then the lessee would retain the option of letting the current lease continue for the final ten years, at which point the government would probably terminate the lease.

- The external effects of ocean wind are not normally a function of output (electricity) but instead of the placement of the structures. Once rock piles, towers, and turbines are in place, both the view and, potentially, the habitat have been altered. Short of removing the structures, there is little that can be done to mitigate adverse effects. As a consequence, relative to the more common types of pollution-generating facilities, such as fossil-fuel generators, refineries, paper and pulp mills, and the like, there would appear to be a reduced need for the ongoing monitoring of ocean wind facilities.

- The uncertainty associated with the construction of a permanent set of towers in an area of the ocean is the main rationale for including monitoring requirements in an access system for ocean wind. Monitoring at ocean wind farms is an activity designed to clarify whether or not external effects occur, rather than to measure the scale of pollution that is known to occur. Ideally, baseline environmental information exists that describes the ecosystem without the wind farm that could be compared to the situation when the wind farm is operational. Alternatively, similar oceanic areas with and without wind farms might be compared to identify possible adverse effects. The understanding gained from these experiments might be of use in subsequent decisions about the location, scale, and patterns of ocean wind farm development.

- The transferability of instruments affects the economic efficiency of an access system directly. In an ideal situation, with all other things (output, environmental impacts, etc.) equal, society would prefer to have those firms that can construct and operate a wind farm at the lowest cost be the holders of instruments. In the case of most access systems, proposed instrument transfers typically must be approved by the relevant administrative authority prior to the actual transfer. Approval may be required for various reasons, the most common being the purported need to ensure that instrument holders meet some level of technical and economic competence, and so that external costs, such as habitat destruction or pollution, are not incurred. Administrative approval imposes costs that limit transferability and reduce economic efficiency.

- Requirements for "reclamation" or "decommissioning" bonds are examples of financial measures to encourage the removal of structures and the cleanup of leased or licensed areas. Such requirements provide firms with a financial incentive to restore or clean up areas that have been used for particular activities to a state in which other previously excluded uses or non-uses (*i.e.*, habitat or ecological services) may resume.

- The decommissioning of offshore wind energy structures presents a different set of issues than decommissioning of offshore oil and gas structures or other types of reclamation policies. Wind power technology consists of turbines, towers, and associated rockpiles. Because wind is a non-consumptive resource, it cannot be depleted. Consequently, there may be no need to actually "decommission" wind energy structures. Towers and turbines are expected to depreciate over time, however. As they reach the end of their useful life, a decision may need to be made about whether to replace the structures and continue operations or to decommission.

- After many years, we might expect that the submerged rockpile structure would be well-established as an artificial reef. It may make sense to leave the rockpile in place, thereby potentially reducing the costs of decommissioning. The presence of an artificial reef may raise questions of potential environmental impacts if either replacement or removal necessitates significant disturbance of a rockpile.

Financial Terms of Access Instruments

- In economic terms, the fair market value (FMV) of a resource is equivalent to its resource rent. Where methods of allocating resources do not necessarily provide efficient incentives for firms to bid the entire resource rent, such as in a first-come, first-serve (FCFS) system, then FMV provisions provide some assurance to the government that rents will be collected. Without such a provision, the government may be subject to criticism about resource "give-aways."

- A form of the resource rent tax or variable royalty might be an appropriate financial term for ocean wind power. Because wind power is subsidized with a production tax credit and accelerated depreciation rules, these subsidies can be thought of as "negative" royalties that apply during the early phases of ocean wind development. Over time, these subsidies may be phased out, and positive royalties could then be invoked.

- An alternative method of instituting a variable royalty involves the use of Townsend-Young evergreen leases. The evergreen lease negotiation process represents a more flexible method for determining the variable royalty rate than a legislated variable rate structure. Lessees have the option of continuing at the previous royalty rate for the original length of the lease, at which point it

might be terminated. Although the precise details of an evergreen lease method need to be ironed out, this kind of an institution may provide benefits for both the government and lessees for a non-consumptive resource in which rents are expected to increase over time due to expansion in demands for both ocean space and electricity.

- Exogenous subsidies will encourage the development of ocean wind power in the United States. Within the maritime boundaries of coastal states, the federal production tax credit (PTC) and accelerated depreciation, state renewable portfolio standards policies, system benefits funds, and property and sales tax abatements can lower the relative costs of wind power construction and operation. Only the federal subsidies would appear to apply to developments in the US exclusive economic zone, however.

- It seems unlikely at this point in time that any of the European-type renewable energy subsidies will be adopted at the federal or state level in the United States. One exception is the possibility of the development of a market in green certificates in the future. Such a market would generally favor the lowest-cost producers of renewable energy. It is too early to tell whether some ocean wind facilities might be considered to be low-cost producers. In highly populated areas, where land costs are steep, the possibility of obtaining sites in the ocean at little or no cost (for ocean "land") may tip the balance in favor of ocean wind. On the other hand, political opposition to the siting of ocean wind projects within the sight of the coast may impose additional or, in some cases, even insurmountable costs.

- Under an access system that mandates a competitive process for allocating ocean space for wind farm development, prospective developers will bid away any subsidies as well as resource rents. The competitive bidding process still will select the most efficient wind farm operations, but bonuses will reflect the combined subsidy and resource rent. Consequently, bonuses will not be a good estimate of resource rents. The bidding away of subsidies implies that a competitive access system may defeat the purpose of other policy objectives to encourage the development of renewable energy.

- In the future, cost reductions are likely to come from efficiencies associated with large-order production runs of turbines for large-scale wind farms and through reductions in investment costs, especially those associated with the permitting process.

- Given the existence of production tax credits, accelerated depreciation provisions, a focused albeit small national R&D effort, and existing public policies that promote R&D, there does not appear to be a pressing need for a specific R&D program for ocean wind development as part of the access system. Nevertheless, in deep-water, exposed ocean environments, there is a clear need for experimentation with prototype platforms and associated infrastructure. An access system might usefully include provisions that minimize the administrative burden associated with projects that involve the application of cutting-edge research and experimentation.

- A strong argument can be made for including provisions in an access system that promote the collection of environmental monitoring data. Specify a few types, since you have already recommended againt too much pollution monitoring (potentially confusing). Such data could be collected by the government and released publicly or through a permitting program for prospective wind farm developers. Analogous to provisions in the regulations for geological and geophysical prospecting under the US Outer Continental Shelf Lands Act, prospective

developers might be encouraged to pool their resources to conduct environmental monitoring efforts in areas that show promise for wind power development. Such a policy would reduce the waste associated with duplicate monitoring efforts in the same location.

- When a particular use of the ocean is the most productive among all possible uses, then, from an economic perspective, performance requirements for that use are likely to be inefficient. In general, economic theory would predict that private firms are more likely than government agencies to make the most efficient choices about the timing and nature of work to be performed in order to carry out a particular activity, such as wind farming.

- In some cases, an exclusive use of the ocean may be preferred from a public policy standpoint, but the preferred use may not be the most efficient use of the ocean. More generally, there may be considerable uncertainty about what single exclusive use or combination of mutually compatible uses yields the highest economic value over time in a particular area of the ocean. In such cases, there is a legitimate concern that any economic loss associated with the preferred exclusive use be minimized. In such situations, performance requirements might usefully be imposed to ensure that economic losses are kept to a minimum.

I. Introduction

A. Growth of Wind Energy

Wind energy is the fastest-growing sector of the electric power industry. During the last decade, the annual rate of growth in production capacity has exceeded 30 percent worldwide. By the end of 2005, the Global Wind Energy Council had estimated the worldwide production capacity of wind energy generating facilities to be 59,084 megawatts (MW) (GWEC 2006). By the year 2020, approximately 12 percent of the world's power is expected to be produced from renewable wind sources.

In the United States, wind power capacity is now approximately 9,149 MW, representing just under 16 percent of world capacity. Wind energy now supplies enough electricity to power 2.3 million homes in the United States (AWEA 2006).[1] Another 3,500 MW are expected to be brought on line in the United States within the next five years. All of this capacity is located on land.

B. Siting Wind Energy in the Coastal Ocean

Wind energy developers seek to locate wind farms in areas where winds are consistently strong and steady, where the demand for power exists, where transmission distances are short, and where there is enough space. Some areas of the coastal ocean exhibit these attributes, as wind is typically more consistent over the ocean, and it tends to increase in strength with distance from the shore. European wind producers have recognized this fact, and developers in several western European countries, including Denmark, Sweden, and the United Kingdom, have begun to locate wind farms in the coastal ocean.

C. Study Objectives and Approach

This study is designed to help clarify national and local decisions about the siting of wind power generating facilities in the coastal ocean. Our objectives are to: (1) assess the extent to which existing systems for managing ocean wind siting in foreign jurisdictions and for managing public lands and resources in the United States provide lessons to be applied to the problem of siting wind power in the US coastal ocean; (2) identify and characterize those features of a land and resource management system that are appropriate for the siting of wind power in the US coastal ocean; and (3) characterize in qualitative terms the implications for economic efficiency of the adoption and implementation of each of these features.

To meet these objectives, we have (1) identified 20 common features of an access system and characterized them in terms of their utility and efficiency; (2) developed a database of the details of each of these features within 25 different access systems in the United States and abroad; and (3) developed a policy analysis framework for decision-making concerning allocations of ocean space. The policy analysis framework is rooted in economics, and we identify areas where it can be applied to allocation decisions, such as nonmarket valuation of seascapes, in our discussion of access system features in Section IV. The policy analysis framework itself is presented after this Introduction (Section II). The database is represented in a series of tables in Appendix A. Appendix B includes a list of the legal authorities for the 25

[1] Assuming the average American household consumes 10,656 kWh per year and wind energy generators operate at 31 percent of capacity.

access systems in our database, as well as a list of the source materials that are cited in the database tables in Appendix A.

D. What is the Relevant Ocean "Resource"?

When examining the potential for wind power development in the ocean, one naturally focuses on wind as a resource. In economic terms, resources are things that have value because they are scarce. The quality of wind, as characterized by its speed and consistency, may vary depending upon its geographic location.[2] Thus, in principle, the wind resource may be more valuable in some locations than in others.

Although wind is the resource to be exploited for transformation into electric energy, its exploitation does not diminish its qualities.[3] In essence, wind is a non-consumptive resource; the consumption of wind by a wind farm does not use it up. Consequently, offshore wind can be conceptualized as a special kind of "public" resource. In economic terms, wind is a quasi-public good.

Even though wind is non-consumptive, prospective consumers of wind can still be excluded from exploiting it in particular locations. The reason for this excludability is technological. The exploitation of wind requires the construction of wind turbines. Once a wind farm is constructed in a particular location, another wind farm cannot be constructed in the same place. Thus a wind farm does not meet the second criterion for a "pure" public good, which is non-excludability.

Because the use of ocean areas for the exploitation of wind implies that other prospective wind developers must be excluded, it is more appropriate to think of the relevant resource as ocean space. In the context of wind farming, ocean space may be characterized by its average wind speed, wind consistency, distance from electrical transmission facilities, distance from electrical consumers, and exposure to adverse weather conditions, among other qualities. The existence of quality differences across ocean areas implies that, like good cropland, ocean space with the right qualities may be a scarce natural resource. As a consequence, ocean space useful for wind farming can have economic value.

E. Resource Rent

In 1817, the English political economist David Ricardo articulated the economic concept of "resource rent." In a functioning market for land, such as agricultural land, rent is equivalent to its price.[4] Ricardo explained how lands of higher agricultural quality naturally command higher prices in the market. In the ocean context, ocean areas that are potentially useful for

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[2] There are some very general rules-of-thumb with respect to wind speed. Wind speed tends to increase with elevation. Wind speed also tends to increase with distance offshore. Even offshore, wind speeds can exhibit considerable variation over time with near- and long-term weather patterns and conditions. Research is now focusing on the development of a better characterization of wind speeds as a function of location in the US coastal ocean.

[3] There is a limited reduction in the strength of the wind resource within a "wind shadow" created by a turbine. This reduction disappears outside of the wind shadow. Consequently, wind turbines can be spaced fairly close together within the confines of a wind farm.

[4] More concretely, rent can be interpreted as the cost to a farmer of leasing farmland from a landowner. Used in this way, resource rent is analogous to the more common use of the term "rent" as payment for leasing an apartment.

exploiting wind energy may exhibit varying qualities, suggesting a variation in rents. If a market were to be established for ocean space, those areas that exhibit the best combination of characteristics would tend to command higher prices.

No market exists for ocean space, however. Instead, the government, acting as an agent for the public, allocates ocean space for alternative uses. A wide variety of institutions are used to allocate ocean space, comprising legislation, common law, and tradition. Examples of legislation include the Magnuson-Stevens Fishery Conservation and Management Act for commercial fisheries harvests and the Outer Continental Shelf Lands Act for offshore oil and natural gas exploration, development, and production. The public trust doctrine, operating on state-owned tidelands, is an example of the allocation of ocean space through the common law. In simple terms, the doctrine characterizes certain lands as public resources which are held in trust by a public entity for the benefit of some class of beneficiaries. Unlike an explicit trust document, however, the conditions for managing public trust lands are somewhat nebulous unless courts or legislatures construct detailed provisions to achieve the objectives of the public trust. In many states, the public trust doctrine has been codified and/or explained in statutes and judicial opinions. As a result, in most states, alienation of public trust lands is generally prohibited, while fairly wide discretion is afforded public trust managers as to how public trust lands may be used. Certain ocean uses, such as commercial or recreational fishing, may be accorded a higher priority than other uses under the public trust doctrine (Duff 2004) . Finally, tradition may play an important role, even if it is not officially sanctioned. For example, commercial fishermen may believe that they have the right to continue to use historical fishing grounds—even if those rights are not articulated in law. Traditional ocean uses may be supported with political influence.

If government institutions do not assess the price of scarce ocean resources and charge the users this price, then resource rents will accrue to private firms or individuals who use the resource. Who collects the rents from the use of a public resource is a distributional issue that in principle should not affect economic efficiency.[5] Nevertheless, where resources are quite scarce, the distribution of rents to resource users can create incentives to overexploit the resource in the absence of other controls. The over-exploitation of open-access wild harvest fisheries is an example of what can happen when users are not charged a resource rent. Analogous to the claim staking policy of the Mining Law of 1872, the existence of rents in ocean space potentially could lead to excessive exploration and development activity—a "bonanza" phenomenon.

From society's point of view, resource rent should be assessed net of all costs, including costs that private firms or individuals might regard as external to their own decision-making. For example, a wind farm operator might not consider the costs of the diminishment of an aesthetic seascape caused by the construction of wind turbines. If forced to consider these costs as part of

[5] It may be useful to consider the US public as the "owner" of ocean space. In this case, a federal agency would be enabled to act on the public's behalf to "dispose" of the resource in a way that receives the highest economic return. Outer Continental Shelf oil and natural gas resources are allocated according to this model. Note, however, that such a system is in itself a distribution of resource rents that is unnecessary for achieving a goal of economic efficiency. All that is required for efficiency is that the rights be established, enforceable, and freely transferable (Dales 1969).

its operation, and if it has been allowed to capture the resource rent, the size of the rent would be reduced.[6]

F. Opportunity Costs

More generally, government will want to consider the opportunity costs of alternative uses (or combinations of alternative uses) in ocean space. Concern about opportunity costs is sometimes expressed vaguely as a "requirement" that the public be compensated for the *use* of its resource (*cf*., Firestone *et al*. 2004).[7] From an economic perspective, government should select those combinations of ocean uses that maximize the resource rent from the use of ocean space. Take a simple (but not unrealistic) example of two hypothetically mutually exclusive uses: wind farming and commercial fishing. If rents are realized from the use of an area of the ocean as a wind farm, and if rents are completely dissipated because of stock depletion as a consequence of the lack of efficient regulation of the fishery, then it would be economically sensible to allocate the space for wind farming.

In practice, the opportunity costs of allocating areas for specific uses or for specific combinations of uses can be very uncertain. No one has attempted—much less suggested publicly—that the citizens of Cape Cod, Massachusetts, be surveyed to estimate the non-market damages associated with the hypothetical degradation of a seascape from the construction of a wind farm in Nantucket Sound. Similarly, few, if any, studies have estimated the non-market values of modifications in seabird habitat when a wind farm is sited. Even the opportunity costs of displacing commercial uses, such as shipping and fishing, can involve uncertainty in their calculations. Nevertheless, we argue that a policy analysis framework be incorporated into an access system so that the government can begin systematically to incorporate estimates of opportunity costs into its decisions about allocating ocean space.

G. Focus of this Study

In this study, we assume that the maximization of resource rents from the use of ocean space is the overriding policy goal. We focus on the allocation of ocean space for wind farming as the primary use, but one that is not necessarily exclusive of other uses. Where relevant, we discuss other uses to the extent that there may be opportunity costs from the allocation of ocean space for wind farming. We analyze the common features of an access system from the perspective of their potential effects on economic efficiency.

The existence of institutions to establish legal interests in ocean space for wind farming and to provide a means for enforcement against any infringement of these interests is critical. Again, there is no market for ocean space. Specialized institutions must be devised, if they do not yet exist, for allocating ocean space. A system of access to ocean space is necessary for the development of wind farming as a productive industry.

Impediments to the realization of economic efficiency as a policy goal are numerous. They include the uncertainties involved in assessing rents, imperfections in existing institutions, historical

[6] If all other factors of production are being purchased at their marginal costs, then the resource rent for ocean space used exclusively for wind power is equivalent to revenues from the sale of electricity less the costs of all other factors. In this calculation, a normal profit to the firm is considered to be a component of cost.

[7] This need for compensation is hardly a requirement. For example, few have suggested that shippers be charged a fee for the use of the oceans as a transportation medium. Nevertheless, the US Minerals Management Service charges a fee for the operators of deepwater ports under provisions of the US Deepwater Ports Act.

patterns of uses and the political influence wielded by users, and the very real possibility of the adoption of other social goals that might be accorded equal or greater weight in policy decisions. We expand on the nature of these impediments as we analyze each of the generic features.

II. Policy Analysis Framework

If we assume that the maximization of resource rents from the use of ocean space is an overriding (or at least a major) policy goal in allocating ocean space to wind farming (and other activities), the natural choice of a policy analysis framework for ocean space allocation decisions is one that is rooted in economics. More specifically, the ocean space allocation decision under this goal becomes an exercise in maximizing the present value of resource rents, or net social benefits, from the use of ocean space under alternative allocations. In this section, we describe in general terms how such an analysis might be carried out.

Economic analysis is a useful tool to guide allocation decisions; and it is particularly helpful in the pursuit of an economically efficient outcome. But it does not by itself provide a complete answer to all allocation problems, which often are fundamentally political in nature and arguably should be settled by a political process. Uncertainty in future costs and benefits, and the possibility of policy goals other than maximizing resource rents (for example, maintaining traditional fishing practices), suggest that while economic analysis should guide the allocation decisions, it is not the only consideration. Still, to the extent that this political process incorporates economic considerations, it is more likely to result in an efficient outcome.

One set of issues that arise in allocation decisions involve the distribution of costs and benefits across different groups. Allocating ocean space so as to maximize resource rents provides for economic efficiency but does not automatically result in a distributional outcome that is fair or politically desirable. Various features of the access system, including those dealing with financial terms and how resource rents are used (for example, to compensate parties who may be adversely affected), will affect the distributional aspects of ocean space allocation decisions.

In simple terms, the economic framework for analyzing ocean space allocation decisions for wind farming is as follows:

> **An area of ocean space should be allocated to wind farming if the resource rents from wind farming in that area exceed the opportunity costs associated with other uses that are excluded or diminished by wind farming.**

We define "resource rents" broadly here to be the net social value generated by use of the wind resource in an area, after accounting for all private and external (social) costs, including a reasonable rate of return on investment.[8] In applying this definition, we assume that individual wind farm operations would be called to account for all external costs or benefits. The

[8] This definition of resource rents may differ from the historical definition of "pure" Ricardian rents, in which only private costs are considered. We note also that the development of wind farms can lead to positive externalities in some situations, including the possibility of aesthetic improvements, the creation of new habitat features (rockpiles) that may enhance biological productivity, and the displacement of fossil-fuel burning electric power generators. Positive externalities would be defined to be social benefits.

opportunity cost associated with excluded (or diminished) other uses of the same area are similarly defined as foregone resource rents.

The framework we describe here can be applied to the allocation of ocean space for any use; we focus on wind farming as a specific example. A more general restatement of the framework would be:

> **An area of ocean space should be allocated to that combination of uses that maximizes the combined resource rents.**

The application of either formulation will have the same result with respect to wind farming allocations.

Wind farming is not necessarily an exclusive use of ocean space. In applying the framework, it is necessary to determine first which other uses are compatible with wind farming and which are excluded or diminished. For example, some types of aquaculture and recreational fishing may be compatible with wind farming, while certain kinds of commercial fishing (dragging) and the use of the area as a certain kind of aesthetic seascape may be excluded or diminished.

Using the first formulation given above, the decision to allocate an area of ocean space to wind farming is justified in economic terms if the following criterion is met:

$$\sum_{i=1}^{n} R_i \left(\frac{1}{1+\delta}\right)^i > \sum_{i=1}^{n} \left(\sum_{j=1}^{m} O_{j,i}\right)\left(\frac{1}{1+\delta}\right)^i$$

where

n is the planning horizon in years;
R_i is the resource rent from wind farming in the area in year i;
δ is the discount rate; and
$O_{j,i}$ is the opportunity cost (forgone resource rent) of excluded or diminished use j ($j = 1, \ldots, m$) in the area in year i.

In practice, the application of this framework requires estimates of the resource rent (net value) generated by different uses of ocean space, individually and in combination, over time. The relevant uses include commercial activities such as maritime commerce, commercial fishing, aquaculture, marine minerals extraction, and wind farming. They also include non-market uses that do not generate goods or services for which market prices can be directly observed. Among these are recreational boating and fishing, ecosystem services, and the aesthetic value of the seascape.

Future resource rents and opportunity costs are discounted to reflect both the time value of resources and increasing uncertainty about the magnitude of benefits and costs projected over increasingly long time horizons. It makes sense to assign less "weight" to a positive or negative value to be incurred ten years from now than a similar value estimated for next year, both because we have more time to take mitigating action for the future event, and because there is greater uncertainty about its magnitude.

As a rule, it is relatively easy to estimate resource rents associated with commercial activities, and progressively more difficult for uses that are further removed from markets, such as recreation,

aesthetics, and ecosystem services. As a result, the opportunity costs of allocating areas for specific uses or for specific combinations of uses can be considerably uncertain. For example, the non-market damages associated with the hypothetical degradation of a seascape from the construction of a wind farm in Nantucket Sound have not been estimated; and doing so would require extensive survey work. Similarly, there is uncertainty about the non-market values of modifications in seabird or subsea habitat when a wind farm is sited. Even the opportunity costs of displacing commercial uses, such as shipping and fishing, can involve uncertainty in their calculations.

These uncertainties can be reduced through the application of established economic techniques for estimating net resource rents and opportunity costs. Benefit-cost frameworks and economic models of commercial activities can be applied to estimate net resource rents. Environmental economists have developed methods for estimating "non-market" values, such as those derived by coastal residents and tourists from an unimpeded view of the ocean, that are not directly observable because the commodity in question is not generally traded in established markets.[9] These methods can be applied to estimate the economic losses associated with changes in the aesthetic properties of seascapes and ecosystem services.[10]

It is important for a disinterested party to apply these economic techniques. Although stakeholders may wish to conduct or sponsor their own analyses, there is the clear possibility of bias built into assumptions and hidden in the results. Ideally, the government would conduct the policy analyses or contract for the analyses to be undertaken by independent analysts. Although arguably more credible than analyses conducted by stakeholders, the government, however, may not be a completely disinterested party. Therefore, the results of the analysis should be subject to a scientific peer-review.

Despite remaining uncertainties, an economic policy analysis framework should be incorporated into an access system so that the government can begin to incorporate systematic estimates of opportunity costs into its decisions about allocating ocean space. Uncertainty about their precise magnitude does not make the values and costs of allocation decisions less real; and it is better to acknowledge uncertainties, and work to reduce them, than to ignore these aspects in the allocation decisions.

III. Access System Design

A. The Developing Access System for Wind Energy in the US Coastal Ocean

The US coastal ocean is a public resource. Before wind-generating facilities can be sited there, a framework for allocating legal interests to generators and for resolving conflicts among alternative uses is needed. The federal "permitting" process has until recently been based upon section 10 of the 1899 US Rivers and Harbors Act (RHA), which assigns jurisdiction to the US

[9] Note, however, that real estate markets may reflect quantifiable values attributable to scenic views.

[10] A number of studies have been conducted to estimate the economic benefits of scenic views or aesthetics or losses associated with changes to these amenities. Brookshire *et al.* (1976) estimate the aesthetic damages associated with the hypothetical siting of an electric power plant near Lake Powell in the Glen Canyon National Recreation Area. Lansford and Jones (1995a, 1995b) use hedonic models to estimate the recreational and aesthetic values associated with one of the Highland Lakes in central Texas. Freeman and Dunford (2003) use stated-preference techniques for estimating the aesthetic impacts of a shipwreck on coastal recreation in Oregon. Mathews *et al.* (2004) use direct survey approaches to estimate the value of scenic views along the Blue Ridge Parkway in the southern Appalachian mountain chain.

Army Corps of Engineers (AcoE) to regulate obstructions to navigation in the navigable waters of the United States and on its outer Continental Shelf (OCS).

Navigational issues still are paramount, but recent legislative developments would seem to acknowledge that the RHA is inadequate for making decisions about the exclusive use of the ocean for permanent activities such as offshore wind facilities. For example, the US Coast Guard has now been assigned authority to review the navigational impacts of the potential siting of the Cape Wind facility in Nantucket Sound, Massachusetts.[11]

Section 388 of the Energy Policy Act of 2005 [P.L. 109-58], which was signed into law by President George W. Bush on August 8, 2005, designates responsibility for the design and implementation of an access system for siting ocean wind energy to the Minerals Management Service (MMS) in the US Department of the Interior. MMS is now in the process of drafting regulations under the authority of section 8(p) of the Outer Continental Shelf Lands Act Amendments of 1978 (OCSLA) to grant leases, easements, or rights-of-way for siting facilities that produce, transport, or transmit energy from sources other than oil and gas, including ocean wind energy facilities. These rights are to be granted on a competitive basis, unless a determination of "no competitive interest" is made.

Additional provisions require MMS to establish financial terms that ensure a fair return to the United States for the granting of these rights and to set up a revenue-sharing program with coastal states for grants within three nautical miles of a state's submerged lands, analogous to the existing 8(g) program for OCS mineral leasing. MMS is now to act as the lead agency in coordinating the actions of other agencies in siting decisions. MMS also recently developed a set of "state offshore administrative boundaries" in US federal waters as part of an effort to, *inter alia*, facilitate cooperative federal-state development agreements and assess the equitable sharing of developmental benefits and risks among regions.[12]

While the assignment of authority to MMS directly responds to the question of the adequacy of the RHA as a legal means for providing access, the issues that arise with coordinating responsible agencies will not disappear. In particular, an RHA §10 permit for potential obstructions to navigation is still required among other approvals or reviews by numerous federal and state agencies. Further, there is now a requirement that energy-related activities authorized under these new provisions "are carried out in a manner that provides for . . . prevention of interference with reasonable uses of the EEZ." The Secretary of the Interior is accorded discretion in determining what uses are to be classified as reasonable.

The Energy Policy Act also provides that the resubmission of documents or the reauthorization of previously authorized actions are not required. Thus, proposed projects such as that of Cape Wind Associates or the Long Island Power Authority may not need to restart their licensing processes.

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[11] This assignment has been incorporated into legislation for the US Coast Guard's annual appropriations. This provision is specific to the Cape Wind proposal, although the Coast Guard is likely to retain review authority under provisions of OCSLA 8(p) regulations now under development by MMS.

[12] Federal Outer Continental Shelf (OCS) Administrative Boundaries Extending from the Submerged Lands Act Boundary seaward to the Limit of the United States Outer Continental Shelf, 71 *Federal Register* 127 (Jan. 3, 2006).

B. US Public Policy Context

The development of wind energy facilities in the ocean is influenced by a number of other public policies. These policies continue to be in a state of flux, thereby increasing the level of regulatory risk faced by entrepreneurs thinking about constructing a wind farm in the coastal ocean. Among these policies are:

- Reinstatement of the federal production tax credit for two years. In August 2005, a federal tax credit of 1.9 cents per kilowatt hour for the production of electrical energy from wind power was reinstated for two years (Energy Tax Incentives Act of 2005). This credit can be used during the first ten years of the operation of a new wind energy generating facility. The size of the tax credit is adjusted annually for inflation. The credit is now due to expire on January 1, 2008. The wind power industry would prefer to see a multi-year extension to the credit, perhaps to as long as five years. The industry claims that the short-term nature of the credit makes investment decisions more difficult, thereby slowing the growth of the industry.

- Renewable portfolio standards. Twenty-two states, the District of Columbia, and the federal government (for its own operations) have now adopted renewable portfolio standards (RPS) (Rabe 2006). These standards are a command-and-control approach to encourage the adoption of renewable energy by requiring that a fixed percentage of electricity consumption in a state be generated from renewable sources. RPSs are typically phased in over a period of several years. For example, Section 203 of the Energy Policy Act requires that, beginning in 2007, at least three percent of energy utilized by the federal government must originate from renewable sources, and this requirement increases to 7.5 percent by the year 2013. (The standard is doubled for federal facilities that produce their own energy or that rely on energy produced on public or Indian lands.) Another RPS provision in the Senate version of the Energy Bill would have required that electrical utilities obtain 20 percent of their electricity from renewable energy by 2025, but this provision was excluded in the final version of the Energy Policy Act.

- Renewable energy on the US public lands. Section 211 of the Energy Policy Act comprises a "sense of Congress" that a generation capacity of at least 10,000 MW of non-hydropower renewable energy should be located and approved on the US public lands by 2015. While this provision has no strict enforceability, it gives direction to US agencies as they seek to encourage the development of renewable energy supplies. For example, the US Department of Energy has adopted an internal agency goal to encourage renewable energy producers to supply at least six percent of the nation's electricity by 2020. And the Bureau of Land Management (BLM) in the US Department of the Interior has now adopted a policy for providing access to the US public lands for siting wind power generation facilities.

- Interest-free clean energy bonds. Another provision of the Energy Policy Act makes renewable energy facilities (including wind, biomass, and solar) eligible for interest-free "clean energy bonds" to finance development (Oswald and Larsen 2006). These bonds would mirror those already available for electric power cooperatives and public power utilities. The Act also gives the Department of Energy broad authority to provide loan guarantees of up to 80 percent of project cost to the implementation of innovative energy production technologies, including renewable energy.

- Relaxation of NEPA Requirements. A recent version of a bill (the "National Energy Supply Diversification and Disruption Prevention Act" [no bill number]) currently under debate in the House Resources Committee includes provisions that would relax the requirements of the

National Environmental Policy Act (NEPA) for environmental reviews for siting renewable energy facilities, such as wind power, among others. The specific provisions of this measure are still being negotiated, but they may limit the scope of the required review of alternatives to a proposed project. If enacted, this policy might speed the approval of environmental impact statements for proposed wind farms in the coastal ocean.

C. Common Features of an Access System

An access system is a body of law, regulation, and agency policy that governs the allocation of a resource in the public domain to private entrepreneurs who would use or exploit the resource in an economically productive way. We have identified 20 common features of an access system that we separate into three broad categories: (1) general management features; (2) allocation of legal interests; and (3) financial features. We list and briefly describe each of these features here.

General Management Features

- Regional Planning: comprehensive review and planning for uses or combinations of uses in a region (planning, not zoning); initial characterization of tradeoffs among potential uses.
- Policy Objectives: characterization of the purposes and rationale for the establishment of a means for providing access to public areas for specific purposes (an "access system").
- Lead Agency: identification of the agency responsible for resource assessments, area selections, and allocations for specific resources.
- Coordinating Agencies: identification of agencies with responsibilities for permitting, conducting ancillary environmental assessments, and consulting or coordinating with the lead agency in carrying out its responsibilities.
- Resource Assessment: process for measuring and assessing resource quantity, quality, location, economic rents, other parameters.
- Area Selection: process for picking specific areas within a region for the development or use of a particular resource; identification of viable alternative areas.
- Multiple Use Decision-making: processes for identifying multiple uses and valid existing rights, characterizing tradeoffs, and resolving conflicts, including public notice and comment; consensus building; stakeholder participation; policy analyses (benefit-cost analysis); arbitration; litigation; others.
- Environmental Review: environmental impact assessments and reporting requirements.

Allocation of Legal Interests

- Allocation Method: procedure for allocating selected areas to developers (first come, first served; competitive auction; auction type; other).
- Instrument: type of instrument establishing legal interests or rights (license, lease, permit, fee simple ownership).

- Interests: precise nature of legal interests or property rights.
- Size: geographic scale of legal interests.
- Tenure: duration of legal interests.
- Monitoring and Enforcement: monitoring and enforcement (including inspections and reporting requirements).
- Transferability: extent to which legal interests may be sold or otherwise transferred to other firms, individuals, institutions.
- Termination: conditions or requirements leading to termination or revocation of legal interests; decommissioning of structures.

Financial Features

- Financial Terms: financial aspects of an allocation that transfer resource rents from a developer to the public, including royalties, rentals, license fees, others.
- Subsidies: financial terms encouraging development, including tax credits, tax deductions, accelerated depreciation, grants, price floors, payment relief periods/conditions, other implicit mechanisms.
- R&D Incentives: financial or other incentives to conduct research and development activities relating to the development of the resource.
- Performance: performance requirements such as due diligence requirements, rentals, bonds, others.

IV. Existing Access Systems for Offshore Wind Power and Other Public Resource Activities

We have compiled a database of information relating to these access system features. The database is represented in a series of tables at the end of the report (Appendix A). The database is a compilation of information about the common features of access systems for a wide variety of resources, including hydrocarbons, hard minerals, ocean space, public lands, wind power, among others. Each access system feature is described in depth and related to the database in the following sections.

A. General Management Features

1. Regional Planning

Regional planning refers to a management process that considers the implications at a broad geographic scale of allocating areas of the ocean for specific uses, such as ocean wind power. There are at least two primary concerns that motivate the need for regional planning. The first pertains to the geographic extent of external effects from specific uses in relation to the existing pattern of political jurisdictions. Specifically, a government agency might sanction a use that has effects that occur beyond its geographic authority. The second concern pertains to the

value of anticipating changes in the distribution of human uses and ecosystem characteristics in the future.

Ocean governance has been criticized recently for lacking integration of management planning and actions (*e.g.*, COP 2004; POC 2003). Policy integration implies the coordination of disparate government programs, achieved mainly through the collaboration of managing agencies. Integration failures can occur where agencies refuse to cooperate, where legal constraints force agencies to conduct overlapping activities or to compete, where single agencies may be assigned conflicting objectives, and where political jurisdictions limit the scope of agency authority. Integration involves identifying and resolving inconsistencies across programs by consolidating agency functions or through other forms of interagency cooperation (Juda and Burroughs 1990; Underdal 1980).

The US Commission on Ocean Policy recently studied the problem of the lack of integration, finding that political jurisdictions in the ocean normally do not coincide with the boundaries of marine ecosystems (COP 2004). Historically, ocean governance has not been designed to transcend political or legal jurisdictions. Consequently, in theory, situations may arise in which the external effects of ocean uses can extend beyond political boundaries, affecting components of ecosystems that are not coincident with political jurisdictions. These external effects may not be fully controlled by ocean users or regulated by managing agencies. The existence of external effects that cross political boundaries is an argument for taking a broader, regional approach to the management of the oceans. The Commission on Ocean Policy has recommended the establishment of regional ocean councils to take on this broader planning perspective.

The notion of regional planning through regional councils is logical in a theoretical sense. From a pragmatic viewpoint, however, there can be problems in executing the approach. First, there is the question of the choice of geographic scale. Different problems may require regional planning institutions that have different political boundaries. Second, there is the issue of the political will to participate in decision-making. Unless participants are motivated to take part, and unless there are opportunities for gains from trade among participants, successful regional management is unlikely. Hoagland and Solow (2005) find that successful regional institutions are organized at the most appropriate scale, focused on a specific problem, and engaged in developing new information about the problem; further, they involve participants who are motivated to seek solutions.

One prominent example of a regional planning approach is the 5-year program for OCS oil and gas leasing in the United States (Table A1). Under section 18 of the Outer Continental Shelf Lands Act (OCSLA), the Secretary of the Interior plans for the size and location of lease sales in regional planning areas (MMS 2006). In adopting the leasing program, the Secretary must take into consideration, at a regional level, geographical, geological, and ecological characteristics; location with respect to regional and national energy markets; location with respect to other uses of the sea and seabed; location with respect to other anticipated uses of the resources and area of the OCS; the policies of affected coastal states; the environmental sensitivity and marine productivity of areas of the OCS; and relevant environmental and predictive information. Thus, the OCS 5-year leasing program attends to the two concerns motivating regional planning: the geographic extent of external effects, and the need for planning for uses in the future, albeit over a short time horizon.

In particular, before adopting a 5-year leasing program, the Secretary must seek an "equitable sharing of developmental benefits and environmental risks among the various regions." The 5-year program must reflect a balance among three potential consequences of leasing: oil and gas discovery, environmental damage, and adverse effects on the coastal zone. The process for drafting the program involves multiple opportunities for public comment, the input of advisory committees on OCS policy, royalty policy, and science, and presidential and congressional review. OCS planning leading to oil and gas production is subject to the environmental impact review procedures of the US National Environmental Policy Act (NEPA) at multiple points: (1) the development of the 5-year lease program; (2) the lease sale(s); (3) the exploration phase (for "frontier" areas); (4) development and production permitting (for other than "mature areas" of the OCS); and (5) production termination with possible rig removal.

There have been numerous court challenges of the OCS 5-year planning process during the last three decades. Moreover, several regions are subject to executive and legislative moratoria on leasing. Ostensibly, litigation and moratoria would appear to be evidence of a failure in regional governance, but the program may be the most sophisticated and "rational" example of a regional ocean planning process to be found. In particular, although the Secretary of the Interior exerts extensive administrative discretion in developing the 5-year program, it cannot be criticized as non-integrated. The US Commission on Ocean Policy finds that OCSLA "presents a clearer roadmap than most other offshore resource management plans or programs." Further, the Commission concludes that the OCS oil and gas leasing program "can be a model for the management of a wide variety of offshore activities" (COP 2004).

The incorporation of regional planning into an access system for ocean wind is economically efficient to the extent that potential external costs are fully incorporated into decisions about siting. In the United States, access for ocean wind has been incorporated into the OCSLA planning process by virtue of the Energy Policy Act of 2005. Nevertheless, the development of ocean wind power presents a different set of external effects than offshore oil and gas development.

The most salient issues in the case of ocean wind power include the potential for aesthetic impacts and changes in habitat for birds, fish, and wildlife. The former is an issue that is characterized by a local scale (the distance a structure can be viewed from land), whereas the latter may be characterized by a regional, national, or even international scale (for migratory species). If regional planning is to be successful, it will need to be appropriately tailored to the geographic scale of these problems. This tailoring may require a modification of the existing planning areas for OCS oil and gas leasing to accommodate the provision of access for ocean wind power.

2. Policy Objectives

One of the central features of an access system is its rationale. Policy objectives refer to the public purposes for establishing a method of regulating access to develop and to use a natural resource and for controlling its side-effects. Some policy objectives pertain directly to the provision of access to the resource, others represent complementary or even competing or conflicting objectives. The panoply of policy objectives associated with an access system is the product of political negotiations among commercial interests, stakeholders, and the public over the system's rationale.

It is commonplace for an access system to incorporate more than one policy objective (Table A2). For example, the US Deepwater Ports Act includes the following stated policy objectives: (1) authorize and protect the interests of the United States and adjacent coastal states in the location, ownership, construction, and operation of deepwater ports beyond state boundaries; (2) prevent or minimize adverse environmental impacts; (3) enhance the safety and economic viability of importing oil into the United States and of transporting oil from the OCS; and (4) protect the rights and responsibilities of states and communities to regulate growth, determine land uses, and protect the environment.

Where multiple policy objectives are set forth, the potential may exist for objectives to conflict. In particular, objectives to promote economic efficiency often may not be aligned completely with objectives to promote fairness to one or more stakeholder groups. Consequently, there may be a need to invoke general methods of decision-making that resolve the conflict by prioritizing policy objectives (*viz*., Sørensen *et al.* 2002), such as by assigning administrative discretion to the managing agency, by requiring stakeholder consensus, or through judicial oversight or other methods of negotiation or arbitration. In order to satisfy multiple objectives, only one of which might involve economic efficiency, resource rents may need to be given up or traded away (*cf*., Schantz 1994).

Generic policy bases or rationales exist for the development of renewable energy from wind (Bird *et al.* 2005; Michaelowa 2004; Meyer 2003; Enzensberger *et al.* 2002). These rationales include the existence of community attitudes favoring environmental protection; a need to level the playing field vis-à-vis fossil fuel–powered utilities, which may receive implicit subsidies in the absence of greenhouse gas controls; a perceived need to boost an infant industry; and a need to diversify sources of supplies of electrical energy. Depending upon the jurisdiction, these rationales have been used to promote the implementation of renewable portfolio standards, production tax credits, and other favorable tax treatments; the setting of price supports for renewable energy; and the development of markets in green certificates. These rationales also appear as arguments for the reduction of legal risks through the establishment of access systems for the development of renewable energy in public areas, such as the oceans.

Policy objectives tailored specifically for ocean wind development in other countries and in the US coastal states span a wide range. In Europe, renewable energy has been promoted to help reduce emissions of greenhouse gases from the burning of fossil fuels for producing electricity. Commonly, European governments set fixed targets in the form of percentage contributions to total electrical energy production, such as Germany's goal of 12.5 percent renewable energy by the year 2010. Additional policy objectives include the protection of ecological processes and ecosystems (United Kingdom); to increase the provision of low-cost electricity from domestic utilities (Spain); and to reduce the dependence upon imports of fossil fuels (The Netherlands). All jurisdictions have the objective of assessing and minimizing adverse environmental impacts. In an interesting policy development, Ireland has put forward an objective to investigate the benefits to fisheries of establishing marine reserves in the same location as wind farms.

Policy objectives for US offshore ocean wind development have been specified in the US Energy Policy Act of 2005. Section 388 of that Act amends section 8 of the Outer Continental Shelf Lands Act by adding a subsection "8(p)" that includes several provisions relating to the grant of leases, easements, or rights-of-way for certain activities, among others, that produce or support production, transportation, or transmission of energy from sources other than oil and gas.

(Although the language is arcane, section 8(p) applies to the siting of renewable energy, such as ocean wind.) Among its requirements, the Secretary of the Interior is to ensure that section 8(p) activities are carried out in a manner that provides for safety; environmental protection; waste prevention; OCS resource conservation; coordination with other federal agencies; protection of US national security interests; protection of the correlative rights in the OCS; a fair return; prevention of interference with other reasonable uses of the EEZ, high seas, or US territorial sea; and consideration of the location of existing legal interests in the OCS and other uses of the sea or seabed.

Ostensibly, only one of these objectives, the one relating to the realization of a fair return from the grant of a lease, easement, or right-of-way, promotes the efficient allocation of ocean space for wind power development. This observation is true only if ocean wind power is the only potential use of ocean space. A competitive auction system, for example, would result in the allocation of legal interests to the most efficient ocean wind power firm. A larger social concern, however, is the problem of whether excluded uses of the ocean are more valuable than the siting of ocean wind. The final two policy objectives, relating to the prevention of interference with other "reasonable" uses and the consideration of other uses of the sea and seabed, appear to require the Interior Department to assess the opportunity costs of siting ocean wind facilities. It is critical that a policy analysis framework be established so that the economic value of these other potentially displaced uses (and non-uses) can be compared to the value of ocean wind power development. Such a framework may be needed especially where renewable energy has been selectively subsidized.

3. Lead and Coordinating Agencies

The lead agency for an access system is the agency that is responsible for resource assessments, area selections, and allocations of specific resources. In the United States and many other jurisdictions, the lead agency is usually designated in legislation that expressly authorizes the activity in question and specifies the relevant authority and responsibilities of the lead agency, usually in rather general terms. Coordinating agencies are agencies with responsibilities for permitting, ancillary environmental assessments, and consulting or coordinating with the lead agency as it carries out its responsibilities. Depending on the location of the activity (*e.g.*, federal vs. state waters or public lands), coordinating agencies may all be at the same level of government as the lead agency, or, more typically, there will be a mix of coordinating agencies from different levels of government. The responsibilities of coordinating agencies may derive either from law or special expertise. (See Appendix B for a list of the legal authorities under which lead and coordinating agencies have jurisdiction over activities conducted in the different access systems.)

Most public resource access systems are led by one of two types of agencies: agencies with a broad mission of managing or administering a certain category of public space where a mix of activities occurs, such as the Bureau of Land Management in the Department of the Interior; or agencies with a more targeted mission of managing and/or promoting particular activities or technologies involving the use of a public resource, such as the National Marine Fisheries Service in the Commerce Department. Although agencies of either type may have the necessary capabilities for resource assessment, area selection, and environmental review, the two types of agencies lend themselves to advancing different policy objectives and, hence, have different implications for economic efficiency.

Agencies with a functional orientation, such as wind energy development, are more likely to focus on promoting the development of the particular industry or technology in question. Combined with a primary policy objective that is expressed in terms of specific targets for increasing the share of renewable energy sources in the nation's energy mix (as in the European Union member countries), such an agency focus is likely to give priority to maximizing such performance objectives as total energy output and reliability over economic efficiency. By contrast, a lead agency with a "place-based" orientation is more likely to allocate access to and manage the area under its jurisdiction within a framework of multiple-use planning that takes the opportunity costs of alternative uses (including non-use) into account. Thus such an agency is better suited, at least in principle, to advance a complex mix of policy objectives, such as (in the case of the United States) energy diversification, environmental protection, resource conservation, and a fair return to the public, among others.

Several foreign jurisdictions (Germany, Ireland, France, Sweden) have offshore wind power access systems that are led by an agency with broad responsibility for managing a designated area of public waters, such as the EEZ or the territorial sea. In most cases the lead agency can be either a national-level agency or its regional-level counterpart, depending on whether the proposed location is in the EEZ or the territorial sea. A notable exception is Sweden, where a municipality can act as the lead agency if the installation in question is small and located very close to shore.

The other common approach is to designate the national agency responsible for energy development (usually located within the ministry for industry and trade) to serve as the lead agency for the siting of all wind farms, irrespective of their size or location. This model has been used to promote research and development on wind power technology (Denmark, Japan, and Belgium) and an assured market for wind-powered electricity (United Kingdom) via government-subsidized technology demonstration programs.[13]

The Minerals Management Service, which will serve as lead agency for the US offshore wind power program, is commonly thought of as a resource-oriented agency, not a place-oriented agency. There is good reason for this impression, given the agency's name and its seemingly narrow focus on offshore minerals management and revenue management for both offshore and onshore mineral leases. It may be more accurate to think of MMS as something of a hybrid of the two agency types, however, considering the many regional-scale natural characteristics, resources, and activities that it is required to take into account in its planning for OCS leasing (see the earlier section on Regional Planning). Indeed, MMS has been praised for achieving a degree of policy integration in its OCS program that is rare in ocean governance, (*e.g.,* COP 2004; Firestone *et al.* 2004).

Virtually all foreign systems, regardless of which lead agency model they follow, involve a rather large number of coordinating agencies (Table A3). In all cases, this includes energy agencies at all levels of government, as well as national agencies for the environment, aviation, and national defense (also navigation/marine transportation, in countries where this is not in the portfolio of the lead agency or the defense agency). It is also fairly common for a regional or local environmental authority to be involved as well. Several foreign access systems (France,

[13] Belgium's R&D program was modified early on in response to extensive public protests and legal challenges over proposals to site wind farms near the coastline. In 2004, the government set aside a 167 km^2 area (64 mi^2) where wind farms are to be located out of sight of land.

Ireland, Sweden, and the United Kingdom) require the approval of a local land-use planning board or zoning board, and in Sweden and the Netherlands there is a national land-use planning agency that must be consulted as well.

The amount of interagency coordination and the number of approvals that these access systems require[14] has been blamed for retarding the growth of the offshore wind industry in general (Dauncey, n.d.) and, especially, in the United Kingdom (Wintour 2001). In 2001, Britain's Energy Minister responded with a plan for a "one-stop shopping" process for all necessary planning documents and approvals, to be based in the Department of Trade and Industry (DTI). Denmark soon followed suit with a program that consolidates leasing, permitting, and environmental review within the Danish Energy Agency.

A 2002 study of offshore wind power developments in eight European countries, sponsored by the European Wind Energy Association, identified the "one-stop shopping" innovation as the most significant of several "best practices" that governments could adopt to advance the development of offshore wind (Shaw *et al*. 2002).[15] As of 2005, however, no additional foreign access systems had adopted a one-stop approach to the licensing, permitting, and leasing process for offshore wind power (Firestone *et al*. 2005).

One likely explanation (beyond the obvious potential for strong resistance on the part of coordinating agencies) is that a single consolidated process is not really feasible in systems where the lead agency can be any of several regional entities with jurisdiction over activities within the 12 nautical miles from the coast where virtually all offshore wind farms have been sited to date. Modifying such a system to accommodate a consistent, predictable, and genuinely consolidated permitting process would require drastic jurisdictional changes that few regional governments would accede to and few national legislatures would attempt. Another likely explanation is that at least some stakeholders in offshore wind farm siting processes do not see a reduction of jurisdictional complexity and bureaucratic delay, however efficiency-enhancing for developers, as translating to a net benefit for the public if other benefits of equal or greater value, such as tourism, fishing, or aesthetic preservation, for example, are sacrificed in the process.

4. Resource Assessment and Area Selection

Resource assessment is a process for measuring or estimating resource quantity, quality, location, economic rents, and other parameters. In most cases, it is an ongoing or recurring activity that spans all phases of resource development. A primary purpose of resource assessment is to enable government managers to estimate the net benefits to the public of a particular resource development or use, and to receive fair market value for the entitlements they authorize. Resource assessment also supports environmental and other analyses required under NEPA and other applicable laws, and it plays an important role in area selection, the process by which discrete areas are selected for resource development or use. Finally, the information generated through resource assessment is used to assess compliance with termination requirements, which typically call for the restoration of a site at the end of a lease term to a state that permits previous uses of the area to resume.

[14] According to a study sponsored by the European Wind Energy Association, approval and development of an operational wind farm requires input from a minimum of seven agencies in each of the eight countries studied (Shaw *et al.* 2002).

[15] With the exception of measures to enhance communication and public involvement, all of the other best practices related to the inclusion of certain financial terns and risk-reduction measures in lease agreements (Shaw *et al.* 2002).

Resource assessment typically begins with the government undertaking or sponsoring an initial survey of resource quantity, quality, and distribution at a very general level (Table A4).[16] Although the results are general, such assessments can require considerable time and expertise to complete. Production of the first wind resource maps of the United States, for example, was a primary research focus of the Department of Energy's Pacific Northwest Laboratory (PNL) from about 1974 until 1981. The initial results consisted of 12 regional atlases; two summary national wind resource maps that were based on a synthesis of the regional assessments (DOE 1982a,b; Elliott and Barchet 1981); and a database containing detailed wind statistics for the 975 sampling stations where the data for the regional assessments was collected (Barchet 1981).[17]

The results of an initial resource assessment are used to identify general high-resource areas for more detailed examination and potential development. In this subsequent phase, which may include both site testing and technology demonstration, data collection covers a broad range of operational and environmental parameters and a sufficient period of time to provide a reasonable basis for assessing the commercial viability of the resource use or new technology to be applied, as well as the likely impacts on other public resources (*e.g.*, wildlife, habitat, cultural and archaeological resources) and other activities in the area. In the case of wind power, at least one year of data is needed in the site-testing phase to evaluate the seasonal characteristics of the wind resource and other factors that can be expected to vary seasonally, such as the frequency and intensity of storms and the accessibility of the site (DOE, n.d.).

Developers are also generally required to continue extensive data collection and reporting throughout the operational life of a commercial lease or license. This information, which in many cases is supplemented by periodic government surveys, is necessary for both the government and the developer to remain current in their assessment of resource quantities, distribution, and so forth (mainly in the case of non-renewable resources), and in their estimates of the present and future net benefits of continuing the resource use in question (applicable to all resources). Environmental monitoring and assessment are usually required as part of this activity, both to ensure that adverse impacts are prevented or minimized, and to allow environmental effects to be taken into account when assessing the net benefits of continuing the resource use relative to other policy alternatives.

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[16] A rare exception to this pattern is the case of minerals extraction on US public lands, where resource assessment has consisted more or less entirely of private-sector prospecting. This is just one of several unusual features of the access system for minerals extraction, the most prominent being the fact that the government collects no royalties and only minimal fees for mining patents. The arrangement made sense when the General Mining Law was enacted in 1872, given that the policy objectives were to encourage settlement of the western United States and promote mineral prospecting and development on US public lands. Today the arrangement is frequently criticized as a giveaway of publicly owned resources, and, indeed, it has been essentially without a policy rationale since Congress placed a moratorium on new mining patents in 1995. Another settlement-focused resource access system can be seen in individual US states that adopted prior appropriation systems for surface water consumption (compared to traditional riparian systems). Prior appropriations systems facilitated settlement by securing and recording legal interests in freshwater on a first come, first served basis.

[17] Most of the data from these pre-existing stations was collected prior to 1979 by anemometers at heights and locations that had not been chosen for the purpose of wind energy assessment. Not long after the initial maps were released, PNL began updating and refining its assessment using a variety of estimation techniques and data from some 270 additional sites, about 200 of which were instrumented specifically for the purpose of wind energy assessment. The updated assessment was released in 1986 as the *Wind Energy Resource Atlas of the United States* (Elliott *et al.*, 1986).

As mentioned earlier, the economic and environmental information generated by the resource assessment process is also important for deciding where offshore wind farms will be sited. Before these types of information come into play, however, there is another set of factors that largely determine *how* siting decisions are made and at what stage of the resource assessment process. These are institutional factors, such as the relevant laws and procedural traditions of the jurisdiction in question, along with the specific policy objectives that the proposed development is intended to serve.

Laws that designate specific areas for special protections or particular uses are one such institution. Virtually all jurisdictions have some areas that will be recognized at the outset as ineligible for wind power development by virtue of their having a "public lands designation" (such as wilderness area or marine protected area) that precludes many industrial and various other activities from being located there. In other cases, government may at a very early stage of resource assessment designate some areas as off-limits expressly for the activity in question, based on such factors as environmental sensitivity or the incompatibility of the activity with other traditional uses of the area.[18]

In response to an increasing incidence of public opposition to wind farm proposals, aesthetics is becoming more common among the official rationales for ruling out certain areas even before site-testing begins. One example is a recent restriction by the Irish government that precludes an offshore generating station from being located within 5 km of the shoreline unless the applicant can demonstrate that the proposed facility will not unduly interfere with the visual amenity. The Belgian government adopted a more targeted approach to the problem in 2004 by setting aside 167 km^2 (64 mi^2) for the siting of offshore wind farms out of sight of land. No such blanket restrictions have been adopted in the United States, but in advice to potential developers the Department of Energy does recommend that "landowner and community support" be included among the essential considerations for the siting of wind farms on land, noting that "objections to the visibility of turbines tend to drive the majority of objections in a community" (DOE, n.d.).

For those areas that are not ineligible for wind farm siting at the outset, the area selection process has covered the spectrum from the highly programmatic and government-centered model epitomized by Denmark,[19] to the virtually laissez-faire approaches of Ireland, Texas, and, at least initially, Belgium and Spain. Most systems are closer to the Danish model, in that they have a two-stage process in which government first designates general areas as suitable for wind power installations and developers then propose specific locations within those areas for site-testing and commercial development (as opposed to having government simply approve or deny whatever

[18] The Irish government, for example, has designated certain offshore areas as ineligible for the siting of generating stations for reasons of safety at sea; protection of shipping lanes, air navigation, telecommunications needs, or defense requirements; or because the area is used for the dumping of dredge spoils.

[19] In Denmark, the siting question was studied from 1992 to 1995 by an Offshore Wind Turbine Committee within the Ministry of Environment, which identified 5 main areas where wind farms were to be concentrated, based on consideration of water depth limitations and the potential impacts on coastal landscapes, marine protected areas, and other ocean uses. The siting study was one part of a sustained government effort to promote public acceptance of wind power throughout Denmark, as well as Danish world leadership in wind turbine technology and the tools and techniques of wind resource assessment. (OPET Denmark 2001). Denmark's Riso National Laboratory, within the Ministry of Science, Technology, and Innovation, has been engaged in intensive R&D on wind resource assessment for the past several decades.

site proposals developers may submit). Within this general model, however, area selection processes differ on a number of counts, such as the extent of industry vs. public input into the siting process; whether the government-designated areas are selected within the framework of multiple-use planning; and whether proposals are evaluated competitively or on a first come, first served (FCFS) basis.

In principle, a system in which site selection is left mainly to developers should produce more economically efficient results than a system in which government limits developers' siting options in order to comply with public preferences or advance other policy objectives. In reality, an offshore wind farm is increasingly likely not to be sited at all absent a process that is seen as welcoming public input and solicitous of the public's aesthetic and environmental concerns. The Minerals Management Service (MMS) appears to be sensitive to these considerations, indicating in its December 2005 Advance Notice of Proposed Rulemaking that it will entertain suggestions concerning areas of the outer Continental Shelf (OCS) that should be included or excluded from its new program for managing alternate energy-related uses of the OCS (70 FR 77348).

5. Multiple Use Decision-making

The need for methods of resolving multiple use conflicts arises from the recognition that allocation decisions may result in opportunity costs in terms of displaced uses, including such "non-uses" as habitat protection or the supply of ecosystem services. This need is a reflection also of the absence or incompleteness of property rights for alternative uses of ocean space as a public resource.

Multiple use conflicts arise only where uses are mutually exclusive or where there is some uncertainty about whether uses might be mutually exclusive. From an economic perspective, the theoretical solution to questions of the multiple use of the oceans is to identify the "highest and best" use or combination of compatible uses and to allocate areas to those uses. In this context, "highest and best" implies the use or combination of uses that generate the highest resource rents. Non-uses (*i.e.*, ecosystem preservation) or amenity uses (*e.g.*, recreational fishing) are accommodated within this theoretical construct as well.

Any access system that allocates areas of the ocean for specific uses must balance potential competing uses and interests. It is possible to conceive of at least three basic mechanisms for seeking to balance multiple uses: (1) a centralized exercise of administrative authority based upon considerations of the "reasonableness" of alternative uses (*e.g.*, the Secretary of the Interior's role in OCS offshore oil and natural gas leasing); (2) a decentralized, negotiated "consensus" solution among stakeholders, perhaps facilitated by government; and (3) a decentralized market process based upon the establishment of transferable property rights. There may be variations of and overlaps among these three mechanisms. The third option is not yet one that is operational in the ocean, where transferable property rights in ocean areas have not yet been established, except in very limited cases. The second option is gaining currency, for example through the designation or management planning processes for US national marine sanctuaries, but it is not yet in widespread use. Economic estimates of the resource rents associated with alternative combinations of ocean uses can be useful for all three options.

Broad decision-making rules may exist that guide or constrain multiple use conflict resolution. For example, in the tidewaters and on the submerged lands of US coastal states, the common law "public trust" doctrine provides a rough decision rule for establishing a priority for particular uses, including navigation and fishing, over others. Importantly, public trust uses tend

to be transitory, in that they do not permanently occupy areas of the ocean. While no public trust doctrine akin to that applied in the states exists in federal offshore areas, the US federal government applies many trust principles, *i.e.* refrain from alienating fee simple interests in offshore lands. Nevertheless, historical patterns of *use* may be regarded as having a *de facto* priority over other uses, even if legal property rights do not exist. Historical users can exercise substantial political muscle in public discussions about the nature and extent of an access system for modern uses. In order to gain legislative support for access to the ocean, modern uses, such as ocean wind, must confront the potential displacement of historical uses.

The stereotypical form of ocean management involves a single agency imbued with authority under a stand-alone statute for allocating areas of the ocean for specific uses. In the absence of transferable property interests, markets are unavailable as institutions for allocating ocean resources, leaving independent agencies to hash it out.

An increasingly common critique of ocean management has been the lack of policy integration across managing agencies (see the section on Regional Management). An important conclusion of the limited academic research on this topic is that the establishment of a regime for managing multiple uses may lead to a more complex political dynamic among interest groups. This dynamic, *per se*, may threaten entrenched stakeholders or special interests who have become comfortable with the status quo (Juda and Burroughs 1990). Consequently, while multiple use decision-making is conceptually appropriate and would seem to be economically rational, the emergence of this dynamic can retard or preclude multiple use conflict resolution under options (1) and (2) above.

Notwithstanding the inertia embodied in traditional non-integrated management, most modern access systems incorporate methods of resolving existing or potential conflicts among alternative uses. First, all of the access systems in our database (Table A6) incorporate provisions for consideration, at some level of detail, of alternative uses of the ocean in areas where ocean wind power facilities might be sited. Other methods include the fundamental rules relating to public notice and comment; opportunities for interested government agencies to review and recommend changes; the establishment of management councils and advisory boards; among other methods. The requirements under the US National Environmental Policy Act (NEPA) to assess and state the environmental consequences of federal agency actions that might have an adverse impact on the quality of the human environment is, in part, a process designed to identify and address multiple use conflicts. Judicial review of certain types of agency allocation decisions may be available, although, in the United States, managing agencies typically are accorded substantial discretion over allocation decisions.

6. Environmental Review

Essentially all public resource access systems have formal requirements for the conduct of some type of environmental impact assessment as part of the project approval process, as well as for regular environmental reporting throughout the life of a project and into the decommissioning or termination phase. The rationale and specific requirements for ongoing environmental reporting are discussed in some detail in another section of this report (see the section on Monitoring and Enforcement). In this section we focus on the environmental review process that is required at a project's outset. In the United States, this is commonly known as the NEPA process, so named for the 1969 National Environmental Policy Act (NEPA) in which the

relevant requirements were first established for all "major federal actions significantly affecting the human environment."[20]

The environmental review required under NEPA is intended to serve three main purposes: to identify less environmentally adverse alternatives to a proposed project where they exist; to instill environmental awareness in federal agencies; and to serve as a project planning tool for agencies (42 USC §§ 4321, 4332(1)). Since its passage, NEPA has served as the model for national and state laws and local ordinances adopted throughout the United States and at all levels of government in many other countries (Tripp and Alley 2004). It also has become commonplace for treaties, declarations, and other non-binding instruments of international environmental law to incorporate language that requires, or at least endorses, two key elements that were first required in NEPA: a detailed statement of the environmental impacts of a major proposed action and of alternatives; and the opportunity for public participation in the project planning and environmental review process.

The outlines of the NEPA process come from the requirement that any agency recommendation concerning a proposed major federal action must include a detailed statement that addresses the following five elements:

- the environmental impact of the proposed action;
- any adverse environmental effects that cannot be avoided if the proposed action is implemented;
- alternatives to the proposed action;
- the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- any irreversible commitments of resources that would be involved if the proposed action is implemented.[21]

The required detailed statement is well-known as an environmental impact statement, or EIS. Under regulations issued by the Council on Environmental Quality (CEQ), agencies may be able to avoid much of the very significant effort that goes into compiling an EIS in cases where they believe a project will not have a significant environmental impact. In such cases, an agency can undertake a less ambitious environmental assessment (EA), which leads to one of two outcomes: either the agency arrives at a finding of no significant impact (FONSI), which must be justified in writing; or it concludes that an EIS is indeed required, at which point a full-blown NEPA environmental review is launched.[22]

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[20] A "major" federal action is one that requires substantial planning, time, resources, or expenditure. (NEPA Sec. 102; 42 USC § 4332 (2)(b)-(c)). Relevant federal actions include both projects to be undertaken by the government itself, such as highway construction projects, and projects that involve government-permitted uses of public resources by private entities.

[21] 42 USC § 4332(2)(c).

[22] So-called categorical exclusions represent another effort by the CEQ to reduce unnecessary analysis and paperwork. Where a federal program involves many recurring activities, CEQ regulations afford a lead agency the ability to establish a "categorical exclusion" for such activities if they "do not individually or cumulatively have a significant effect on the human environment . . . and for which, therefore, neither an environmental assessment nor an environmental impact statement is required" (40 CFR 1508.4). Examples of categorical exclusions that have been

Where an EIS is required, the lead government agency publishes a Notice of Intent to inform affected agencies and the public that a review will be undertaken. The process then enters the "scoping" phase in which potential impacts, alternatives, and issues requiring further analysis are identified. The scoping process is the first specified opportunity for public participation, and it establishes the parameters of a draft EIS (DEIS) by the lead agency. Upon completion, the DEIS is presented to the public for comment. The lead agency must take these comments into account in preparing a final EIS, which likewise is published for comment. Once again, the lead agency considers the comments it has received and, at the end of the specified public comment period, it responds to the comments and issues a record of decision (ROD).

However widely appreciated the purposes and principles of NEPA may be, the NEPA environmental review process has been roundly criticized as inefficient and, in too many cases, environmentally ineffectual. Dissatisfactions and reform proposals have been voiced by academics, members of Congress, and representatives of every type of "stakeholder" group involved in the NEPA process, from industry, environmental, and local citizens groups to the federal, state, and local agencies with jurisdiction over the many projects that undergo NEPA review (Tripp and Alley 2004; NEPA Task Force 2003).

The most common complaints about the NEPA process target its provisions concerning stakeholder and public participation. Depending on the perspective of the critic, these provisions are most often characterized either as excessive, in that they introduce significant delay and cost; or as inadequate to compel a genuine consideration of environmentally preferable alternatives, because the lead agency is required only to solicit and consider the comments of other agencies and groups, not to adopt the least environmentally harmful alternative. The view of NEPA as needlessly adding cost and delay is held by many within industry and the implementing federal agencies, while dissatisfaction with the NEPA process as environmentally immaterial is common among environmental and citizens groups and, to some extent, among state and local authorities, all of whom may feel politely ignored by the federal agencies driving the NEPA process (Tripp and Alley 2004; NEPA Task Force 2003).

The NEPA process has occasioned a considerable amount of litigation (as well as political lobbying) over the past few decades. Initially environmental groups and other project opponents sought to compel agencies to act on the results of environmental reviews that favored alternatives to their proposed actions, but the courts have repeatedly ruled against them, finding that NEPA "simply guarantees a particular procedure, not a particular result."[23] Following this logic, more recent lawsuits have been brought on grounds of alleged procedural deficiencies, for which the relevant standards are not confined to NEPA but are set forth in the Administrative Procedure Act of 1946[24] and a number of other administrative laws. One perverse consequence of these developments has been to encourage lead agencies to produce ever larger "piles of paperwork

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established within the offshore oil and gas leasing program of the Minerals Management Service (MMS) include the issuance of regulations, which normally would not result in any potentially significant environmental effects; and the approval of certain types of exploration and development and production plans in the Central and Western Gulf of Mexico, for which hundreds of EAs had previously been prepared and had all led to a FONSI (MMS 2006).

[23] Ohio Forestry Association v. Sierra Club, 523 US 737 (1998).

[24] Probably the best-known and most frequently invoked provision of the Administrative Procedure Act is the "arbitrary and capricious" standard, which requires a finding that an agency's decision or action was unlawful and must be set aside (5 USC § 706).

that exhaustively discuss every potential impact of the proposed action--creating a 'bullet-proof' EIS" (Tripp and Alley 2004:83). This not only adds further delay and cost, but arguably it promotes a sense within the federal agencies that much of the paperwork they generate is ignored and ultimately irrelevant.

Legal scholars, legislators, and others have advanced reform proposals, most of which call for amending NEPA and/or redrafting the CEQ regulations to simplify the requirements for interagency cooperation and public participation. The proposals are hardly in agreement, however, on such questions as whether NEPA's environmental provisions should be strengthened and whether public participation should be reduced in frequency, invested with more practical consequence, or both. Also, environmentalists and federal officials are unlikely to favor proposals to amend NEPA or overhaul the regulations, since this could result in a weakening of NEPA's environmental safeguards and almost certainly would introduce more delay and cost, at least for a time, as implementing agencies learned how to comply with a new set of rules and regulations.

All of the European access systems for offshore wind power include some requirement for a NEPA-like environmental process (following the EU Directive on Environmental Impact Assessment), and a few have a threshold provision that reduces the number of individual installations that must undergo a full-blown EIS review (Table A7). In the German system, for example, the extent and scope of the environmental assessment that is required depends on the number of turbines planned for the installation, with a full-blown EIS required when an applicant proposes a wind farm of more than 20 turbines. Sweden has a similar system in which the thresholds are determined by the number of turbines and their combined megawattage, with an EIS threshold of 3 or more turbines with a combined output of more than 10 MW. Ireland uses a single threshold of 5 or more turbines with a combined output of more than 5 MW.[25]

While such schemes may enhance the cost profiles of small-scale projects, they do nothing to promote a sincere and meaningful consideration of alternatives that is perceived by many participants in the NEPA process to be lacking in the United States. One proposal that has been advanced in favor of legislative and/or regulatory reform addresses this problem by recommending that agencies adopt a "concurrent review process" for implementing NEPA (Tripp and Alley 2004). Under concurrent review, the EIS and public participation process would be launched when a project is first proposed rather than substantially later, when (as is often the case) the lead agency has already committed serious resources to developing an extensive project plan and a list of preferred alternatives.

Tripp and Alley argue that the enhancement of public involvement that this implies would be welcomed by environmental and public interest groups, and thus would reduce the likelihood of litigation. They also suggest that agencies model their public participation process on the discipline of negotiated rulemaking,[26] which offers a highly structured decision-making process that would demand less expenditure of time and political capital. Interested stakeholder groups would respond to the initial Notice of Intent by applying for a seat at the negotiating table, and

[25] France has an unusual variation on the threshold scheme under which a full review is required for any wind farm whose cost equals or exceeds €1.83 million (12 million francs), including taxes, land acquisitions, and all operational phases.

[26] Tripp and Alley (2004) refer readers to law review articles by Harter (2000) and Freeman and Langbein (2000).

representative stakeholders would be selected and become real contributors to the project planning and environmental review process.

Both concurrent review and negotiated rule-making are capable of being implemented under existing laws and regulations. They may also be especially well suited to the new program for alternate energy-related uses of the US outer continental shelf, where the law mandates coordination and consultation with interested and affected parties in a number of areas, including the involvement of certain federal agencies and affected state governors in the development and implementation of regulations.[27]

B. Allocation of Legal Interests

1. Allocation Methods

Allocation refers to the means for distributing legal interests, such as leases or licenses, to use ocean areas for specific purposes. Legal interests can be given away on a first come, first served (FCFS) basis, assigned according to the discretion of the managing agency, or sold competitively (Hoagland 1987). Examples of "discretionary" allocation methods include hard mineral mining claims, livestock grazing rights, commercial fishing licenses, deepwater port sites, archaeological prospecting licenses, ocean thermal energy conversion (OTEC) facilities, and deep seabed mining claims. Examples of resources sold through competitive allocation methods include timber on the US national forest lands, oil and natural gas on public and OCS lands, geothermal resources, and portions of the electromagnetic spectrum (Table A8).

FCFS allocation methods typically accord the first applicant a preferential right to use a resource. A classic example is the claim system for placer and lode minerals on the US public lands under the US Mining Law of 1872. The primary purpose of the 1872 Mining Law was to encourage development of the American West. As that development took place over time, the need to continue to offer mining rights through a FCFS method has been questioned. One basis for criticism concerns the incentives associated with FCFS methods, which offer resource rents to the first claimant. If resource rents for hard minerals are significant, the FCFS method of allocation can result in inefficient levels of prospecting and exploration, as potential claimants compete for claims, referred to as a "gold rush" or a "bonanza." Further, the claim system, *per se*, does not require claimants to consider the opportunity costs of displacing other potential uses of the public lands.

Where rents are thought to be small or nonexistent, the potential for a rush to explore and develop also is small. In many areas of the ocean, where the economic feasibility of ocean wind power generation is uncertain—implying that rents are small—FCFS allocation methods have been established already. FCFS allocations for ocean wind are in place in ocean areas under the jurisdiction of Germany, Belgium, Ireland, the US state of Texas, and formerly in the US exclusive economic zone under section 10 of the US Rivers and Harbors Act.

An FCFS allocation method also makes sense when a resource is abundant, again implying that rents are small, and the potential for a rush is minimal. The administrative costs of an FCFS allocation method are likely to be lower than those for alternative rights allocation methods. Abstracting from the other features of an access system, including environmental

[27] P.L. 109-58, Sec. 388 (p)(8).

assessments, an FCFS allocation method involves little effort, other than that of recording claims, on the part of the managing agency. If legal interests are freely transferable to other users, then an FCFS system may be seen as economically efficient. The question of who captures the resource rents is a distributional (equity) issue, not an efficiency issue.

Discretionary systems can be found established where resources are in demand but market-based approaches to allocation are prohibited through laws or regulations. Under the US Ocean Thermal Energy Conversion Act, the NOAA Undersecretary is to consider applications for the siting of OTEC plants in the order that they are submitted (*i.e*., FCFS). The NOAA Undersecretary is accorded special discretion, however, after consulting with the Secretary of Energy, in allocating legal interests to facilities that "best serve the national interest," even if applications for such facilities are submitted later than others. Other access systems are even more specific about the factors to be considered in making allocation decisions. For example, under the rules for allocating livestock grazing lands in the United States, the US Bureau of Land Management uses a range of criteria to make decisions about allocating rangelands for which multiple applications exist. These criteria include the historical and proper use of rangelands; the needs of the applicant's livestock operations; the ability to cross private lands to access public lands; topography; other land use requirements; an applicant's demonstrated stewardship to improve, protect, or maintain rangeland; and an applicant's past history of compliance.

The sale of legal interests in ocean space for specific uses is an alternative method for allocating the resource. Competitive auction sales are theoretically capable of allocating ocean space in an efficient manner for specific uses. A very extensive academic literature on auctions analyzes the efficiency of this allocation method (*cf*., Reece 1978; Wilson 1977; Rothkopf 1969). Much of this literature focuses on OCS oil and gas allocations. In the case of OCS lands, for example, energy producers bid "bonuses" for the rights to oil and gas leases. Bonuses are payments of a portion of the resource rent offered at the time of the auction to secure a lease. Alternatives to bonus bidding have been proposed, and the US Minerals Management Service has experimented with a few of these methods. Among these alternatives are methods by which royalties, royalty-bonus combinations, profit shares, or work commitments are the relevant bidding variable (Mead *et al*. 1984; Mead 1976). These alternatives may involve auctions in which royalties are set at different fixed levels or ones in which they are set to vary over the course of a deposit's lifetime (so-called "sliding scale" royalties) (Jones *et al*. 1979).

Discretionary methods of allocation are unlikely to assign rights to the least-cost user of a resource, unless there is only one potential user. Consequently, discretionary methods are economically inefficient when there are multiple potential users who might compete for a resource. If legal interests are freely transferable, however, and if other users appear, then a discretionary system can be efficient, even if the initial allocation is not. The government, however, would be unable to claim resource rents from a discretionary allocation method that allows the subsequent transfer of rights to other parties, unless royalties or other financial terms are embodied in the rights. Auction methods, on the other hand, are an efficient means for allocating access to a natural resource, and the government collects the resource rent in the form of a bonus. Competitive allocation methods may be administratively costly, however. These methods obviously are more effective where there is significant demand for the legal interests to utilize a resource.

How does the government know about the existence of resource rents, particularly in the early stages of interest in a potential resource? One way in which to gauge industry interest is to

ask firms to express their interest informally by nominating areas to be leased. This procedure is used to help plan lease sales in offshore planning regions of the US outer Continental Shelf. Another way is to hold a lease sale and wait and see if any bidders show up. The latter procedure is now in place for the allocation of geothermal resources on the US public lands. Areas that are nominated by industry as demonstrating potential geothermal resources are offered for bid initially on a competitive basis. Lease tracts that receive no bids in the competitive auction are offered subsequently for a limited time on a FCFS basis.

We have assessed the relative economic efficiency of alternative allocation methods in the context of a specific use. Where specific uses are exclusive, in the sense of precluding other uses of the resource or of an area, the *method* of allocation is essentially irrelevant to the imposition of opportunity costs. For example, if an ocean wind farm is constructed in a particular area, and if it leads to opportunity costs on other ocean users by excluding them, it does not really matter whether the area was allocated on the basis of a discretionary method or by an auction. Note that the overall efficiency of resource allocations can be improved if all potential uses are considered simultaneously. For example, if other "stakeholders" have access to a competitive auction for ocean space, then they may be willing to purchase rights in order to preclude specific types of development that lead to lost opportunities for their preferred use. Along these lines, Farrow (1989) presents a discussion of a hypothetical market for "lease delay rights" in the context of OCS oil and natural gas development. In such a market, environmental groups would compete with energy producers for the legal right to "occupy" areas of the ocean and to use them for their own specific purposes. Although such a comprehensive allocation method would appear to be ideal from the standpoint of economics, it is unlikely to be implemented given the current legal status and array of political interests that favor either "open-access" (*i.e.*, commercial and recreational fishing) or "ocean zoning" allocations that are determined through discretionary or political processes.

2. Instruments and Interests

Legal interests in the use of areas of the ocean are conveyed to a wind farm developer through the issuance of an instrument. Instruments comprise a range of types, including contracts, rights-of-way, licenses, leases, concessions, and other authorizations. Instruments include descriptions of any relevant property, and they characterize the financial terms, size, tenure, transferability, mortgageability, performance requirements, and other dimensions of the granting of interests or rights to use the ocean for a specific purpose. These dimensions can affect the distribution of development risk between the government and a wind farm developer. We discuss these other dimensions in separate sections of this report.

In this section, we focus on three important characteristics of an instrument: clarity, exclusivity, and priority. Clarity refers to absence of ambiguity with respect to the specification of the terms of an instrument and what it conveys. Exclusivity refers to the extent to which an instrument allows the holder to exclude other users from the relevant area. Priority is closely related to exclusivity; it refers to instances in which multiple instruments might be utilized at different development stages relating to wind farming (*e.g.*, environmental monitoring, construction, and operation) and whether holding an instrument at one stage implies a priority for the issuance of an instrument at a subsequent stage.

It is crucial for economic efficiency that the interests that are conveyed in the relevant instrument are clear. If the interests conveyed by an instrument are not clear, then the risks to

private investment may be heightened. For an industry in which financial viability depends upon subsidies, such risks pose a serious impediment to investment.

Importantly, the instrument must characterize the extent to which the use of an ocean area for producing energy from wind is exclusive with respect to other wind farm developers or other permanent uses of the ocean (such as for a deepwater port or an aquaculture operation). Exclusivity is important because, without it, conflicts over the use of ocean space may arise, thereby engendering delays, litigation, and other costs of conflict resolution. The tribulations faced by the Cape Wind project in its efforts to obtain a legal interest to construct and operate a wind farm in Nantucket Sound is an excellent illustration of the risks that are faced in the absence of an access system that allocates exclusive rights to ocean areas.

Exclusive rights to an area of the ocean do not necessarily imply the exclusion of all other ocean uses. Certainly, the immediate area around towers supporting wind turbines, where the tower and associated riprap are placed, cannot be used for other purposes. Nevertheless, with proper planning and engineering, the placement of towers can permit navigation, commercial and recreational fishing, and other uses.[28] Again, prospective developers need to be assured that once an instrument is granted, other uses cannot come in and adversely affect their use of the ocean area.

A government's choice of instrument may be a function of the legal status of the offshore area. Typically, leases are issued where tangible property interests are conveyed, whereas licenses or permits may authorize permission for the use of an area for specific purposes. Thus, as in the example of the United Kingdom's ocean wind program, we might expect to see the use of leases in territorial seas, where the government owns the seabed, and licenses in EEZs, where the government has the sovereign right of exploitation but no ownership. Leases often are utilized where an exploitable resource, such as hydrocarbons or hard minerals, are being extracted. In this case, the lease conveys ownership of the resource upon extraction, as in the production of OCS oil and natural gas in the United States.

Table A9 lists the instruments and interests from the database. Other than the general rules described here, there does not appear to be any overall preference for the choice of instrument for offshore wind. In general, the following pattern may be observed:

- Licenses or permits may be issued for small-scale environmental monitoring, energy testing, site suitability investigations, resource exploration, and scientific research. These permits tend to be non-transferable and of short duration.
- Leases may be issued for the use of areas that are on public lands or properties or for extractable resources, even in EEZs. These leases may be transferable to other parties, with the permission of the government, and of longer duration.
- Licenses or contracts are issued for non-extractable but long-term uses, such as the siting of a deepwater port, a wind farm, or other energy-producing facility, such as an ocean thermal energy conversion (OTEC) plant. These licenses or

[28] Indeed, the compatibility of wind farms with other uses has led to proposals for multiple industrial uses of wind farm areas, such as the combination of wind farms and open-ocean aquaculture farms (Buck *et al.* 2004; Braginton-Smith 2002).

contracts tend to be non-transferable, with the permission of the government, and of longer duration.

- Rights-of-way are issued for permanent uses, such as cables or pipelines, that convey energy or resources from areas where they are produced or grown. These rights-of-way tend to be non-transferable, with permission, and of longer duration.

Many existing access systems are organized in stages. Possible stages include prospecting or pre-exploration, exploration or testing, development, and production. For example, the US Bureau of Land management (BLM) policy for providing access to public lands for wind energy has identified three such stages: (1) wind energy testing and monitoring; (2) site testing and monitoring; and (3) long-term commercial wind energy development. Typically, instruments are issued for each stage. The "priority" characteristic refers to whether an instrument issued at one stage implies that the holder has a priority over other users for the issuance of an instrument for a subsequent stage.

In many cases, a license or permit for prospecting or pre-exploration does not necessarily accord the holder a priority for subsequent instruments. This is the policy under quite different laws for placer and lode mineral prospecting and for preliminary archaeological surveys on the US public lands. These early stage permits are designed to encourage potential developers to learn about the resource characteristics of an area so that they can make more informed decisions about whether subsequent development is worthwhile. At the same time, other prospectors and other uses are not excluded from using the area. Where prospecting is costly, some access systems permit multiple prospective developers to work together. Under the Outer Continental Shelf lands Act Amendments, the rules for geological and geophysical activities not under a lease allow several oil companies to work together to conduct geophysical prospecting.

Where permittees must physically occupy an area to the exclusion of others, the priority policy may be modified somewhat. In the case of the BLM program, a right-of-way grant for wind energy testing and monitoring is site-specific and non-renewable, but it does not imply an interest in the relevant area. Once the grant has expired, other potential developers are free to apply for a similar permit for the same area.

Later-stage permits often do include a priority for the existing instrument holder. Under Irish law, multiple licenses may be granted to a particular site for the potential development of a wind farm. The first applicant, however, has a "legitimate expectation" to a first claim on a foreshore lease for developing a wind farm. Although the term legitimate expectation does not imply a contractual obligation on the part of the government to grant a foreshore lease, it precludes the government from granting leases to subsequent applicants without first offering it to the original applicant.

Similarly, when instruments are about to expire, it is often the case that the existing instrument holder is accorded a priority to renew the instrument. On the US public domain rangelands, for example, permittees or lessees holding expiring rights are given first priority for new rights. Similarly, the holders of ocean thermal energy licenses have a preferential right of renewal for a limited period of time.

Finally, performance requirements are sometimes tied to the priority characteristic. Under the Deep Seabed Hard Minerals Resources Act, for example, potential deep seabed miners

holding exploration licenses must demonstrate that their exploration efforts are such that they will likely lead to the ability to apply for and obtain a commercial recovery permit within a ten-year exploration period.

3. Size and Tenure

The spatial and temporal dimensions of an entitlement are important features of an access system. All other things being equal, prospective developers would prefer to have larger areas and longer time frames with which to work. Both features influence the opportunity costs of exclusive resource allocations directly, however. To the extent that other ocean uses are excluded from wind farms in the ocean, increases in either the size of the area or the duration of an entitlement will increase opportunity costs.

Wind farms are regarded by experts as a "dilute" technology for producing electric energy. Wind farms require more space per unit of electrical output than most other forms of electricity production. Nevertheless, technological change, particularly the movement toward larger turbines, is making the technology potentially less dilute. By 2003, wind turbines were capable of producing 1,050 annual net kilowatt hours (kWh) per square meter (Bird *et al*. 2005).

The optimal size of a wind farm is a function of both the technology utilized and the technical potential (quantity and quality of wind) of a site. The use of larger turbines implies that the same amount of energy can be produced using a smaller footprint. Similarly, a higher speed and more consistent wind resource implies that the same amount of energy can be produced with a smaller footprint. Scale economies also may be a relevant consideration, as it is likely to be more efficient to spread the fixed costs of electrical collection and transmission infrastructure, including transformers and cables, and construction and maintenance capital (barges and service vessels) over larger numbers of turbines located in a larger area.

Areas occupied by existing and proposed ocean wind farms vary widely. The proposed LIPA wind farm off of Long Island would occupy 5 square miles. The Horns Rev facility in Denmark occupies eight square miles. The area proposed for Cape Wind would occupy 24 square miles.

With respect to the design of an access system, the managing agency may need the flexibility to decide on a case-by-case basis the most appropriate size of wind farm entitlements. This kind of administrative discretion is found in BLM's wind power policy for the US public lands. The policy states that a "reasonable amount of land" should be allocated to support an application for a wind energy development project. Similarly, facilities for the production of geothermal energy on the US public lands are not to exceed "acreage determined by the Secretary [of the Interior] to be reasonably necessary for the proposed purpose."

Leases offered at auction for hydrocarbon extraction on the US outer Continental Shelf are limited to 5,760 acres (about nine square miles). Where it is economically efficient to produce the oil or natural gas underlying several leases using one production platform, leases can be merged together or "unitized." Such units often involve the lease holdings of more than one firm. An analogous policy could be adopted for ocean wind entitlements that are offered at sizes that are too small to achieve scale economies. Alternatively, a policy could be established to require adjacent wind farms to share electrical collection and transmission infrastructure.

In general, a longer tenure allows prospective developers to plan for a longer development period. In this sense, tenure is analogous to the investment horizon for holding

securities. A longer horizon permits an investor to reduce the costs of risk by riding out short-term market fluctuations. In a practical sense, prospective developers rarely look longer than 30 to 35 years, because discounted cash flows have little effect beyond a horizon of that length.

The usefulness of a long tenure is tied closely to two features: the transferability of legal interests and performance requirements. If rights are not transferable or if there exist requirements to utilize the resource regardless of market conditions, then legal interests may be weakened, thereby cutting into resource rents.

Tenure for early stages of development may be limited to short periods of time. In some cases, these tenure terms are renewable. For example, under BLM's policy for wind development on the US public lands, three-year right-of-way grants for site-specific wind energy testing and monitoring are non-renewable. Subsequent three-year right-of-way grants for site testing and monitoring facilities are renewable, as long as an application for a commercial wind energy development facility and a plan of development are filed before the expiration of the three-year term.

There is little agreement on the length of tenure across access systems for different types of resources (Table A10). US federal timber contracts run for five years, but most terms are met within 1 to 3 years. US federal grazing permits run for ten years, and they include a priority for reissuance to the existing permittee. BLM's policy for wind development on the US public lands sets no limit on a commercial wind energy development right-of-way grant, although the useful life of a facility is recognized as 30 to 35 years. The Irish law pertaining to offshore ocean wind limits tenure at 60 years.

The potential costs of limiting tenure may be reduced through policies that grant rights holders a priority to renew their rights after an administrative review. Many of the access systems in our database allow for the continuation of entitlements as long as they are being productively used. For example, there is no explicit limit on tenure for both onshore and offshore hydrocarbon entitlements in the United States as long as oil or gas is produced in "paying quantities."

A potentially useful institution for managing legal interests by adjusting tenure is known as an "evergreen lease" (Townsend and Young 2005). An evergreen lease allows the terms of a lease to be renegotiated before the tenure has expired. Typically, an evergreen lease is renegotiated after approximately one-half of the tenure has been completed: say at ten years on a 20-year lease. Such negotiations for an ocean wind power lease might involve an increase in royalty payments, in line with the sequencing of a resource rent tax (discussed in the next section). A lessee would benefit from an extension of the lease for another 20 years. If the lessee disagrees with the increase in royalty, then the lessee would retain the option of letting the current lease continue for the final ten years, at which point the government would probably terminate the lease.

4. Monitoring and Enforcement

Monitoring and enforcement refers to activities undertaken to ensure that the uses authorized by a lease or license are being carried out according to its terms. Monitoring can be undertaken by the government, by an authorized user, or by a third party; enforcement is undertaken by the government. In particular, monitoring and enforcement are conducted to guarantee that the external effects of a particular activity are controlled. As one element of this

concern for external effects, monitoring of the environment, including taking measurements of the release of emissions (for polluting facilities), the status of stocks of birds, fish, and wildlife, and other environmental parameters, is often a requirement. In Germany, for example, the monitoring of environmental impacts can be made a condition of a license for an ocean wind power facility. German environmental monitoring rules require monitoring before, during, and after construction; required observations comprise counts of birds and marine mammals, fishery stock assessments, and analyses of geological conditions.

Most access systems call for monitoring to be conducted by firms that have been allocated rights to use the resource (Table A11). The results of monitoring efforts typically are reported to the managing agency and made available to the public. Reporting requirements often include the possibility of criminal sanctions if information has been supplied incorrectly or falsified. The publication of monitoring efforts increases the transparency of firm activities. Transparency enhances firm accountability, as the prospect of either adverse publicity or litigation provides strong incentives for firms to follow the rules for monitoring and reporting. In some circumstances, private, non-profit third parties, such as "riverkeepers" or "Save the Bay" organizations, are involved in monitoring as an additional means of ensuring the accountability of polluting firms (*cf*., Tietenberg 1995). In Spain, third-party organizations have agreed to monitor bird migrations near functioning onshore wind farms.

Much of the academic literature in the field of economics discusses optimal levels of environmental monitoring, firm compliance, and government enforcement in the context of air, soil, or water pollution (*e.g*., for recent theoretical studies, see Macho-Stadler and Perez-Castillo 2006; Shimshack and Ward 2005; Franckx 2005). For ocean wind power, the set of potential external effects differs from the typical effects discussed in this literature. The reason for the difference is that the effects of ocean wind are not normally a function of output (electricity) but instead of the placement of the structures. Once rock piles, towers, and turbines are in place, both the view and, potentially, the habitat have been altered. Short of removing the structures, there is little that can be done to mitigate adverse effects.[29] Any mitigation must occur prior to the construction of the facility, such as through changing turbine design, the numbers of towers, the spatial pattern of towers, or the site itself. As a consequence, relative to the more common types of pollution-generating facilities, such as fossil-fuel generators, refineries, paper and pulp mills, and the like, there would appear to be a reduced need for the ongoing monitoring of ocean wind facilities. Monitoring is therefore arguably an unnecessarily onerous and potentially economically wasteful feature of an access system for ocean wind.

The uncertainty associated with the construction of a permanent set of towers in an area of the ocean is the main rationale for including monitoring requirements in an access system for ocean wind. Little is known about the potential external effects of a large-scale ocean wind generating facility. Even the scale of impacts on scenic visibility is not fully appreciated. *Ex ante*, environmental impact assessments are an important means of reducing the uncertainty about the potential effects of an ocean wind farm on environmental features and ecosystems. Even with environmental impact assessments, however, there may be a need for collecting

[29] If bird strikes become an issue, one possibility is to take the turbines off-line during periods of heavy coastal migrations. Bird strikes are thought to be a minor problem with modern turbine technology, however, because the turbine blades move slowly. A more significant question is whether the siting of the towers and turbines displaces seabirds—or other fish and wildlife—from their traditional habitats.

additional data that help to understand the baseline characteristics of habitats and ecological status. Thus there may be value to gathering and analyzing information, such as surveys of the spatial distribution of seabirds and their migration patterns, prior to undertaking an essentially irreversible decision to permit the construction of an ocean wind farm.

Uncertainty about environmental effects still may exist, including the potential adverse impacts on habitat. The siting of the first generation of wind farms in the ocean may be understood as a kind of experiment. Ideally, baseline environmental information exists that describes the ecosystem without the wind farm that could be compared to the situation when the wind farm is operational. Alternatively, similar oceanic areas with and without wind farms might be compared to identify possible adverse effects. The understanding gained from these experiments might be of use in subsequent decisions about the location, scale, and patterns of ocean wind farm development. Viewed in this way, monitoring at ocean wind farms is an activity designed to clarify whether or not external effects occur, rather than one to measure the scale of pollution that is known to occur.

5. Transferability

The transferability feature refers to the extent to which an instrument may be transferred or assigned from the holder to another firm, typically through its sale in a market setting. The transferability of instruments affects the economic efficiency of an access system directly. In an ideal situation, with all other things (output, environmental impacts, etc.) equal, society would prefer to have those firms that can construct and operate a wind farm at the lowest cost be the holders of instruments.

Where access is allocated competitively, the lowest-cost developers tend to be the ones who can outbid other firms for the instrument. Consequently, instrument transferability is not as critical, at least in the near-term, for competitive allocations. Transferability is important in both the near and long terms for access systems that allocate instruments non-competitively, such as for first come, first served allocations.

In the absence of any legal restrictions, transferability can be affected by typical market characteristics, such as the number of buyers and sellers, the resource quality of the ocean area, information asymmetries across market participants, and exogenous economic conditions.

In the case of most access systems, proposed instrument transfers typically must be approved by the relevant administrative authority prior to the actual transfer. The entries in Table A12 confirm this observation, although some instruments, such as the BLM rights-of-way grants for wind power development and archaeological excavation permits on the US public lands, are not transferable. (Concern in the former is over the need to curb the practice of holding rights-of-way for the purpose of land speculation.) Approval may be required for various reasons, the most common being the purported need to ensure that instrument holders meet some level of technical and economic competence, and so that external costs, such as habitat destruction or pollution, are not incurred. Administrative approval imposes costs that limit transferability and reduce economic efficiency.

In many cases, instrument holders are charged a fee to cover the administrative costs of instrument transfer approvals. The charging of a fee occurs under the provisions of the Irish law for ocean wind and for geothermal resources on the US public lands.

6. Termination Requirements

Termination requirements refer to procedures that require rights holders to perform certain tasks at the end of a lease or license term. Termination requirements are a special type of performance requirement (see below), relating to the completion of agreed-upon activities. Analogous to performance requirements, termination requirements may specify in detail the specific duties required of a rights holder, or they may invoke financial terms that encourage these duties to be undertaken. An example of the former can be found in proposed legislation in the United States for offshore aquaculture permitting. According to the proposal, once a permit expires or is terminated for any reason, the permit holder must restore the site, including the removal of all structures, gear, and other property. Termination requirements appearing in a variety of domestic and international policies relating to resource development in the public domain can be found in Table A13.

Requirements for "reclamation" or "decommissioning" bonds are examples of financial measures to encourage the removal of structures and the cleanup of leased or licensed areas. Such requirements provide firms with a financial incentive to restore or clean up areas that have been used for particular activities to a state in which other previously excluded uses or non-uses (*i.e*., habitat or ecological services) may resume. In this sense, bonding requirements are analogous to a deposit-refund scheme for recycling materials. Typically, bonding requirements may specify the extent of the restoration or clean-up, but often the language is fairly general, leaving developers some flexibility in terms of what needs to be done in order to achieve a specific end result. For example, under new rules promulgated in 2001 for onshore mining of placer and lode minerals on the US public lands, mining companies must post reclamation bonds equal to all of the estimated cleanup costs that they anticipate upon the shutdown of their mining operations.

While the concept appears straightforward, a number of issues must be addressed before a decommissioning policy can be implemented. The decommissioning of offshore oil and natural gas structures in the United States provides a useful illustration of some of the issues involved (*cf.*, McGinnis *et al*. 2001). Although regulations under the Outer Continental Shelf Lands Act Amendments of 1978 require the plugging of wells and the removal of structures to a certain level below the mudline, oil and gas developers have been reluctant to undertake decommissioning because of the significant costs of removal, the potentially ecologically damaging means for removing structures (*e.g*., underwater explosions), the potential costs of personal injury and property damage liabilities, and the potential for destroying localized ecological habitat that has been created on and surrounding a structure over a number of years. These issues led to the passage of the US National Fisheries Enhancement Act (NFEA) in 1984, which encouraged the use of decommissioned rigs as artificial reefs.

The NFEA policy achieved partial success in the Gulf of Mexico, where some of the Gulf states were willing to accept responsibility for liabilities arising from the use of decommissioned rigs as artificial reefs for commercial and recreational fishing. Too, the public in the Gulf states historically has been less concerned about the visual and environmental impacts of offshore oil and gas development than the public in other parts of the country. The concept of rigs to reefs was not as well received in Southern California. Even where the decommissioning of oil rigs is politically acceptable, there still remain unresolved scientific issues about whether artificial reefs enhance biological productivity at higher trophic levels or merely act as fish aggregation devices, allowing fish stocks to be exploited more easily. Further, even if there is some localized stock

enhancement, it is unclear that the limited number of artificial reefs actually contributes to productivity on an ecosystem scale.

Reclamation bonds have been discussed for offshore wind energy development in the United States, but this type of termination requirement appears in the database for offshore wind energy only in Ireland and the Netherlands. Interestingly, Ireland requires that a bond or other financial instrument be reviewed every five years in order to ensure that it continues to be sufficient for achieving its purpose. In the Netherlands, the government estimates the decommissioning costs, and it requires that a security for the full decommissioning costs be submitted by a developer.

The decommissioning of offshore wind energy structures may present a different set of issues than decommissioning of offshore oil and gas structures or other types of reclamation policies, however. Wind power technology consists of turbines, towers, and associated rockpiles. Because wind is a non-consumptive resource, it cannot be depleted. Consequently, there may be no need to actually "decommission" wind energy structures. Towers and turbines are expected to depreciate over time, however. As they reach the end of their useful life, a decision would need to be made about whether to replace the structures and continue operations or to decommission. Such a decision would hinge upon the relative profits associated with replacement in comparison with the costs of decommissioning. In many cases, should ongoing maintenance costs be low enough, we might expect that wind generating technology would be pressed into service well beyond its anticipated useful life.

After many years, we might expect that the submerged rockpile structure would be well-established as an artificial reef. It may make sense to leave the rockpile in place, thereby potentially reducing the costs of decommissioning. The presence of an artificial reef may raise questions of potential environmental impacts if either replacement or removal necessitates significant disturbance of a rockpile.

A corollary to termination requirements is termination rights. Where a lessee/permittee of a public space or resource is subject to a unilateral change in the terms or duration of that interest due to some decision or action of the government lessor/permitting authority, the lessee/permittee may be afforded compensation in some form.[30]

Ordinarily, the US and state governments work to avoid paying such compensation by notifying the lessor/permittee that the government reserves the right to make certain modifications. Additionally, state and federal governments regularly characterize the interest conferred in the negative, *e.g.*, the Magnuson Stevens Act specifically refers to fishing interest as "privileges" to avoid claims under the "takings clause" of the Fifth Amendment in the event that economic value of individually held fishing interests are reduced or eliminated due to management decisions.

[30] See Mobil Oil Exploration & Producing Southeast, Inc. v. United States, 530 U.S. 604 (2000) (oil companies entitled to reimbursement of lease fees when exploration plan was deemed in conflict with provisions of the Outer banks Protection Act).

C. Financial Features

1. Financial Terms

Financial terms refer to provisions that require a payment to the government for access to or the use of a resource. Financial terms may involve administrative fees as well as a number of methods of collecting resource rents, including annual fixed payments (or "rentals"), severance taxes, royalties, resource rent taxes, bonus bids, or combinations of all of these. In some cases, financial terms may change over the lifetime of an instrument in a prescribed way or at the discretion of the government.

There are two main policy objectives related to financial terms. The first concerns compensation to the public for the use of its resource. The second concerns the need to recover the administrative costs of processing an instrument. The two objectives may be related. From an economic perspective, if the potential rents from resource development do not exceed the costs of administering an access system, particularly the marginal costs of processing the issuance of an instrument, then allocating the resource for this particular use is inefficient. Charging a fee for processing an instrument can be thought of as a very rough method for ensuring that rents equal or exceed administrative costs.

Many of the access systems in our database have financial terms requiring that applications cover the administrative costs of processing applications (Table A14). Fees range from an apparently anachronistic $32 for locating and recording a claim under the Mining Law of 1872 to $250,000 for an OTEC application in the United States. Under the Irish offshore wind access system, a minimal fee of €5 for issuance of a license must be accompanied by a deposit of €100,000.

Provisions may appear in access systems requiring that the government realize the "fair market value" (FMV) of the allocation of a resource. The US Outer Continental Shelf Lands Act and the US Deepwater Ports Act both include FMV provisions. In economic terms, the FMV of a resource is equivalent to its resource rent. Where methods of allocating resources do not necessarily provide efficient incentives for firms to bid the entire resource rent, such as in a first come, first served (FCFS) system, then FMV provisions provide some assurance to the government that rents will be collected. Because the government acts as an agent for the public in allocations of OCS leases or ocean areas for deepwater ports, without such a provision, the government may be subject to criticism about resource "give-aways."

There are many methods that governments use to collect resource rents (Neher 1990). Bonus bids and net profit-type royalties (royalties assessed on pre-tax revenues net of costs) are both efficient means of collecting rents. In a competitive auction for the access rights to a resource, firms bid "bonuses" in order to win the auction. In order to obtain access rights, firms should be willing to bid all of their expected profits, *i.e.*, revenues net of all costs to the firm, including fixed and variable costs of resource development, royalties, and corporate taxes, in the form of a bonus bid.[31]

[31] Some studies of bonus bid auctions conclude that winning bids approximate the second highest bid (*viz*., Hansen 1985). If so, then winning bids do not reflect the full resource rent, because a portion of the rent will be captured by the winning bidder.

A royalty or "profit tax" is designed to collect the resource rent for the government. Because a royalty usually is set as a *fixed* percentage of pre-tax profits net of development costs, however, only a specified proportion of the rent is collected. A royalty may create an incentive to exaggerate factor costs in order to reduce the size of the royalty payment (this practice is referred to as "gold-plating"). A profit tax should be distinguished from a "gross royalty," or severance tax, which is based upon the gross value of production. A severance tax reduces revenues directly, potentially forestalling commercially viable projects or terminating them prematurely. Rentals are fixed annual payments that are another way of collecting resource rents. Rentals do not vary with production revenues or costs, so they are unlikely to equal the full rent, except by chance. Rentals are thought to provide an incentive for firms to remain diligent, especially during the pre-production stages of development.

The financial terms for offshore oil and natural gas leasing under the US Outer Continental Shelf Lands Act Amendments of 1978 offer one of the best examples of a bonus bid system. Potential developers offer variable cash bonuses in their bids for lease tracts offered at auction. The tracts are offered with fixed royalty rates of between 12.5 and 33.3 percent for a ten-year lease. Bidders are aware of these royalties, so they factor them into their bids (by reducing the size of the bid appropriately). Upon the award of a lease, the winning bidder must make fixed annual rental payments. Once hydrocarbon production starts, annual rentals are credited against royalty payments. The US Minerals Management Service has the discretion to reduce royalty payments on leases, typically as the production on a lease is playing out. This discretion is an example of a variable royalty policy.

The use of both bonus bids and royalties together is a means of sharing risks between the developer and the government where there is substantial uncertainty regarding the nature of the resource, market conditions, or other aspects. Under a system without royalties, the possibility exists that winning bids might be too low. If prices increase as a consequence of expanded demand, then resource rents would accrue to the developer, not the government. This possibility is sometimes referred to as a "bonanza complex." Such a scenario has begun to play out under provisions of the US Deep Water Royalty Relief Act (Andrews 2006). Under provisions of the Act, royalty payments were waived on sales of deep water leases in the Gulf of Mexico. No provision was made for reinstituting the royalties in the event that oil and natural gas prices might rise, which is exactly what has happened in the last decade.

On the other hand, uncertainty may cause developers to reduce the size of their bonus bids in a system without royalties, because there is some risk that they might overestimate the resource potential of an entitlement or that market conditions might turn adverse. Incorporating royalties into the financial terms has the tendency of reducing the risk to the developer of overbidding on an instrument, because royalties do not need to be paid if production does not occur (McDonald 1979).

Because developers regard both rentals and royalties as accounting costs, their use may lead to an inefficiently premature termination of an instrument. Rothkopf and Engelbrecht-Wiggans (1992) recommend the use of "variable royalties" that decline with cumulative production or over time as a method for reducing this inefficiency. A "resource rent tax" is a variant of the variable royalty; it creates an additional incentive for exploration or innovation by subsidizing a project in its early phases when cash flows are negative. Once cash flows turn positive, a royalty would then be charged on net profits. The potential for exaggerating factor costs, so as to continue subsidies or to reduce royalty payments, is not avoided with this type of financial term however.

A form of the resource rent tax or variable royalty might be an appropriate financial term for ocean wind power. Because wind power is subsidized with a production tax credit and accelerated depreciation rules, these subsidies can be thought of as "negative" royalties that apply during the early phases of ocean wind development. Over time, these subsidies may be phased out, and positive royalties could then be invoked. The State of Texas has adopted a variable royalty system for ocean wind. According to this system, a fixed annual rental is charged until production begins. Once production starts, royalties are charged as follows: 3.5 percent for the first eight years; 4.5 percent for years nine through 16; and 5.5 percent for years 17 through 30.

An alternative method of instituting a variable royalty involves the use of evergreen leases (Townsend and Young 2005), as described in the section on "Size and Tenure." With an evergreen lease, instruments would be renegotiated at the mid-point of the lease tenure. Lessees would be offered a lease renewal for an extended period of time in return for the government readjusting (increasing) the royalty rate. The evergreen lease negotiation process represents a more flexible method for determining the variable royalty rate than a legislated variable rate structure. Lessees have the option of continuing at the previous royalty rate for the original length of the lease, at which point it might be terminated. Although the precise details of an evergreen lease method need to be ironed out, this kind of an institution may provide benefits for both the government and lessees for a non-consumptive resource in which rents are expected to increase over time due to expansion in demands for both ocean space and electricity.

2. Subsidies

Subsidies refer to government-authorized price controls or quotas that provide financial benefits for ocean wind power developers. Within the context of an access system, subsidies should be regarded as one of the financial terms of an instrument. For example, financial terms that allow developers to capture all or portions of resource rents associated with ocean space can be interpreted as subsidies.

In this section, we distinguish between subsidies that are explicitly a part of the financial terms of an access system from the more general (exogenous) subsidies that apply to wind power facilities, regardless of their location. We make this distinction to highlight the importance of the latter to wind power development; in particular, exogenous subsidies may influence the decisions of firms about whether to seek access to ocean space for wind power development. Table A15 presents the different types of subsidies across access systems in our database.

Subsidies for wind power can be classified broadly into two types: those that affect prices and those that affect quantities (Meyer 2003). Pricing policies include the production tax credit, which has been implemented at the federal level in the United States, and price floors, which have been implemented in several European countries (Germany, Denmark, Sweden, and Spain). Other price-based subsidies include accelerated depreciation rules, system benefits funds, and property tax and sales tax abatements (Bird *et al*. 2005). An accelerated depreciation provision for renewable energy has been implemented in the US federal tax code; the other types of subsidies are variably applied across US states. System benefits funds are financed typically through a charge on electricity consumers; these funds may then be utilized to provide financing on favorable terms, production subsidies, or other incentives.

The US federal production tax credit is a short-term policy that provides a credit on the production of electrical energy from wind power. In August 2005, a federal production tax credit of $0.019/kWh was reinstated for two years (Energy Tax Incentives Act of 2005). This credit

can be used during the first ten years of the operation of a new wind energy generating facility. The size of the tax credit is adjusted annually for inflation. The credit is now due to expire on January 1, 2008. The wind power industry would prefer to see a multi-year extension to the credit, perhaps to as long as five years. The industry claims that the short-term nature of the credit makes investment decisions more difficult, thereby slowing the growth of the industry.

The price floor approach comprises the "feed-in tariff," which is a minimum sales price for electricity produced by wind power. Under a feed-in tariff policy, electricity produced by renewable energy suppliers (RES-E) must be purchased, either by grid operators or power distributors (Enzensberger *et al*. 2002). German policy represents one example of the implementation of a feed-in tariff. Under German law, electricity from ocean wind power generators is guaranteed a price of €0.09/kWh (~$0.11/kWh) for up to nine years for those farms located more than three nautical miles from the coast. This tariff is reduced by 1.5 percent annually. Wind farm operators are guaranteed access to the electrical grid; grid operators must pay for any costs necessary to allow wind farms to hook up to the grid; and the grid operators receive the tariff.

A variant of the feed-in tariff is represented by the tender system, which has been tried in the United Kingdom, Ireland, and France. Under a tender system policy, a quota for renewable energy produced by wind is set periodically by the government.[32] Prospective suppliers of wind power compete among each other at an auction by submitting bids in the form of prices to supply electricity. The winning bidders (those who offer the lowest prices) are awarded long-term contracts for the supply of power at the price that they bid. The tender prices for wind power are higher than the supplied price of electricity from the more traditional sources; this subsidy is paid for with a tax on consumers.

In theory, in the presence of uncertainty about production costs, the tender system is considered to be more efficient because the periodic offering of tenders implies that RES-E will continually compete to offer the lowest prices. Prices for renewable energy are expected to decline because of technological advances and learning. Nevertheless, the incentives for investing in research and development (R&D) to achieve technical change are believed to be greater with a feed-in tariff policy, which implies that the feed-in tariff may be more efficient over time. Menanteau *et al*. (2003) conclude that price-based approaches (as exemplified by the feed-in tariff) have been more effective in stimulating technical change because they provide a more predictable investment environment, thereby encouraging R&D. In the United Kingdom, many of the proposed facilities that were awarded contracts under the tender system were not constructed. The reasons for not constructing these facilities include unanticipated competition for the best sites, the costs of connecting to the grid, and public opposition (Butler and Neuhoff 2004). The tender systems in the UK and France now have been abandoned in favor of a green certificate system in the former and a feed-in tariff in the latter.

A quota policy involves the setting of a minimum standard on the production of renewable energy. These standards, also known as "renewable portfolio standards" (RPSs), require that a fixed amount of energy must be produced by renewable power, including wind.

[32] Because the tender system works by setting a quota for the amount of renewable energy to be produced, it is more appropriately regarded as a quantity-based policy instrument (*viz*., Menanteau *et al*. 2003). Nevertheless, the tender system has market-based characteristic, as RES-E compete to supply the quota on the basis of price. Once the tender has been carried out, it is implemented analogously to the feed-in tariff.

Bird *et al*. (2005) characterize state RPSs as the primary driving force behind the development of onshore wind energy in the United States. Eighteen states and the federal government (for its own operations) have now adopted RPSs. RPSs are typically phased in over a period of several years. For example, Section 203 of the Energy Policy Act requires that, beginning in 2007, at least three percent of energy utilized by the US federal government must originate from renewable sources; this requirement increases to 7.5 percent by the year 2013. (The standard is doubled for federal facilities that produce their own energy or that rely on energy produced on public or tribal lands.)

In Europe, several countries, including the Netherlands and Denmark, have experimented with markets for renewable quota. In such a market, individual power suppliers are required to supply some proportion of their total power from renewable energy. In order to meet their quotas, these suppliers must choose among the following options: in-house production of renewable energy; contracting for power from a specific renewable energy supplier directly; or purchasing renewable electricity quota in a market in which the quota is denoted by "green certificates."

The green certificate option involves the existence of a market. The market is established by allocating transferable green certificates that correspond to the output of electricity by renewable power suppliers. Non-renewable power suppliers have an obligation, set by the government, to supply renewable power at some fraction of their total electricity sales. In the United Kingdom, this fraction is set at three percent. Non-renewable power suppliers have the option of purchasing green certificates on the market in order to ensure that their quota is met. Green certificates can be valuable if the demand for electricity is high and the output of renewable power suppliers is low. If this is the situation, then a clear incentive exists for new entry or for capacity expansions by existing renewable power suppliers. In some cases, the quota cannot be met because of the supply constraint. In the United Kingdom, non-renewable power producers must pay a penalty for any unmet quota (this penalty is fixed at 3 p/kWh); and this penalty, called a "buy-out" payment, is recycled to renewable power suppliers as an additional subsidy.

In general, exogenous subsidies will encourage the development of ocean wind power in the United States. Within the maritime boundaries of coastal states, the federal PTC and accelerated depreciation, state RPS policies, system benefits funds, and property and sales tax abatements can lower the relative costs of wind power construction and operation. Only the federal subsidies would appear to apply to developments in the US exclusive economic zone, however.

It seems unlikely at this point in time that any of the European-type renewable energy subsidies will be adopted at the federal or state level in the United States. One exception is the possibility of the development of a market in green certificates in the future. Such a market would generally favor the lowest-cost producers of renewable energy (Menanteau *et al*. 2003). It is too early to tell whether some ocean wind facilities might be considered to be a low-cost producer. In highly populated areas, where land costs are steep, the possibility of obtaining sites in the ocean at little or no cost (for ocean "land") may tip the balance in favor of ocean wind. On the other hand, political opposition to the siting of ocean wind projects within the sight of the coast may impose additional or, in some cases, even insurmountable costs.

Under an access system that mandates a competitive process for allocating ocean space for wind farm development, prospective developers will bid away any subsidies as well as resource rents. The competitive bidding process still will select the most efficient wind farm operations, but bonuses will reflect the combined subsidy and resource rent. Consequently, bonuses will not be a good estimate of resource rents. The bidding away of subsidies implies that a competitive access system may defeat the purpose of other policy objectives to encourage the development of renewable energy. A less efficient allocation method, such as a first come, first served method, would allow the financial benefits of subsidies to continue to accrue to developers.

3. Research and Development Program

A research and development (R&D) program refers to the incorporation of incentives of a variety of types for private firms to conduct basic and applied research on wind power in the ocean. It should be noted that many of the nations in which ocean wind power is under development have adopted policies that promote R&D on renewable energy generally. Some of these nations also have adopted policies that target ocean wind energy for special research incentives. For example, the German government's "Investment Programme for the Future" has initiated R&D projects on ocean wind, including the compilation and analysis of data on environmental conditions, the state of the ecosystem, and the pattern of human uses. These R&D policies supplement existing policies, such as intellectual property rights and funding for basic R&D. For example, in the United States about $40 million is spent annually to fund R&D on wind power technologies.

Many of the different access systems in our database incorporate incentives to encourage R&D of the technologies needed to exploit the relevant resource (Table A16). Under provisions of the Ocean Thermal Energy Conversion Act in the United States, for example, the Secretary of Commerce has the discretion to exempt demonstration projects from any of the Act's licensing requirements, as appropriate. Further, federal loan guarantees are available to assist with financing demonstration projects. Similarly, under proposed legislation for open-ocean aquaculture in the United States, the Secretary of Commerce is authorized to waive any fees or payments for aquaculture facilities that are used primarily for research.

The production of electrical energy from wind power has been growing at a rapid pace during the last three decades. Even with this rapid growth, the costs of producing electricity from wind are not yet fully competitive with the costs of production from other sources, including fossil fuels, nuclear power, and hydropower. One rationale for funding R&D in the wind energy field is the potential for "learning efficiencies" with increased levels of electricity production from this technology. In a recent study, Junginger *et al*. (2005) estimate experience curves for wind power in the United Kingdom and Spain. These authors find that for each doubling of capacity in wind farms, the learning rate (or the reduction in costs associated with learning) increases by 19 percent on average. Historically, most of the learning economies can be attributed to improvements in turbine technologies, which may account for 65-85 percent of the total costs of a wind farm. These technologies appear to be maturing, however. In the future, cost reductions are likely to come from efficiencies associated with large-order production runs of turbines for large-scale wind farms and through reductions in investment costs, especially those associated with the permitting process.

Given the existence of production tax credits, accelerated depreciation provisions, a focused albeit small national R&D effort, and existing public policies that promote R&D, there does not appear to be a pressing need for a specific R&D program for ocean wind development as part of the access system. Nevertheless, in deep-water, exposed ocean environments, there is a clear need for experimentation with prototype platforms and associated infrastructure. An access system might usefully include provisions that minimize the administrative burden associated with projects that involve the application of cutting-edge research and experimentation. These provisions could be discretionary, analogous to provisions in the Ocean Thermal Energy Conversion Act.

A strong argument can be made for including provisions that promote the collection of environmental monitoring data. Such data could be collected by the government and released publicly or through a permitting program for prospective wind farm developers. Analogous to provisions in the regulations for geological and geophysical prospecting under the US Outer Continental Shelf Lands Act, prospective developers might be encouraged to pool their resources to conduct environmental monitoring efforts in areas that show promise for wind power development. Such a policy would reduce the waste associated with duplicate monitoring efforts in the same location.

4. Performance Requirements

Performance requirements refer to policies necessitating that holders of legal interests for the use of public resources perform certain types or levels of work according to a schedule. Performance requirements also may be known as "due diligence" provisions or "assessments." Performance requirements typically are authorized in legislation and promulgated through agency regulations, and they may be further articulated as provisions in a license or lease. Performance requirements may include periodic reporting requirements, environmental monitoring, commitments to perform certain kinds of work according to a schedule, among other terms (Table A17). For example, leases for geothermal resources on the US public lands include minimum work requirements first to establish a geothermal potential and second to confirm the existence of producible resources.

Although many performance requirements are specific about the actions to be taken once legal interests are conveyed, performance also may be encouraged more generally through the use of financial measures. For example, the payment of annual rentals (also known as "minimum royalties") is required for both onshore and offshore oil and natural gas properties prior to production on public or OCS lands in the United States. Offshore lessees must pay an annual rental of $3.00 per acre or $17,280 per lease tract. Onshore lessees (both competitive and non-competitive) must pay $1.50 per acre for the first five years and $2.00 per acre thereafter. In both cases, annual rentals are usually credited against royalty payments once production has been initiated.

The purpose of annual rentals is to encourage the full range of activities needed to explore and develop the relevant resource. Financial measures allow some flexibility on the part of the lessee on the choice of activities to undertake. As an example of a hybrid performance requirement, combining the flexibility of financial measures with the specificity of work requirements, proposals have been made in the past to permit exploration and development expenditures to be credited against annual rentals (PLLRC 1970).

The potential for private "speculation" with public resources is sometimes used as a rationale for imposing performance requirements. Although its connotation is negative, speculation can be economically beneficial. If legal interests are transferable, speculation may lead to a situation in which the most efficient firm ends up with the rights to undertake the relevant activity. Concern about speculation may relate also to the potential for an exclusive use of an area to preclude other potential uses; thus stakeholders may worry that speculation can impose opportunity costs.

When a particular use of the ocean is the most productive among all possible uses, then, from an economic perspective, performance requirements for that use are likely to be inefficient. In general, economic theory would predict that private firms are more likely than government agencies to make the most efficient choices about the timing and nature of work to be performed in order to carry out a particular activity, such as wind farming. Over three decades ago, performance requirements were the subject of debate for inclusion into the United Nations Convention on the Law of the Sea with respect to the exploration for and exploitation of deep seabed minerals. In an analysis of these requirements, Nobel economist Ronald Coase (1974) argued that "such [provisions are] completely unnecessary and, if [they have] any effect at all, it will be to cause wasteful expenditures to be incurred."

In some cases, an exclusive use of the ocean may be preferred from a public policy standpoint, but it may not be the most efficient use of the ocean. Namely, other uses might yield larger resource rents over time (higher net present values).[33] More generally, there may be considerable uncertainty about what single exclusive use or combination of mutually compatible uses yield the highest economic value over time in a particular area of the ocean. Weighing the economic value of alternative uses is an important rationale for incorporating methods of policy analysis into an access system. In such cases, there is a legitimate concern that any economic loss associated with the preferred exclusive use be minimized. Performance requirements might usefully be imposed to ensure that economic losses are kept to a minimum. Again, financial measures are likely to be the most effective way in which to accomplish this objective.

The case of the construction of an ocean wind farm within sight of land provides an atypical example. Assume that all uses of the ocean (*e.g.*, habitat, fishing, recreation, navigation, overflight) except for the aesthetic views from the shoreline are fully compatible with the construction and operation of a wind farm. In this case, stakeholders who are opposed to the obstruction of their views might prefer that there be no performance requirements put in place to accelerate the pace of construction. Delays in construction are beneficial to these stakeholders, because economic losses from the obstruction of views would be pushed off into the future.

V. Conclusions and Recommendations

Modern access systems can be characterized by at least 20 common features. An access system for ocean wind will need to attend to all of these features in some fashion. Based upon our review of access systems for ocean wind in other countries and for natural resources on the

[33] The concern with net present value is important in this context. Excluded stakeholders might argue that their particular uses could earn positive resource rents during the years when a preferred—but less efficient—use is gearing up. The correct comparison should be between the discounted value of rents from alternative uses over time, not over only a few years of lost rents.

US public lands, significant lessons can be drawn for the design of an access system for ocean wind.

A. Regional Planning

The existence of external effects that cross political boundaries is an argument for taking a broad regional approach to the management of the oceans. Successful regional planning is organized at the most appropriate scale, focused on a specific problem, and engaged in developing new information about the problem. Moreover, successful regional planning involves participants who are motivated to seek solutions.

The OCS planning process, which has been established for offshore oil and natural gas development, attends to two primary concerns motivating regional planning: the geographic extent of external effects, and the need for planning for uses in the future. In adopting the OCS 5-year leasing program, the Secretary of the Interior must take into consideration, at a regional level, geographical, geological, and ecological characteristics; location with respect to regional and national energy markets, other uses of the sea and seabed, and other anticipated uses of the resources and area of the OCS; the policies of affected coastal states; the environmental sensitivity and marine productivity of areas of the OCS; and relevant environmental and predictive information. Among regional planning tools, the US Commission on Ocean Policy found the OCS Program to be among the best available.

The development of ocean wind power presents a different set of external effects than offshore oil and gas development, however. Issues that are local, such as aesthetic impacts, while important, do not necessarily need to be a part of a *regional* planning effort. Other issues, such as impacts on habitat for migratory species, including birds, fish, and marine mammals, will need to be addressed at a regional level. If regional planning is to be successful, it must be tailored to the appropriate geographic scale of these problems. This tailoring may require a modification of the existing OCS oil and gas 5-year planning areas. Further, regional planning should focus on the cumulative effects including the potential for wind farm siting on the submerged lands of coastal states.

B. Multiple Use Decision-making

Most modern access systems incorporate methods of resolving existing or potential conflicts among alternative uses. All of the access systems in our database incorporate provisions for consideration, at some level of detail, of alternative uses of the ocean in areas where ocean wind power facilities might be sited. Other methods include the fundamental rules relating to public notice and comment; opportunities for interested government agencies to review and recommend changes; the establishment of management councils and advisory boards; NEPA requirements to assess and state the environmental consequences of federal agency actions that might have an adverse impact on the quality of the human environment; and judicial review of certain types of agency allocation decisions.

Only one of the OCSLA 8(p) objectives, the one relating the realization of a fair return from the grant of a lease, easement, or right-of-way, promotes the efficient allocation of ocean space for wind power development. This observation is true only if ocean wind power is the only potential use of ocean space. A competitive auction system, for example, would result in the allocation of legal interests to the most efficient ocean wind power firm. A larger social concern, however, is the problem of whether excluded uses of the ocean are more valuable than the siting of ocean wind.

From society's point of view, decisions about providing access for ocean wind must consider the opportunity costs of alternative uses (or combinations of alternative uses) in ocean areas. Government should select those combinations of ocean uses that maximize the resource rent from the use of ocean space. In practice, estimating the opportunity costs of allocating areas for specific uses or for specific combinations of uses can be very uncertain. Nevertheless, we argue that an economic policy analysis framework should be incorporated into an access system so that the government can begin systematically to incorporate estimates of opportunity costs into its decisions about allocating ocean space.

Performance requirements, which are one of the important terms of a contract between the government and an ocean wind farm developer, can be useful in ensuring that economic losses arising from lost opportunities are minimized.

C. Lead and Coordinating Agencies

Current US policy assigns responsibility for the design and implementation of an access system for siting ocean wind energy to a single agency, MMS, in the US Department of the Interior. Thus, on the surface, this action continues the tradition of single agency, discretionary management, which has been criticized as not fully integrative of ocean resource management. Nevertheless it is a common approach in most of the access systems studied here to designate a national agency responsible for energy or mineral resource development to serve as the lead agency for the siting of wind farms, irrespective of their size or location.

Virtually all foreign access systems, regardless of which lead agency model they follow, involve a large number of coordinating agencies. The amount of interagency coordination and the number of approvals that these access systems require has been blamed for retarding the growth of the offshore wind industry. EWEA's 2002 study of offshore wind power developments in eight European countries (Shaw *et al*. 2002) identified "one-stop shopping" as the most significant of several "best practices" that governments could adopt to advance the development of offshore wind.

A single consolidated process is infeasible where the lead agency can be any of several regional entities with jurisdiction over activities within the 12 nautical miles from the coast, as is the case in several European countries. Modifying such a system to accommodate a consistent, predictable, and consolidated permitting process would require drastic jurisdictional changes that few regional governments would accede to and few national legislatures would attempt. A similar situation exists in the United States, but the fact that US federal waters begin just 3 nm from the coast (except in Texas) makes it much more likely that a great share of the nation's offshore wind farms will be sited under a single federal program to be administered by the MMS. Thus, a one-stop shopping approach is likely to be more practicable in the United States, and it should be among the areas in which MMS builds on its experience and strong performance in managing the OCS oil and gas leasing program.

It is worth bearing in mind that some stakeholders in offshore wind farm siting processes may not see a reduction of jurisdictional complexity as translating into a net benefit for the public if other benefits of equal or greater value, such as tourism, fishing, or aesthetic preservation, for example, are sacrificed in the process.

D. Legal Interests and Allocation Methods

An instrument that conveys legal interests or rights to undertake ocean wind power development needs to be clear and exclusive. Further, legal interests are strengthened to the extent that initial allocations of rights to prospect or monitor ocean areas establish a priority for the rights holder. Finally, economic efficiency is enhanced through the ability to transfer legal interests.

In the early stages of "prospecting" for ocean areas that might become productive sites for producing electricity from ocean wind, it is sensible for nonexclusive rights to be assigned. Further, ocean wind entrepreneurs might be encouraged to work together to monitor the wind resource in prospective areas, so that duplication is reduced and overall monitoring costs are minimized.

Discretionary methods of allocation are unlikely to assign rights to the least-cost user of a resource, unless there is only one potential user. Consequently, discretionary methods are economically inefficient when there are multiple potential users who might compete for a resource. If legal interests are freely transferable, however, and if other users appear, then a discretionary system can be efficient, even if the initial allocation is not. The government, however, would be unable to claim resource rents from a discretionary allocation method that allows the subsequent transfer of rights to other parties, unless royalties or other financial terms are embodied in the rights.

Auction methods, on the other hand, are an efficient means for allocating access to a natural resource, and the government collects the resource rent in the form of a bonus. Competitive allocation methods may be administratively costly, however. These methods obviously are more effective where there is significant demand for the legal interests to utilize a resource. Where ocean space is scarce and resource rents for ocean wind power development exist, then a competitive allocation process is preferred.

In the early stages of interest in a potential resource, the existence of resource rents may be difficult to determine. Government can and should develop economic models of the operations of a wind farm in different locations to estimate the potential for rents. A second means of testing for the existence of rents can be obtained through a nomination process, in which private firms are asked to identify areas for potential lease. A third way to see if rents exist is to hold a competitive lease sale and see if any bidders show up. All three methods can be used in combination: areas for which no nominations are made can be held for the future; areas in which only one firm expresses an interest might be offered non-competitively; areas in which multiple firms express an interest can be allocated competitively.

E. Financial Terms, Subsidies, and Tenure

Policy discussions calling both for subsidies for renewable energy and charges (royalties or other) for the use of ocean areas are apparently inconsistent. Does it make sense for the US government to promote ocean wind with a production tax credit and accelerated depreciation on the one hand and exact a royalty on the production of electricity on the other? This question raises issues of the relative incentives faced by wind farm developers in choosing onshore versus offshore sites.

Under an access system that mandates a competitive process for allocating ocean space for wind farm development, prospective developers will bid away any subsidies as well as

resource rents. The competitive bidding process still will select the most efficient wind farms, but bonuses will reflect the combined subsidy and resource rent. The bidding away of subsidies implies that a competitive access system may defeat the purpose of other policy objectives to encourage the development of renewable energy. A less efficient allocation method, such as a FCFS allocation, would allow the financial benefits of subsidies to continue to accrue to developers.

In the case of an FCFS allocation, a practical method of resolving this inconsistency involves the application of a combination of the resource rent tax and evergreen lease approaches. Assume that leases are to be issued on a FCFS basis for a tenure of 20 years. Operators would enjoy the production tax credit without paying a royalty for the first ten years of the operation. This period represents the initial negative royalty period for the resource rent tax. After the first ten years, the PTC expires and the lease is renegotiated to include a positive royalty rate. Lessees have the choice of continuing at a zero royalty (without a subsidy) for the final ten years or obtaining an extension for 20 years at a positive royalty rate. After another ten years the process repeats itself, perhaps with an even higher royalty rate.

Given existing subsidies and promotional efforts, there does not appear to be a pressing need for a specific R&D program for ocean wind development as an explicit part of an access system. In deep-water, exposed ocean environments, however, there is a clear need for experimentation with prototype platforms and associated infrastructure. An access system might usefully include provisions that minimize the administrative burden associated with projects that involve the application of cutting-edge research and experimentation. These provisions could be discretionary, analogous to provisions in the Ocean Thermal Energy Conversion Act.

F. Monitoring

The external effects of ocean wind are not normally a function of output (electricity) but instead of the placement of the structures. As a consequence, relative to the more common types of pollution-generating facilities, there would appear to be a reduced need for the ongoing monitoring of ocean wind facilities. Monitoring is arguably an unnecessarily onerous and potentially economically wasteful feature of an access system for ocean wind.

The uncertainty associated with the construction of a permanent set of towers in an area of the ocean is the main rationale for including monitoring requirements in an access system for ocean wind. Thus there is value to gathering and analyzing information, such as surveys of the spatial distribution of seabirds and their migration patterns, prior to undertaking an essentially irreversible decision to permit the construction of an ocean wind farm.

The siting of the first generation of wind farms in the ocean may be understood as a kind of experiment. The understanding gained from these experiments might be of use in subsequent decisions about the location, scale, and patterns of ocean wind farm development. Viewed in this way, monitoring at ocean wind farms is an activity designed to clarify whether or not external effects occur, rather than one to measure the scale of pollution that is known to occur.

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APPENDIX A

DATABASE TABLES

Table A1. Regional Planning

Activity	Resource	Jurisdiction	Regional Planning
wind energy/power plant siting	ocean wind	Germany	In the German EEZ, two ministries of the Federal government are involved in the identification of suitable areas for offshore wind farm installations and areas to be protected for environmental reasons or because of the high potential for conflict with other uses. Given the large number of pending license applications, the regional planning process will proceed in phases, concentrating on nearshore areas first.
wind energy	ocean space	Belgium	Unlike land-based activities, which is under the purview of the 3 regional governments (along with renewables policy and economic activities), regional planning for offshore wind is under the jurisdiction of the central government, specifically the Management Unit of the North Sea Mathematical Models (MUMM), a dept of the Royal Belgian Institute of Natural Sciences. MUMM renders opinions as to suitability of proposed projects in light of likely effects on the environment and other uses (see Multiple Uses).
wind energy	submerged lands	North Carolina	Would be required for coastal wind energy projects under the North Carolina Coastal Area Management Act (CAMA), administered by the NC Division of Coastal Mgmt. CAMA establishes a cooperative state-local program of coastal area management in which local government (especially county) has the initiative for planning, and state government establishes areas of environmental concern and acts primarily in a supportive standard-setting and review capacity. I.e., in addition to State guidelines, planning processes include a land-use plan for each county within the coastal area, which plans shall serve as criteria for the issuance or denial of
wind energy	state waters and submerged lands	New York State	The NY Waterfront Revitalization of Coastal Waterways Act, which implements the CZMA, requires coastal area planning and development/preservation policies. In addition to the resulting NYS Coastal Management Program, numerous municipalities have exercised their authority under NYS executive law to adopt and implement their own Local Waterfront Revitalization Programs.[1] (Depending on location, Town boundaries can extend to the mean high water mark or to the State border.)
wind energy	state submerged	Texas	No information
wind energy	ocean space	Denmark	Possible locations for wind farms were identified from 1992 to 1995 by an Offshore Wind Turbine Committee within the Ministry of Environment and Energy. Wind power siting was to be concentrated in 5 main areas, considering water depth limitations, potential impacts on coastal landscapes, MPAs, and other ocean uses. Initial small-scale pilot demonstration projects (5MW) were licensed at Vindeby (1991) and Tuno (1995). A medium-scale pilot project (40MW) was licensed at Middelgrunden (1999).
wind energy	ocean space	United Kingdom	

Activity	Resource	Jurisdiction	Regional Planning
wind energy	public lands	United States	Regional planning occurs for federal public lands under the authority of the Federal Land Policy and Management Act (FLPMA). Land use planning is implemented for wilderness areas; wilderness study areas; areas of critical environmental concern (ACECs); visual resource management areas; national scenic or historic trails; national landscape conservation system units; critical habitat areas; and other special management areas.
wind energy	ocean space	France	A 2002 report presenting recommendations of the General Secretariat of the Sea calls for the development of plans and policies for offshore wind within the framework of integrated coastal zone management. The report acknowledges that such an approach might necessitate the siting of installations in non-optimal locations, from the standpoint of the wind resource, as well as major additions to the power grid; notes that more studies are needed to assess the costs and benefits of the relevant socioeconomic, technical, and environmental considerations. [1]
wind energy	ocean space	Sweden	A regional state authority is responsible for providing the national and regional focus for comprehensive planning by the municipalities. In general, the regional state authority represents and coordinates the state's interests in the planning process.
wind energy	public land	Japan	Projects are subject to a Law on Development of Areas Adjacent to Electric Power Generating Facilities, but details are not readily available.
wind energy	public land	Spain	Details of EIA requirements not readily available. However, there is a basic national law that establishes the EU's minimum EIA requirements as national law. In addition, each of Spain's 17 Autonomous Communities (I.e., regional govts.) may have its own relevant laws and regulations, but more than half apparently do not. As of about 2002, wind farms were operating or under construction in 7 of the 17 regions, at least some of which have EIA requirements. One region, Navarre, has experienced a recent boom in installations guided by EIA laws and regulations that apply expressly to wind farms. (Apparently similar conditions in Galicia.) Navarre's policies are perceived as very rigorous (at least by Spanish standards) and the installations have substantial public support--as opposed to significant opposition in at least one region, Andalusia, where Spain's first wind farms proliferated in a much more haphazard fashion.[2, 3]
wind energy	ocean space	Ireland	No.
wind energy	ocean space	Netherlands	Govt. is developing spatial planning tools for offshore (beyond 12 nm) wind power in the North Sea, with an initial focus on several 600 MW farms. (This is an entirely new endeavor for the central government, since issues such as environmental management, spatial planning, and energy have previously been the sole responsibility of provincial authorities.) For reasons of visual intrusion and birdlife protection, govt. has decided that no commercial windfarms will be sited within the 12-nm territorial sea. (Govt. has one nearshore demonstration project; see more under Policy Analysis.)

Activity	Resource	Jurisdiction	Regional Planning
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Public lands available for geothermal leasing only after they are evaluated through BLM's multiple-use planning process (NEPA, FLPMA). (See entries under Multiple Use and Area Selection for more specifics.)
livestock grazing	public domain rangelands	United States	Land use plans and range allotment management plans are developed to manage rangeland.
electricity generation	ocean thermal energy	United States	No, but in most instances state CZM consistency requirements would apply.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	No
port siting	ocean space	United States	None.
offshore aquaculture	ocean space (EEZ)	United States	Permit decisions would be based on criteria that take into account the environmental considerations and planning requirements established under the Coastal Zone Management Act.
ocean disposal of wastes	ocean waters/marine environment	United States	No, but ODA requires that any existing uses (navigation, fishing, etc.) be taken into account by permitting agency. Presumably, in some instances, state CZM consistency requirements would also apply.
mineral extraction	placer and lode minerals	United States	Under the General Mining Law of 1872, the public domain lands are open for prospecting and claiming unless withdrawn for various reasons. There is no regional planning explicitly related to the access system for placer and lode minerals, although other laws, such as FLPMA, do influence the pattern of prospecting and claiming indirectly. Withdrawals could include the existence of other valuable minerals, such as hydrocarbons or coal, that are allocated under other
hydrocarbon	offshore oil and natural gas	United States	

Activity	Resource	Jurisdiction	Regional Planning
hydrocarbon	oil and natural gas	United States	BLM develops and implements multiple-use, sustained-yield resource management plans (RMPs) [sometimes referred to as "land-use plans"] for the federal public domain lands. Each RMP may encompass hundreds of thousands of acres. RMPs must consider diverse uses, including fish and wildlife conservation, recreation, timber harvests, grazing, and energy exploration and development. Many RMPs are now out of date, because of the potential for surface disturbances that were unanticipated in the original RMPs. The average lifetime of an RMP is now about seven years. The revision of an RMP (which requires an EIS) now averages about three years (roughly 3 times as long as the original RMP development). About 165 million (23 percent) of the 700 million public domain lands have been "withdrawn" from mineral entry, leasing, and sale through the FLPMA and a number of congressional acts and executive actions under a wide range of natural resource and environmental laws. [Some of those lands, however, still contain valid existing subsurface mineral rights.] Mineral development on another 182 million acres (26 percent) is subject to the approval of the surface managing agency (SMA).
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	No regional planning requirements, although the 1980 Act (which applies only to "the Area" beyond national jurisdiction) calls for application of various relevant principles of international law: conservation of resources, protection of environmental quality, promotion of safety of life and property at sea, and non-interference with high-seas freedoms of other countries and their citizens and vessels. [1] (Since passage of the 1980 Act, entry into force of UNCLOS established an International Seabed Authority charged with regulating environmental and other aspects/consequences of activities in the Area. The US is not formally subject to ISA regulations, however, since it has yet to ratify/accede to UNCLOS. Since adoption of UNCLOS, US orientation to deep seabed mining has shifted to a focus on the US EEZ.)

Table A2. Policy Objectives

Activity	Resource	Jurisdiction	Policy Objectives
wind energy/power plant siting	ocean wind	Germany	By the year 2010, a target of 12.5% of energy generation is to be supplied by renewable energy. Offshore wind energy is to be developed in a step-by-step approach, following the precautionary principle. Protected areas are to be identified where no wind farming may occur. The German policy relies upon European Union directives relating to environmental impact assessments, habitats, and bird conservation.
wind energy	ocean space	Belgium	Federal "rational use of energy" (RUE) policy requires that all energy suppliers include a minimum of 3% renewables among their energy sources (6% minimum for electricity suppliers) [3]. (Very low by EU standards. Wood-based biomass is the most important renewable, about 90%, followed by hydro, then wind.) Other top federal energy policy objectives are progressive disengagement from nuclear power (complete stop by 2025) and market liberalization.[4] Within these guidelines, the 3 regional govts have their own energy objectives that they pursue under "instruments of co-ordination" with the central govt. The regional govts. have many areas of authority, notably economic activities and land-use planning, which give them jurisdiction over land-based wind farms. However, all offshore wind farms are under federal jurisdiction
wind energy	submerged lands	North Carolina	North Carolina has adopted various policies and measures designed to create a market and incentives for companies to develop and sell renewables-generated electricity. This includes wind power, for which the state resource is considerable. One state-supported initiative is exploring key issues posed by the development of coastal wind power, including existing public attitudes and the prospect of securing special development permits given current rules that allow only docks, boat ramps, and walkways to be built in navigable waters of the state. (Because of the need to run power distribution lines, this requirement is seen by the NC Coastal Resources Commission as applying even to windfarms in federal waters that would be connected to land via NC state waters.) [2]
wind energy	state waters and submerged lands	New York State	The 2002 state energy plan calls for a 50% increase in renewables' share of state energy use by 2020. Governor announced a renewable portfolio standard in 2003 that calls for at least 25% of electricity purchased in the state ultimately to come from renewable sources. Among other state initiatives in line with these goals, the state-owned Long Island Power Authority issued an RFP for development of an offshore wind-powered electricity station of at least 100 MW capacity in designated areas off the southern coast of Long Island.[2] LIPA and its selected developer, FPL, have applied to USACE for a permit to develop a 140 MW facility.
wind energy	state submerged lands	Texas	Under the Texas Constitution, the Texas General Land Office has a responsibility to maximize assets on state lands to fund the Permanent School Fund.

Activity	Resource	Jurisdiction	Policy Objectives
wind energy	ocean space	Denmark	Denmark has set a target of 50% of electricity consumption (5,500MW) to be produced by onshore and offshore wind power by 2030. Denmark has a policy for consumers to choose electricity suppliers, but the effectiveness of this policy is constrained by the lack of domestic and international grid connections. Denmark has the legal right to exploit ocean energy of all types from its territorial sea and EEZ. Denmark began with an offshore wind "demonstration program" and is now moving toward large-scale wind farms selected on the basis of a public tender.
wind energy	ocean space	United Kingdom	Provide an assured market for wind power for 25 years. The UK "Renewables Obligation" sets target levels of energy supply from renewable energy sources. Protect ecological processes and
wind energy	public lands	United States	One strategy of the Bush Administration's National Energy Policy is the diversification of methods of domestic energy production, including the development of wind energy . BLM's policy is to encourage the development of wind energy in "acceptable areas." At the same time, BLM policy is to minimize negative impacts to natural, cultural, and visual resources on the public lands by avoiding special management areas with land use restrictions. Title V of the Federal Land Policy and Management Act (FLPMA)
wind energy	ocean space	France	France has an EU commitment to increase its electricity production from renewable sources from 15% (in 2002) to 21% by 2010. Land-based wind is expected to contribute most of the increase, whereas offshore wind is not expected to make any significant contribution until after 2010.[2] The French govt. currently assumes that offshore facilities will be sited within the territorial sea; rationales apparently include cost; the notably inhospitable conditions further offshore in the French EEZ (e.g., significantly greater depths, turbulence, etc., relative to the Baltic and other European locations); and the absence of national law and rules concerning such constructions in
wind energy	ocean space	Sweden	Country must reduce GHG emissions by 4% 2008-2012, relative to 1990 emissions (a domestic goal that exceeds Kyoto obligations). Local authorities must have approved plans for 10 Twh/yr of wind power by 2015.
wind energy	public land	Japan	Stabilize GHG emissions at 1990 levels (6% cut as of about 2000); provide 3.1% of Japan's primary energy supply from renewable resources by 2010 (compared to 2.1% in 1996). For wind, which is expected to contribute the least, the corresponding target increase is from 14 MW to 150 MW. (Quite low relative to other Kyoto Protocol Annex I countries, because areas in Japan with good wind resource are remote from population and industrial centers). Biggest contribution to come from PV, followed by waste power generation and geothermal.)[1]
wind energy	public land	Spain	A key objective of Spanish energy policy generally is to have a secure supply of low-cost energy from a range of domestic sources. (Only 24% of primary energy supply is from domestic sources.) A national goal is for renewables to constitute 12% of total primary energy supply by 2010 and to account for 29% of all electricity generated.[1] Also, Spanish govt. is keenly aware that turbine design is one of very few industries where Spain has a global profile (the others being olive oil and

Activity	Resource	Jurisdiction	Policy Objectives
wind energy	ocean space	Ireland	"It is government policy to promote the use of renewable energy to generate power, including electricity. . . . Abstraction of wind, wave and tidal energy contribute positively to environmental protection." The Minister is to seek an economic return from licensed activities within the coastal zone: "It is the policy of the Minister for the Marine and Natural Resources to maximize the use of Ireland's offshore resources. In so doing he is anxious to maximize the value of these resources to the State and to protect, to the maximum extent practicable, the environment and rights of other users. He will have regard for the competing demands on these resources both in general and in regard to particular areas. The possibility of offshore electricity generating stations being designed in such a way as to contribute, in a positive way, to the regeneration of fish stocks will receive ongoing consideration." [1]
wind energy	ocean space	Netherlands	(1) Reduce EU dependence on limited foreign energy supplies. (2) Reduce environmental impacts of growing fossil fuel consumption. Renewables are targeted to account for 10% of primary energy consumption and about 25% of electricity by 2020. Wind share of renewables (all uses) is projected to be 16%. For reasons of space, most of the growth in wind power will have to come from offshore farms. (3) Reduce share of imported renewable electricity and stimulate investment in domestic capacity. (Policies have been characterized as unusually national in focus relative to those of other EU Member States.)
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Apparent (but not stated) objective of the original 1970 Act was to allow for the orderly development and utilization of geothermal steam and associated resources (primarily for commercial electricity generation) on public, withdrawn, and acquired lands administered by the Sec. Interior or the Forest Service (Agriculture). The apparent (but not stated) objectives of the 2005 amendments are (1) to provide stronger incentives for commercial (electricity) development of recently identified areas with high resource development potential (see Resource Assessment); and (2) to lower barriers to "direct use" applications (I.e., uses other than commercial electricity generation, such as district and space heating or building heating and cooling) of lesser-quality geothermal resources.
livestock grazing	public domain rangelands	United States	Public domain lands are to be managed for multiple use and sustained yield. The US is to receive fair market value for the use of public lands.
electricity generation	ocean thermal energy	United States	Regulate commerce, promote energy self-sufficiency, and protect the environment, by establishing procedures for the location, construction, and operation of ocean thermal energy conversion facilities and plantships to produce electricity and energy-intensive products off the coasts of the United States; make financial assistance available for the construction and operation of OTEC facilities and plantships.

Activity	Resource	Jurisdiction	Policy Objectives
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	1. To protect as national monuments historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest* that are situated on federal lands. (Antiquities Act) 2. To authorize the President to declare federal lands as national monuments for the purpose of protecting sites and objects of antiquity. (Antiquities Act) 3. To make illegal the destruction, excavation, or removal of archaeological resources from federal or Indian lands (except OCS lands), except with a permit that may be issued only to reputable scientific and educational institutions and their duly authorized agents, and only if the resulting activities will increase knowledge about archeological resources. (Natl. Historic Preservation Act, ARPA) 4, To promote cooperation and information exchange between government authorities, the professional archaeological community, and private individuals with collections and data obtained prior to enactment of ARPA. (ARPA) *NOTE: "Scientific interest" has frequently been used by presidents as a rationale for declaring special geologic features and scenic landscapes as national monuments, many of which Congress has eventually redesignated as national parks (which enjoy greater protections and larger budgets).
port siting	ocean space	United States	Authorize the location, ownership, construction, operation of deepwater ports in waters beyond state seaward boundaries. Prevent or minimize adverse marine environmental impacts as a consequence of the development of deepwater ports. Protect the interests of the United States and adjacent coastal states in the location, construction, operation of deepwater ports. Protect the rights and responsibilities of states and communities to regulate growth, determine land uses, and protect the environment. Enhance the safety and economic viability of importing oil into the United States and transporting oil from the outer Continental Shelf.
offshore aquaculture	ocean space (EEZ)	United States	". . . (1) Support an offshore aquaculture industry that will produce food and other valuable products, protect wild stocks and the quality of marine ecosystems, and be compatible with other uses of the Exclusive Economic Zone. (2) Encourage the development of responsible marine aquaculture in the Exclusive Economic Zone by providing the necessary authorities and procedures for offshore marine aquaculture operations, demonstrations, and research, through public-private partnerships. (3) Establish a permitting process for aquaculture in the Exclusive Economic Zone to encourage private investment in aquaculture operations, demonstrations, and research. (4) Promote research and development in marine aquaculture science, technology, and related social, economic, legal, and environmental management disciplines that will enable marine aquaculture operations and demonstrations to achieve operational objectives while protecting marine ecosystem quality."
ocean disposal of wastes	ocean waters/marine environment	United States	Regulate dumping of all types of material into ocean waters and prevent or strictly limit unregulated dumping of material into ocean waters that endangers human health, welfare, and amenities and the marine environment, ecological systems, and economic potentialities. More specifically, regulate the transportation of material from the US for dumping into ocean waters (as opposed to the discharge of material from land-based outfalls), and the dumping into a US territorial sea or contiguous zone of material transported from outside the US. (Ocean Dumping Act is implementing legislation for the London Convention).

Activity	Resource	Jurisdiction	Policy Objectives
mineral extraction	placer and lode	United States	Settlement of the western United States. Promotion of mineral prospecting and development on the US federal lands (originally applicable to all valuable minerals except coal). Opportunity to obtain a clear title (a "patent") to mines on the public lands. A congressional moratorium has been in place on patents since 1995.
hydrocarbon extraction	offshore oil and natural gas	United States	Provide access to lands of the US Outer Continental Shelf for private firms to extract oil and natural gas resources. Receive fair market value from the disposition of OCS lands. [1] Promote exploration for and production of natural gas and crude oil in deep water in the western Gulf of Mexico, and development of related deep water infrastructure. (Deep water defined as 200 m or deeper; western Gulf of Mexico defined as west of 87 deg 30 min W longitude, i.e., the Florida-Alabama boundary.)
hydrocarbon extraction	oil and natural gas	United States	In 1920, for national security purposes, defense-related minerals, such as hydrocarbons, were removed from the mineral patenting system of the Mining Law of 1872. Under the Mineral Leasing Act, these minerals were to be disposed of through a leasing process. Because the land remains in the public domain, the public retains the right to exploit the resource directly in a national emergency. BLM is to manage the federal public domain for multiple uses and sustained yields. BLM provides access to the public domain lands for oil and natural gas exploitation by issuing leases to private parties. BLM attempts to realize fair market value for the leases it offers. 50 percent (90 percent in Alaska) of the revenues obtained from oil and gas leasing are shared directly with the state where the leases are located. Another 40 percent of revenues are shared indirectly with the continental states.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Fivefold purpose enumerated in Act: 1. to encourage successful conclusion of UNCLOS; 2. to establish an interim program to regulate the exploration for and commercial recovery of hard mineral resources of the deep seabed by US citizens, pending the entry into force for the US of UNCLOS; 3. to accelerate the program of environmental assessment of exploration for and commercial recovery of these resources, and to assure that such activities are conducted in a manner that will encourage the conservation of such resources, protect EQ, and promote the safety of life and property at sea; 4. to encourage the continued development of relevant technology; and 5. pending entry into force for US of UNCLOS, to provide for the establishment of an international revenue-sharing fund the proceeds of which will be used for sharing with the international community pursuant to UNCLOS. [1]

Table A3. Lead and Coordinating Agencies

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
wind energy/power plant siting	ocean wind	Germany	Federal Maritime and Hydrographic Agency (BSH) in the EEZ.	Federal Ministry for Environment, Nature Conservation, and Nuclear Safety; Federal Ministry of Economics and Technology; Federal Ministry of Transport, Building, and Housing; Federal Ministry of Consumer Protection, Food, and Agriculture; Federal Ministry of Defence. The German Lander are responsible for licensing offshore wind facilities in the 12nmi territorial sea. The federal government has responsibility for the EEZ.
wind energy	ocean space	Belgium	Energy Administration of the Ministry of Economic Affairs [4]	3 federal entities: 1-Commission for Regulation of Electricity and Gas (for the liberalized segments, including offshore wind) (For non-liberalized market segments, the corresponding authority is the Control Committee for Electricity and Gas) 2-CONCERE/ENOVER (State/Regional Energy Consultation)--Permanent working body to ensure coherence between federal and regional policies; gives advice and makes recommendations but has no regulatory authority 3-Managaement Unit of the North Sea Mathematical Models (MUMM), a dept.of the Royal Belgian Institute of Natural Sciences (for formulation of an EIA; also provides a non-binding opinion as to whether license should be granted) Note: in the case of land-based wind farms, the following regional entities have coordinating roles: Walloon Region: General Directorate of Technology, Research and Energy (DGRE)--energy policy and research Brussels-Capital Region: Brussels Institute for Environmental Management (IBGE, BIM), in charge of matters related to energy Flemish Region: 1-Division of Natural Resources and Energy (ANRE) within Admin of the Economy (answerable to Dept. of the Economy, Employment, Internal Affairs and Agriculture of the Ministry of the Flemish Community) 2-Flemish Institute for Technological Research 3-Institute for the Advancement of Scientific and Technological Research in Flanders 4-Flemish Institute for the Rational Use of Energy (VIREG)--responsible for actively engaging the players in the RUE policies; coordinating Flemish initiatives; ensuring best use of public funds

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
wind energy	submerged lands	North Carolina	USACoE and NC Coastal Resources Commission (as per NC CAMA)	Likely to include a host of federal and state agencies plus (potentially) municipalities and tribes: Federal: DoD, DoI, EPA, FAA, FERC NC: Dept. of Environment and Natural Resources (Divs. Of Coastal Mgmt, Water Quality, Marine Fisheries); Depts. Of Cultural Resources, Tourism, Commerce, Administration, NC Public Utilities Cmsn and NC Coastal Resources Cmsn Local: Planning and zoning boards, tribal nations
wind energy	state waters and submerged lands	New York State	Federal: USACE State: NY State Dept. of State (NYSDOS), Coastal Management Program (federal consistency review)	FAA, USCG, Interior (USFWS, NMFS, and possibly Sec. Interior for compliance with Archaeological and Historic Preservation Act [1] State: Dept. of Environmental Conservation (use and protection of waters; tidal wetlands; coastal erosion management) and, NY State Office of General Services (lease or easement for lands underwater) Local: Town Planning Board
wind energy	state submerged lands	Texas	Texas General Land Office	Army Corps of Engineers Texas Coastal Coordination Council (policy-making and oversight of the state Coastal Management Program)
wind energy	ocean space	Denmark	Danish Energy Authority (DEA) in the Ministry of Economic and Business Affairs (MEBA)	The Danish wind energy siting framework has been under reconsideration by a working group within the Economic and Business Affairs Ministry (recommendations were due in November 2002). DEA acts as the "one-stop" coordinating agency for wind power project proposals.
wind energy	ocean space	United Kingdom	Offshore Renewables Consents Unit of the UK Department of Trade and Industry (DTI)	-Marine Consents and Environment Unit (MCEU), Dept. for the Environment, Food and Rural Affairs -Consents and Emergency Planning Unit of the Scottish Executive (for territorial waters adjacent to Scotland) Other permissions needed under various acts: -Electricity Act 1989 -Food and Environment Protecftion Act 1985 Coast and Protection Act 1949 Town and Country Planning Act 1991 Transport and Works Act 1992
wind energy	public lands	United States	Bureau of Land Management (BLM), Department of the Interior (DoI)	National Renewable Energy Laboratory (NREL), Department of Energy (DoE). National Wind Coordinating Committee (NWCC). Fish and Wildlife Service (FWS), Department of the Interior (DoI);

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
wind energy	ocean space	France	1. Ministry of Equipment, Transport, Housing, Tourism and the Sea (represented by the Prefects of the various departments [comparable to US states]; exercises the central government's authority as landowner of the seabed up to 12 nm, known as the Marine Public Domain) 2. Maritime Prefecture within the Secretariat General of the Sea (representing all ministers at sea except for the Marine Public Domain) NOTE: There is so far no regulation defining how to apply France's rights to regulate the building of structures such as windmills or the laying of cable in the EEZ. Consequently, there is technically no competent authority for such activities beyond the territorial sea.	Ministry in Charge of Industry, Directorate General for Energy and Raw Materials (DGEMP) (national energy policy) Ministry of Environment and Sustainable Development Agency for the Environment and Energy Resources (ADEME, a state entity with industrial and commercial character and a major actor in French wind energy, with a delegation in each region)
wind energy	ocean space	Sweden	Municipality or National Judicial Board for Public Lands and Funds (for projects in territorial sea, and depending on project size) or Dept. of Environment (for all projects in EEZ)	Within territorial sea: -Environmental court on water activities or regional state authorities (depending on size of project) Outside territorial sea: Ministry of Industry, Employment and Communications Swedish Energy Agency National Board of Housing, Building and Planning National Judicial Board for Public Lands and Funds
wind energy	public land	Japan	Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry	

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
wind energy	public land	Spain	Somewhat ambiguous as to whether federal government or Autonomous Communities have the lead role (as is true for many policy matters in Spain). In general, however, the Autonomous Communities in which major wind farms are located have asserted their authority to regulate size, location, and related environmental and other technical matters. (The relevant federal agency focuses on market conditions and business arrangements). Within the Autonomous Communities, environmental matters (including wind farm siting, scale, etc.) are generally handled within the Department of Industry/Commerce or the Department of Infrastructure/Land Use; only Andalusia has an Environmental Department per se.)	Directorate for Electricity of the National Energy Commission (CNE), established under Law 54/1997. (Statutory mission is to ensure effective competition, objectivity and transparency in the functioning of energy markets to the benefit of all agents, including consumers)[4]
wind energy	ocean space	Ireland	Foreshore Administration section within the Department of Communications, Marine and Natural Resources (until recently, Dept. of the Marine and Natural Resources). Responsible for Foreshore legislation, leases, and licenses insofar as marine regulatory issues and management of the property function are concerned. (The foreshore is defined as the land and seabed between the high water of ordinary or medium tides and the 12-nm limit of the territorial sea. Note: Ireland has declared a 200-nm EFZ, not an EEZ.)	Commission for Energy Regulation (until recently, Comsn for Electricity Regulation; oversees regulation of the electricity and gas markets; is responsible for licensing of electricity generation and supply and (re)construction authorization for new generating plant. Foreshore Leases (issued by the Minister of Marine and Natural Resources) require that the applicant has secured (or at least has applied for) three permissions from the Commission for Energy Regulation: an authorization to construct a generating station, a license to generate electricity, and a license to supply electricity. Local planning authorities must be consulted about the land-based elements of an offshore generating station, as per the Local Government Planning and Development Acts and Regulations.

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
wind energy	ocean space	Netherlands	NOVEM (Dutch Agency for Energy and the Environment) NOTE: There are as yet no established, uniform rules or procedures for offshore wind installations. [2] The two installations initiated so far (government's NSW in the territorial sea and a commercial venture 25 km offshore) have been subject to different procedures in the pre-exploitation phase, the government having opted, as a result of consultations with NGOs, to follow an especially heavy administrative procedure under the Dutch physical administration law. [1]	Ministry of Economic Affairs (energy policy); Ministry of Agriculture, Nature Management and Fisheries; Ministry of Transport, Public Works and Water (North Sea matters); Ministry of Management and Housing, Spatial Planning and the Environment
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Bureau of Land Management or, occasionally, Minerals Management Service (Interior)	Sec. Interior needs concurrence of Sec. Agriculture for lease applications involving Forest Service lands. Also, an Interagency Agreement (which expired in 1992 but is still adhered to by some BLM state offices) prescribes coordination among BLM, NPS, USGS, and FS in reaching a determination as to whether a given lease would reasonably likely result in adverse effect on a listed "significant thermal resource" within a national park (see Area Selection). In addition, the 2005 amendments direct the Secs. Of Interior and Agriculture to enter into an MOU that establishes (1) administrative procedures to expedite geothermal lease applications; (2) an updatable 5-yr program for geothermal leasing; (3) a program for reducing the backlog of pending lease applications (see Management): and (4) a joint lease and permit application data retrieval system. The Amdmts also direct the Secretary to coordinate with appropriate State agencies to coordinate unitization and pooling activities whereby lessees jointly develop resources on separate tracts that cannot be independently developed and operated.
livestock grazing	public domain rangelands	United States	Bureau of Land Management (BLM), US Department of the Interior; Forest Service (USFS), US Department of Agriculture	

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
electricity generation	ocean thermal energy	United States	NOAA (OCRM)	I. Necessary approvals: Army Corps (permit concerning obstructions to navigation), Coast Guard (safety at sea of OTEC facilities and operations), and Energy (in the event of multiple proposals for the same area, determination as to which project or combination of projects best serves the national interest [see Allocation Method]) II. Required consultation: EPA, plus Departments of Energy, Transportation, State, Interior, and Defense, to determine their views on the adequacy of an application and its effect, from the standpoint of legal considerations, on programs within their jurisdiction. Agencies not in favor must provide their objections in detail and suggest how the application can be amended or the license conditioned so as to bring it into compliance. Similar consultation requirements concerning Governors of affected coastal states with approved CZM programs in place (OTEC projects must meet CZMA consistency requirements)
protection and lawful excavation/removal in the public	archaeological resources on public and Indian lands	United States	Under the Antiquities Act, primary permitting authority resided with secretaries of Agriculture, Interior, and War, depending on which had jurisdiction by virtue of the location of the object/lands in question Today, under the Archaeological Resources Protection Act (ARPA), all federal agencies/departments with federal lands management responsibility have permitting authority, although the law and regs provide for (encourage) the delegation of such authority to the Sec. Interior. Most often the lead agency is the National Park Service, followed by BLM and the Bureau of Indian Affairs, all within Interior. Other agencies that sometimes issue permits are the Forest Service (Agriculture), the Defense Department (mainly the Army) and the Tennessee Valley Authority.	The federal land manager (usually Interior) must obtain the concurrence of the relevant tribe when Indian lands are involved. Also, when the managing agency is outside Interior, it will coordinate either with Interior (which has a resident Consulting Archaeologist) or with the Smithsonian for archaeological advice/recommendation (which need not be followed, as long as cause can be shown). Occasionally there is coordination between federal land managers because the area in question crosses jurisdictional boundaries and therefore requires that applications be submitted to more than one agency.

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
port siting	ocean space	United States	The Department of Transportation (Maritime Administration) and the Department of Homeland Security (US Coast Guard) share the authority to license deepwater ports. MarAd is primarily responsible for financial reviews, and it has the ultimate authority to issue, transfer, amend, or reinstate deepwater port licenses. USCG is primarily responsible for environmental, public health, and safety reviews. A current legislative proposal would transfer this authority to the Federal Energy Regulatory Commission (FERC).	Department of the Interior and NOAA consult with USCG and MarAd regarding potential adverse effects on the environment, interference with authorized OCS uses, or threat to human health and welfare. EPA must find a license application in conformance with the Clean Air Act, the Clean Water Act, and the Marine Protection, Research and Sanctuaries Act. The Defense Department, Army Corps of Engineers, and the State Department all consult on the adequacy of the Application. Adjacent state governors must approve a license.
offshore	ocean space (EEZ)	United States	Currently: Army Corps of Engineers As proposed under 2005 bill: NOAA (Permitting decisions by Sec. Commerce; concurrence of Sec. Interior required for sites located on leases or easements issued under the OCSLA)	Currently: 2005 bill: Various, especially NMFS, regional FMCs, coastal states and affected tribes
ocean disposal of wastes	ocean waters/marine environment	United States	EPA (authority for setting review criteria, designating recommended sites, and issuing permits for most categories of materials; Army Corps of Engineers (authority to permit, with EPA concurrence, the disposal of dredge materials, which account for nearly all ocean dumping today.)	Coast Guard has responsibility for surveillance of dumping activities and enforcement of relevant laws, regulations, and conditions of individual dumping permits. NOAA coordinates with EPA and other relevant departments on research into long-range effects of pollution, overfishing, and other anthropogenically induced ecosystem effects. In some instances, state CZM officials must be consulted when proposed dumping may have an effect on state waters or otherwise be inconsistent with state CZM program.
mineral extraction	placer and lode minerals	United States	Bureau of Land Management (BLM), US Department of the Interior	
hydrocarbon extraction	offshore oil and natural gas	United States	Minerals Management Service, US Department of the Interior	
hydrocarbon extraction	oil and natural gas	United States	Bureau of Land Management (BLM), US Department of the Interior	US Environmental Protection Agency (EPA) [particularly with respect to the maintenance of a record of decision (ROD), including a resource management plan (RMP) and its associated EIS]

Activity	Resource	Jurisdiction	Lead Agency	Coordinating Agencies
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	NOAA (originally the Office of Ocean Minerals and Energy; checking on current identity of this office/function) [2]	State, Transportation (or, currently, Homeland Security, as the current home of USCG), Justice (antitrust), Interior, Defense, Treasury, Labor, EPA, FTC, SBA, NSF, and any affected regional FMC [2]

Table A4. Resource Assessment

Activity	Resource	Jurisdiction	Resource Assessment
wind energy/power plant siting	ocean wind	Germany	The federal government identifies areas "especially suitable" for siting offshore installations (this does not preclude the possibility of siting a facility in an unidentified
wind energy	ocean space	Belgium	[Apparently done by potential developers.]
wind energy	submerged lands	North Carolina	Undertaken in 2002 by TrueWind Solutions, LLC, for the NC State Energy Office [2]
wind energy	state waters and submerged lands	New York State	Completed for offshore Long Island by AWS Scientific, Inc., with the sponsorship of the NY State Energy R&D Authority (NYSERDA) and the state-owned Long Island Power Authority (LIPA). [3]
wind energy	state submerged	Texas	By wind energy developer, who will pay annual lease rent until actual energy production begins.
wind energy	ocean space	Denmark	Wind resource assessments have for several decades been a major research activity of the Riso National Laboratory, a government entity within the Ministry of Science, Technology, and Innovation. The Riso Wind Energy Department developed, and now markets and provides training and user support for, the Wind Atlas Analysis and Application Program (WAsP), which is considered a worldwide industry standard tool for wind resource assessment. In collaboration with the Technical University of Denmark, Riso also maintains an extensive database on wind characteristics and turbine performance at dozens of locations, which is available for use by industry members and government and private researchers.
wind energy	ocean space	United Kingdom	Industry and academia have played the main roles, in some cases with the support of DTI. A recent example of government-funded research is a study on the UK wind resource by the Environmental Change Institute at Oxford University.[2] Less directly, DTI facilitates wind resource assessment (and many other technology R&D efforts) through its Council for the Central Laboratory of the Research Councils (CCLRC), which was formed to promote high-quality scientific and engineering R&D projects through the provision of facilities, technical expertise, and a nexus for collaboration.
wind energy	public lands	United States	Collaboration between BLM and NREL to inventory "high-potential" wind energy resources on the public lands of the western United States. "Sufficiently detailed" wind data must be supplied by site-testing and monitoring grantees to support the review of a proposed commercial development.
wind energy	ocean space	France	As of July 2002, ADEME categorized offshore wind energy as a renewable source that still required major R&D initiatives to improve profitability and marketability.

Activity	Resource	Jurisdiction	Resource Assessment
wind energy	ocean space	Sweden	Conducted by National Energy Administration (which was established 1998). Begun 1999, when a commission concluded that a major expansion of the Swedish wind sector would not occur without wind surveys and resource planning, especially in offshore and mountain areas. [2] As of November 2004, 49 areas in 13 counties have been designated of national interest for wind power. Assessment includes consideration of
wind energy	public land	Japan	NEDO carried out a wind resource measurement study 1990-94. In 1999, NEDO launched an R&D program called the Development of Local Area Wind Energy Prediction Model (see also Area Selection),[1]
wind energy	public land	Spain	Began as a federal initiative in 1979, then evolved into a combination of government (mainly regional) and private efforts, most of which occurred 1981-1986. [2] Spain has an unusually large wind resource on land, especially in the southwest.
wind energy	ocean space	Ireland	Government commissioned a study, completed in 2000, which concluded that the island's overall wind energy resource is "very significant." In terms of individual projects, however, resource assessment is carried out by the prospective developer, under a Foreshore License issued for the purpose.
wind energy	ocean space	Netherlands	Assessment was initiated by a Dutch company, ECN (Energy research Center of the Netherlands), whose clients include the Dutch government, the wind power industry, the International Energy Agency, and the EU. Under contract to IEA and EU, ECN has developed and regularly updates a "Database on Wind Characteristics" that includes a growing number of European and other developed countries that support the initiative. ECN persuaded the Dutch government to join this effort in the mid-1990s, when it began an effort, completed in 2004, to add to the database new information on the wind resource in the Dutch part of the North Sea.[4,5]
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Has been done through a combination of private efforts and periodic public study. Last major public assessment was completed in 1978. Recently, DOI/BLM and DOE/NREL have conducted a more focused study (released April 2003) that identifies and provides information about 18 BLM Planning Units with high, near-term geothermal power development potential. (Most resources/ leases on federal lands occur in CA and NV. Other states with federal leasing activity include UT, NM, OR, and HI. Newly identified Planning Units occur in all these states, plus WA.)[5,6] 2005 Amendments call for an updated assessment, to be led by USGS and completed within 3 years.
livestock grazing	public domain rangelands	United States	BLM inventories its lands and develops land use plans for specific planning units. 150 land use plans cover all BLM lands. BLM estimates that more than 50 percent of the existing land use plans need to be revised or replaced. Grazing occurs on 164 million acres of BLM lands and 95 million acres of USFS lands. Forage grazed from these lands is only 2 percent of the total forage consumed by beef cattle in the United States.

Activity	Resource	Jurisdiction	Resource Assessment
electricity generation	ocean thermal energy	United States	DOE (NREL) has collaborated in and/or funded studies and demonstrations of OTEC technology since the 1970s, most of which has been located in Hawaii and sponsored by the Hawaii state government as well. The technology is suited mainly to tropical coastal areas (Hawaii, Guam, USVI), where relevant electricity markets may be inadequate to offset the considerable investment costs. (High investment stems from the difficulty of energy extraction through OTEC, which has an overall efficiency of just 1 to 3 percent. [5])Other applications of the technology now appear more economically promising, especially cold-water aquaculture and cold water production/coastal cooling, which are currently being studied in Hawaii under the sponsorship of the state and commercial enterprises that use the cold water. (NREL's ocean energy program has been inactive since at least 2000.)
protection and lawful excavation/removal in the public	archaeological resources on public and Indian lands	United States	Archaeological assessments are initiated and performed mainly by the permit holders. Other, more general assessments are carried out mainly by USGS or the National Park
port siting	ocean space	United States	None.
offshore	ocean space (EEZ)	United States	Performed primarily by applicants/operators, but NOAA coordinates with various management agencies to identify areas in federal, state, and local waters that are appropriate for aquaculture facilities.
ocean disposal of wastes	ocean waters/marine environment	United States	NOAA is charged with conducting comprehensive, long-term research on the effects of ocean dumping, as well as pollution, overfishing, and other human-induced changes on the marine environment. EPA is charged with research to support designation of recommended ocean dumping sites (preferably beyond the continental shelf), assess technology advances to reduce environmental effects, and evaluate alternatives to ocean
mineral extraction	placer and lode minerals	United States	Private sector prospecting.
hydrocarbon extraction	offshore oil and natural gas	United States	One billion acres of non-moratorium OCS lands are potentially available for development. Potential leasing areas are assessed at a very general level during a five-year lease planning process. Areas that are identified for sale at auction are evaluated by both federal officials and private oil and gas firms for their resource potential. Firms may collaborate in joint prospecting efforts and share the resulting data.
hydrocarbon extraction	oil and natural gas	United States	BLM undertakes a land-use planning process for the US public domain lands that includes an assessment of those lands that have oil and natural gas potential. Resource management plans (RMPs) detailing multiple uses are a product of the land-use planning

Activity	Resource	Jurisdiction	Resource Assessment
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Comparatively little known about the seabed hard minerals resource potential, in part because only four private/commercial concerns have applied for exploration licenses to date. Government efforts to inventory US EEZ resources have included early surveys by USGS; a joint project (1983-92) of the NOAA Geophysical Data Center and the MMS Office of International Activities and Marine Minerals to compile a computerized bibliography and geochemical database on offshore marine mineral deposits (with citations and analyses dating from 1831 through 1990); and, more recently, a USGS project (2003-08) to fill in data gaps with new information on US Pacific EEZ mineral deposits. [4,5] Also contributing to knowledge of US Pacific resources has been work by the Marine Minerals Resource Centers (MMRC), a joint venture of U. Hawaii, U. Mississippi, and U. Alaska, and "the only government sponsored university research program in the United States that addresses sustainable development of seabed minerals." [6] In the past decade, the International Seabed Authority, established under UNCLOS to regulate mining in The Area, has chartered modeling studies of deep seabed hard minerals resources in the Indian Ocean and the Clarion-Clipperton Fracture Zone.

Table A5. Area Selection

Activity	Resource	Jurisdiction	Area Selection
wind energy/power plant siting	ocean wind	Germany	Areas "potentially suitable" for siting offshore wind energy must be identified jointly by the appropriate ministries. Studies for identifying suitable sites for both offshore installations and protection areas are to be linked. A first "expansion phase" focuses on the identification of potentially suitable nearshore EEZ areas that are most likely to be proposed for development before 2010. "Potentially suitable areas" are areas for which studies are still in progress. Eventually, "potentially suitable areas" are to be designated as "especially suitable areas." A second expansion phase will focus on identifying areas even
wind energy	ocean space	Belgium	Following strong popular opposition to several proposed offshore wind farms, in 2004 the Belgian government set aside 167 sq km (64 sq mi) to locate windfarms out of sight of land. In a new govt. planning document for the North Sea, a sand bank 27 km (~ 17 mi) from the coast marks the landward perimeter of the area, which will accommodate approximately 2000 MW of wind plant. [6] (Previously applicants were required to propose locations, which were subject to approval by MUMM. NOTE: For land-based installations (wind, hydro and PV), measures have been taken to integrate plans for renewable energy with regional and municipal planning, using GIS and including a new inventory of potential sites [4]
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	Developers propose specific site(s) within area designated eligible by the state power authority. For such designation, a database of siting parameters was analyzed to identify the LI offshore areas possessing the most preferred combination of attributes for a 100 MW or greater wind project. [3] The most influential factors were water depth, distance from shore (at least 2.5 nm), transmission access, bird activity, and area requirements (5 sq nm
wind energy	state submerged lands	Texas	As proposed by wind energy developers.
wind energy	ocean space	Denmark	Possible locations for wind farms were identified from 1992 to 1995 by an Offshore Wind Turbine Committee within the Ministry of Environment. Wind power siting was to be concentrated in 5 main areas, considering water depth limitations, potential impacts on coastal landscapes, MPAs, and other ocean uses.
wind energy	ocean space	United Kingdom	Sites are proposed by developers to DTI in "rounds." Successful developers in Round 1 compete for one of three "strategic areas" in Round 2.
wind energy	public lands	United States	BLM field offices are encouraged to use FWS guidelines for the "pre-development" evaluation of potential wind resource areas based upon their impacts on wildlife.

Activity	Resource	Jurisdiction	Area Selection
wind energy	ocean space	France	So far, no directly applicable legislation. Secretariat-General of the Sea has recommended (Dec. 2002) that the State designate a limited number of appropriate zones, based on a study that takes into account existing uses, the wind resource, technical feasibility, environmental effects, and cumulative impacts. Info on the status of this recommendation is not readily available.
wind energy	ocean space	Sweden	Municipalities draw up comprehensive plans for their land territories and corresponding territorial sea areas. They have been asked to identify suitable land and sea areas for wind turbines. Through a government decision, the National Planning Authority has been assigned responsibility for working out the general conditions for the siting of large offshore wind farms. [1]
wind energy	public land	Japan	Between 1991 and 1998, NEDO undertook several increasingly large demonstration wind farms on Miyako Island in Okinawa Prefecture. Various area selection initiatives were launched in 1999 as NEDO R&D efforts: -Development of Local Area Wind Energy Prediction Model, which is able to accurately predict the correct siting for wind projects in the complex Japanese terrain; -Development of Advanced Wind Turbine Systems for Remote Islands, designed to utilized the wind resource in Japanese islands where fossil-fuel derived electricity is expensive to produce; and -Research into the feasibility of siting wind turbines offshore. [1]
wind energy	public land	Spain	No uniform process (except that the issue is often hotly contested at the local level, typically between environmentalists and energy providers). The Autonomous Community of Andalusia has (belatedly) prepared a territorial plan--a product of negotiation with various stakeholders--that identifies areas as "forbidden," "possible," or "preferable" wind farm zones. The plan is not legally binding, but has been cited as a model now being followed in other regions of Spain. [2] [NOTE: Despite the fact that parts of Andalusia (esp. far southwest) have some of the best wind conditions in the world and favorable infrastructure conditions, both public support and leadership in turbine technology are notably absent. This has been explained by the fact that Spain's first windfarms proliferated here in a haphazard fashion, and the opportunities for sustained popular support and profitable ventures were squandered.[2]
wind energy	ocean space	Ireland	Applicants select areas, subject to two main restrictions: (1) offshore generating stations are not normally allowed within 5 km of shore, but applicants may advance a case that a facility closer to shore will not unduly interfere with the visual amenity (both landscape and seascape); (2) certain areas are prohibited for reasons of safety at sea, protection of established shipping lanes, air navigation, telecommunications needs, defense requirements, licensed dumping of dredge spoils.

Activity	Resource	Jurisdiction	Area Selection
wind energy	ocean space	Netherlands	Process in transition. Goal is to have federally designated areas in the North Sea EEZ based on new spatial planning capability. In the recent past, processes have been as follows: For the govt-sponsored NSW facility, the government performed a location EIA and conducted public hearings on the proposed siting. The lower house of parliament took testimony, mainly from Cabinet ministers, and approved the choice of location in October 2001. For the first commercial facility beyond 12 nm, location was effectively up to the developer under the Public Works and Water Management Act. This procedure has since been superceded by a new method based on state spatial planning and to include a concession procedure (see Allocation Method).
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	"Qualified" individuals and companies (US citizens, companies) may nominate public lands for geothermal leasing. Geothermal development is prohibited on certain classes of public lands: (1) certain units within the National Park system, including wilderness areas, wilderness study areas, and National Recreation areas; (2) areas outside National Park boundaries where geothermal leasing could, in the opinion of the Secretary, "reasonably likely" result in an adverse effect on any of 16 formally listed "significant thermal resources" (see below) within the National Park System; (3) fish hatcheries or wildlife management areas administered by the Secretary; and (4) Indian trust lands . (Note: Listed "significant thermal resources" were designated in 1988 amendments to the Geothermal Steam Act. In the 2005 Amdmts, the term was stricken and replaced with "land subject to prohibition on leasing.")
livestock grazing	public domain	United States	As of 1990, BLM had an inventory of nearly 162 million acres in 16 western states, which were divided into about 22,000 separate grazing units, known as allotments.
electricity	ocean thermal energy	United States	As proposed by license applicants.
protection and lawful excavation/removal in the public	archaeological resources on public and Indian lands	United States	Applicable areas are federal and Indian lands, from which permit holders select specifically defined areas for archaeological investigation.[1]
port siting	ocean space	United States	Applicant proposes area.
offshore aquaculture	ocean space (EEZ)	United States	Area selection is a function of the permit and operating applications of individual operators. (Under 2005 bill, if enacted, Sec. Commerce would be authorized to collect information independently to evaluate the suitability of sites for aquaculture.)

Activity	Resource	Jurisdiction	Area Selection
ocean disposal of wastes	ocean waters/marine environment	United States	EPA is responsible for designating environmentally suitable dumping sites and for specifying which site is to be used under a given permit. In some cases, the governors of affected states have negotiated (together with EPA) the cessation of dumping at a site (e.g., Long Island Sound) where the activity adversely affects the environment and/or the physical or economic well-being of their residents Permit applicants generally propose which designated site they prefer to use, subject to EPA approval. Applicants may also propose sites not yet designated by the EPA, but both the burden of proving no unreasonable harm and the application processing fees are considerably greater.
mineral extraction	placer and lode minerals	United States	Private sector claims.
hydrocarbon extraction	offshore oil and natural gas	United States	Within 5-year lease planning (FYLP) process, MMS performs multidisciplinary analyses of areas to be offered. A request for industry interest sent out to oil companies. Public comments, comments of state Governors, and the interests of oil companies are analyzed, and a draft leasing program is created. A Final Proposed Program is drafted, which undergoes congressional review.
hydrocarbon extraction	oil and natural gas	United States	BLM develops and implements multiple-use, sustained-yield resource management plans (RMPs). Through its land-use planning process, BLM decides which public lands are to be made available for the exploration, development, and production of oil and natural gas resources. BLM can "withdraw" lands from leasing for up to 20 years (subject to renewal).
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Applicants select the area to be explored/mined and its size (up to 150,000 sq km). Selection will be approved unless the Administrator finds that it is not a "logical mining unit"--I.e.., not capable of being explored within the 10-yr exploration period (or commercially exploited within the initial 20-year commercial recovery period) in an efficient, economical, and orderly manner with due regard for environmental and other

Table A6. Multiple Use Decision-making

Activity	Resource	Jurisdiction	Multiple Use Decision-making
wind energy/power plant siting	ocean wind	Germany	Other uses of the ocean are to be taken into consideration when siting offshore wind facilities, including air and sea navigation, environment protection and nature conservation, commercial uses, such as fishing, oil and natural gas extraction, sand and gravel mining (especially for coastal protection), and military uses. As long as there are alternative low-impact areas that can be utilized for offshore installations, then wind farms will be excluded from designated protection areas. "Important bird areas" are off limits to wind farming, in principle; however, it is possible that a study could allow portions of an
wind energy	ocean space	Belgium	Royal Decree provides that the influence of wind farm activities on other important maritime activities, such as shipping and fisheries, must be considered among the selection criteria used in granting a domain concession. However, in contrast to the 1977 Royal Decree governing installations for marine mining and other activities on the continental shelf, the 2000 Royal Decree does not specify that wind farms shall be sited so as to protect other important uses. Various other uses are otherwise protected, however, under individual national regulations. (Note: building zones for the exploitation of mineral and non-living resources are pre-established by law, whereas the procedure for granting domain concessions for offshore wind requires that building zones be proposed by the applicant.) [1] NOTE: Flemish Region has taken measures to integrate windfarms and other renewable energy facilities in regional and municipal planning, using GIS [4]
wind energy	submerged lands	North Carolina	Currently only water-dependent structures such as docks, boat ramps, and walkways may be built in navigable waters of the state.
wind energy	state waters and submerged	New York State	Area Selection process (for southern coast of Long Island) used an analysis that took into account numerous factors besides the wind resource and technical suitability of sites from the developer's standpoint. The factors that received the most attention were natural resources conservation, fisheries, navigation, risks to bird populations, and cultural and archaeological considerations. [3]
wind energy	state submerged lands	Texas	No information.
wind energy	ocean space	Denmark	Public hearings are required on applications for preliminary survey permits and for building permits. Wind energy siting decisions made by the Energy Authority can be appealed to the Energy Board of Appeal, an independent appeals institution that is also part of the Economic and Business Affairs Ministry.

Activity	Resource	Jurisdiction	Multiple Use Decision-making
wind energy	ocean space	United Kingdom	An 8-13km coastal strip (buffer) is excluded from all strategic areas. Shallow water regions excluded in the North West strategic area due to potential disturbance of birds, visual impacts, and impacts on commercial and recreational fishing, and other recreation. The "consents" process is streamlined by providing for the DTI to extinguish navigation rights through the location of the generating plants in the territorial sea only. At the request of the developer, a discretionary "safety zone" of <500m may be established around each
wind energy	public lands	United States	Wind energy applicants are encouraged to schedule "pre-application" meetings with BLM officials to identify potential issues and conflict areas, including other uses, necessary studies, alternative site locations, and financial obligations. Wind energy applicants are encouraged to notify and involve local communities and other interests early in the application process. Applications are "identified" as a high-priority workload; site testing and monitoring right-of-way applications are to be processed in 30 days. A commercial wind energy development right-of-way grant ordinarily will include stipulations for wildlife and avian resources mitigation and monitoring and site reclamation.
wind energy	ocean space	France	Generally developments in the marine public domain must take into account and accommodate existing activities and uses such as shipping lanes, dredging areas, fisheries, conservation areas, cables and pipelines, etc. Additionally, certain nearshore areas may be covered by so-called Schemes for Development of the Sea (SMVM) established under Law 83-3 of 7 Jan 1983, which are elaborated under the authority of the Prefect and aim to define the purpose of the designated space and ensure coherence of its uses. Eleven such schemes existed as of 2001 and covered in total a rather small area within the territorial sea.
wind energy	ocean space	Sweden	The issue of multiple uses is considered as part of the wind resource assessment process (National Energy Administration).
wind energy	public land	Japan	Basic Environmental Law calls for new development projects to avoid interference with environmental conservation efforts.
wind energy	public land	Spain	
wind energy	ocean space	Ireland	Applicants should first ascertain the requirements of the National Heritage Service of the Dept of Arts, Heritage, Gaeltacht and the Islands (aka the Duchas), which has responsibility for both wildlife (National Parks and Wildlife Division) and national monuments (including shipwrecks). Consultation with the following entities is recommended: Irish Aviation Authority, the Harbor Master or appropriate authority in ports near the proposed site; and NGOs and local tourism and fishing interests. Local planning authorities should be contacted for prior approval of land-based elements of offshore windfarms; common types of authorities include Gas Board, and Inspector of Lights and Marine Superintendent (restricted areas and hazards to navigation).
wind energy	ocean space	Netherlands	?

Activity	Resource	Jurisdiction	Multiple Use Decision-making
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Public lands available for leasing only after they are evaluated through BLM's multiple-use planning process (NEPA, FLPMA). Stipulations could be placed on leases to protect other natural resources through mitigation or restrictions on surface use (e.g., geothermal leasing not allowed on lands within National Parks, wilderness areas, wilderness study areas, or National Recreational areas). [4] New as of 2005: Secs. Of Interior and Agriculture are to give priority to the timely completion of administrative actions associated with lease applications, "including amendments to applicable forest plans and resource management plans. . . . All future [such] plans for areas with high geothermal resource potential shall consider geothermal leasing and development." [1]
livestock grazing	public domain rangelands	United States	Fifty percent of grazing fees (at least $10 million) go into a range betterment fund to rehabilitate, protect, and improve rangelands. Environmentalists are concerned that grazing leads to adverse environmental impacts on the public lands, including soil compaction, increased flooding, coliform pollution in streams, reduced wildlife forage, invasive species introductions, and harm to endangered species habitat. Cattlemen argue that grazing preserves open space and habitat for some types of wildlife.
electricity generation	ocean thermal energy	United States	OTEC Act (Sec. 109) requires that each license include such conditions as may be necessary and appropriate to ensure that construction and operation of OTEC units are conducted with "reasonable regard for navigation, fishing, energy production, scientific research, or other uses of the high seas, either by citizens of the United States or by other nations in their exercise of the freedoms of the high seas as recognized under the Convention of the High Seas and the general principles of international law." In particular, the Administrator must develop regulations that: (1) define the conditions under which an OTEC thermal plume is deemed to impinge on/degrade (a) the thermal gradient used by another OTEC unit and/or (b) the marine area of US natural resource jurisdiction; and (2) establish the terms under which the Administrator will mediate or arbitrate any disputes among licensees regarding such thermal plume effects.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	No multiple use requirements specific to archaeological permits are referenced or spelled out. However, the federal land manager may require any permit terms and conditions deemed necessary to safeguard other legitimate land uses. Also, a permit can be suspended or revoked for "management purposes" (convenience of the government) when continuation of work under the permit would be in conflict with management requirements not in effect when the permit was issued. [2]
port siting	ocean space	United States	USCG establishes "environmental review criteria" to evaluate proposed deepwater ports, including effects on alternate uses of the oceans and navigable waters. Public notice and public hearings are required. At least one public hearing must occur in every coastal state designated as "adjacent." Adjacent state governors must approve the issuance of a license. Deepwater port may not "unreasonably interfere" with international navigation or other reasonable uses of the high seas. Best available technology (BAT) must be utilized by a licensee to prevent or minimize impacts to the environment.

Activity	Resource	Jurisdiction	Multiple Use Decision-making
offshore aquaculture	ocean space (EEZ)	United States	Secretary must consult with other federal agencies "to ensure that offshore aquaculture for which a permit has been issued under this section meets the environmental requirements established under section 5(a) and is compatible with the use of the Exclusive Economic Zone for navigation, fishing, resource protection, recreation, national defense (including military readiness), mineral exploration and development, and other
ocean disposal of	ocean waters/marine environment	United States	"The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation." [1] Approval of a permit application requires separate determinations as to the effects of the proposed dumping on a variety of factors, including "alternate uses of oceans, such as scientific study, fishing, and other living resources exploitation, and nonliving resource exploitation." [2]
mineral extraction	placer and lode minerals	United States	The lands available for prospecting and claiming under the General Mining Law have been reduced by the withdrawal of lands under FLPMA, the Wilderness Act, and other statutes and as a consequence of the enactment of the Mineral Leasing Act and the Materials Act of 1947. Recent regulations governing the surface impacts of hardrock mining on the public lands (so-called "3809" regulations) have been controversial. A Clinton Administration assignment of authority to BLM to prevent mining in the event that it might result in "substantial irreparable harm" to significant resources that cannot be effectively mitigated (so-called "mine veto") was removed by the Bush Administration in 2001. Regulations now attempt to make mining companies more responsible for land reclamation.
hydrocarbon extraction	offshore oil and natural gas	United States	The Secretary of the Interior must select the timing and location of leasing " . . . To obtain a proper balance between the potential for environmental damage, the potential for the discovery of oil and gas, and the potential for adverse impact on the coastal zone." Concerns about protection of coastal and marine resources has led Congress to impose moratoria for large-scale ocean areas. Profit sharing with coastal states for leases located in 3nmi zone outside of the state submerged lands. Permits may be required for air or water pollution discharges, waste disposal, drilling, construction, navigation, pipeline laying, and impacts on corals. In drafting a Five-Year Lease Plan, areas can be excluded from leasing because of conflicts with other ocean uses, including navigation, fisheries, and other uses. Restrictions also may be placed on the nature of hydrocarbon development in certain areas. The existence of a lease does not preclude the issuance of leases for other nonhydrocarbon OCS minerals in the same area.

Activity	Resource	Jurisdiction	Multiple Use Decision-making
hydrocarbon extraction	oil and natural gas	United States	Each lessee must file an application for a permit to drill (APD) for each exploration or production well. An APD includes a drilling plan, a surface use plan (including drill pad location and construction, spill containment, waste disposal, and surface reclamation plans), and proof of a bond to cover unexpected surface damages. About 11 percent of the public lands are "split-estate" lands in which surface rights, such as those for placer claims, homesteads, or farmlands, are held privately, but the public owns the subsurface mineral rights. Under several US laws, the surface uses are "servient" to the mineral rights, but subsurface mineral leaseholders must obtain permission, pay for damages, and post bonds to accommodate the surface owner. Major concerns are now being voiced about the surface disposal of trapped fresh water that is produced during the production of coalbed methane (CBM).
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Applications must include information known to the applicant on other uses of the proposed mining area to support the Administrator's determination regarding potential use conflicts between commercial mining activities and those activities of other nations or other US citizens.

Table A7. Environmental Review

Activity	Resource	Jurisdiction	Environmental Review
wind energy/power plant siting	ocean wind	Germany	The extent and scope of environmental assessment depends upon the scale of the proposed project. There are four scales, measured in terms of the number of planned turbines: 1-3, 3-6, 6-19, and 20-?. A full environmental impact assessment is required for license applications proposing wind farms of greater than 20 turbines. The EIA process follows the EU Directive on Environmental Impact Assessment. BSH is required to consult with all institutions safeguarding the public interest. The plan for a wind energy facility must be published. The Public is permitted to comment on the plan at an application conference.
wind energy	ocean space	Belgium	Applications for licensing and for authorization to build an offshore wind farm must be accompanied by an EIS, which will form part of the basis of an EIA. The EIA is ongoing throughout the operational life of the installation, in that operations are submitted to a permanent evaluation by monitoring programs and regular examinations. (EIS and all monitoring at developer's expense. Developer must adhere to principles of pollution prevention, precaution, sustainable development [5])
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	Required under NEPA and under NY's State Environmental Quality Review Act, which specifies four general review phases for activities undertaken by state agencies and local govts in NY: 1) threshold questions concerning whether the activity is subject to the environmental review mandates 2) submission of preliminary info, selection of lead agency, determination as to whether EIS will be required 3) draft EIS is scoped out, prepared, subjected to agency and public review 4) final EIS is prepared and accepted and findings are issued [1]
wind energy	state submerged lands	Texas	Terms of first lease require developer to conduct studies on migratory bird patterns for use in determining turbine placement and operation of the wind farm. Information needed for state and federal permits will also be gathered during Phase I. [1]
wind energy	ocean space	Denmark	Several EIA studies on the siting of offshore wind turbines have been conducted since the early 1990s. A new Danish law on electricity supply (1999) assumes that new ocean wind power projects or major changes to existing projects have a major impact on the environment, requiring an EIA (but DEA has discretion on whether an EIA must be conducted). EIA procedures conform to principles set out by the Offshore Wind Turbine Committee, according to a government order issued in 2000. Application for a Building Permit triggers the EIA
wind energy	ocean space	United Kingdom	Lease applications subject to a Strategic Environmental Assessment (SEA).

Activity	Resource	Jurisdiction	Environmental Review
wind energy	public lands	United States	Stipulations on rights-of-way grants may require biological and cultural resource surveys and studies. Application for a site testing and monitoring (ST&M) right-of-way must include a NEPA environmental analysis (EA) of the direct, indirect, and cumulative effects of the proposed facilities (or a "land use conformance determination" and a "determination of NEPA adequacy"). Proposed facilities must be in compliance with the ESA, MBTA, NHPA, and other laws. The "reasonable foreseeable development" discussions in the EA for a ST&M right-of-way do NOT have to focus on commercial development scenarios. For commercial wind energy development (CWED) applications, a comprehensive EA is required. If there is significant public controversy or if determination of significant adverse impacts is made, then an EIS is required. The analysis of avian and bat concentrations and movement patterns is required in EAs or EISs.
wind energy	ocean space	France	Environmental impact statements must be filed with applications for occupancy concessions in the marine public domain (more under Instruments).
wind energy	ocean space	Sweden	Within territorial sea: Some contradiction between the requirements of the Planning and Building Act and the Environmental Code, but both require an EIS for projects with 3 or more turbines and a combined output of > 10 MW. (Environmental Code requires EIS for all sea-based projects.) Detailed content of EIS is typically standard but is technically subject to negotiation with the relevant authority. Developer usually bears the full cost of the EIS and the responsibility for carrying out hearings with the responsible parties (but in some cases municipality may manage hearings and share EIS costs). For projects in EEZ, application must include a statement on Environmental Impact Assessment.
wind energy	public land	Japan	Commercial projects projects are subject to the 1997 Environmental Impact Assessment Law, but details are not readily available.
wind energy	public land	Spain	Requirements have generally become extensive but are simultaneously seen as having no real teeth and as far exceeding what is required of much less benign energy and other industrial installations. [2] Too many studies are conducted solely on paper, with no case by case field studies, no attention to site variations in environmental conditions and effects (e.g., copying information from one EIA to another may have harmful effects, especially on bird life).

Activity	Resource	Jurisdiction	Environmental Review
wind energy	ocean space	Ireland	Under EU Directive 97/11/EC and Irish law, preparation of an EIS is mandatory for offshore installations for harvesting wind (or wave) power for energy production with more than 5 turbines or for more than 5 MW total output. EIS by licensees/developers are required to address 20 elements relating to a description of the project, 15 relating to the existing environment, 13 relating to expected impacts from construction through decommissioning, as well as alternatives considered, mitigation measures undertaken, and monitoring programs adopted. Separate from the EIS, installations proposed for development less than 5 km from the shore (which is normally not allowed) are subject to a special review concerning their visual effects, and special rules apply. For example, nacelles and support towers must be of similar design in order to minimize "visual conflict." (Certain bird hazard requirements also apply to facilities within 5 km.) Authorities at the Dept. of Marine and Natural Resources consult with local developers in regard to visual impact, and they issue fairly detailed guidelines for crafting photomontages that are created for purposes of persuading authorities that installations within 5 km of the shore should be permitted.
wind energy	ocean space	Netherlands	Law on Public Water Works provides basis for requiring an EI Report before granting a building license, for which the competent authority is the Minister of Transport, Public Works and Water Mgmt. Details not readily available.
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral	United States	In addition to the usual NEPA requirements, many lease applications require lengthy and costly review of land-use plans for national forest or other federal resource area plans.
livestock grazing	public domain rangelands	United States	NEPA environmental assessments are required for each grazing allotment decision. The Forest Service currently has a backlog of 4,100 grazing allotments, each of which may take up to two years to process.
electricity generation	ocean thermal	United States	OTEC Act authorizes NOAA to require EIA/EIS relating to site evaluation and preconstruction testing at potential OTEC facilities or plantships locations.
protection and lawful excavation/removal in the public	archaeological resources on public and Indian lands	United States	Archaeological resources/values enjoy protections similar to the protections afforded to environmental resources/values under NEPA.

Activity	Resource	Jurisdiction	Environmental Review
port siting	ocean space	United States	DWPA mandates one NEPA process for all federal agencies involved in the license application review process. An EA or an EIS (at the discretion of the USCG) is required for all applications relating to a single location. The NEPA review must conclude that a license application is in substantial compliance with USCG environmental criteria. USCG establishes "environmental review criteria" to evaluate proposed deepwater ports, based upon recommendations from EPA and NOAA and after consulting with other federal agencies. Criteria include: effects on the marine environment, oceanographic currents and wave patterns, alternate uses of the oceans and navigable waters, environmental dangers to the port and steps taken to minimize such dangers, land-based developments, human health and welfare, and other appropriate considerations.
offshore	ocean space (EEZ)	United States	Legislation provides that environmental requirements for permitting "shall consider risks to and impacts on: (1) natural fish stocks, (2) marine ecosystems, (3) biological, chemical and physical features of water quality and habitat, (4) marine mammals, other forms of marine life, birds, and endangered species, and (5) other features of the environment as identified by the
ocean disposal of wastes	ocean waters/marine environment	United States	Permits for dumping of dredged material may be issued only after a determination that the dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems or economic potentialities. Independent determinations must be made as to: the need for the dumping; the effects on human health and welfare, on fish and other wildlife, on shorelines, and on marine ecosystems; the persistence and permanence of the effects; the effect of dumping particular volumes and concentrations; effects on alternate ocean uses; the availability of other disposal methods; and appropriate locations (from among the recommended sites designated by the EPA administrator). Before issuing a permit, there must be notice and opportunity for a public hearing.
mineral extraction	placer and lode minerals	United States	The General Mining Law contains no environmental provisions. Nevertheless, the mining industry must follow federal and state laws regarding pollution, reclamation, and the handling and disposal of toxic wastes. BLM's activities must be in accordance with NEPA.
hydrocarbon extraction	offshore oil and natural gas	United States	An EIS is required on the 5-year program plan and for each individual lease sale. If any additional exploration is done, another environmental assessment is performed. Each lessee must submit an exploration plan, which must be approved by MMS prior to the end of the exploration term. Each lessee must submit a development and production plan, which must be approved by MMS prior to the initiation of production.

Activity	Resource	Jurisdiction	Environmental Review
hydrocarbon extraction	oil and natural gas	United States	The leasing of oil and natural gas on the public lands must be in compliance with NEPA, CWA, CAA, SWDA, RCRA, and federal and state reclamation standards. The initial development of a resource management plan (RMP) or the revision of an older RMP requires preparation of an EIS. Mineral industry officials have criticized the often lengthy delays that are caused by federal environmental reviews. BLM must approve applications for a permit to drill (APDs) for the drilling of any exploration or production well on existing leases. These applications are to be approved or rejected within 35 days, but many must be delayed for additional analysis or information, stretching the average processing period to 137 days now. One significant source of delay is the need to rewrite the relevant RMP because it is out of date. In 2003, BLM announced a strategy to expedite the APD approval process.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	The usual NEPA requirements apply for an exploration license. NOAA's EIS, prepared with applicant's data, must present adequate physical, chemical, and biological information for the license/permit area. Administrator must include the complete spectrum of activities resulting from the issue of a commercial recovery permit, which occurs only if the Administrator determines that recovery cannot reasonably be expected to result in a significant environmental

Table A8. Allocation Method

Activity	Resource	Jurisdiction	Allocation Method
wind energy/power plant siting	ocean wind	Germany	Depends upon the existence of competition for particular areas. The process is first-come, first serve unless competition exists.
wind energy	ocean space	Belgium	Apparently first come, first served, according to procedures and selection criteria set forth in the Royal Decree of 20 Dec 2000 for the construction and exploitation of installations in Belgian waters of the North Sea.
wind energy	submerged lands	North Carolina	None established, and allowability of such projects is unclear. (See policy objective.)
wind energy	state waters and submerged lands	New York State	Competitive bidding on a project as defined by and to be funded by state-owned utility.
wind energy	state submerged lands	Texas	Apparently first come, first served.
wind energy	ocean space	Denmark	First-come, first-serve for the initial demonstration projects. Competitive public tender system is now in place for future large-scale ocean wind applications: 200MW at Horns Rev and 200MW at Rodsand.
wind energy	ocean space	United Kingdom	
wind energy	public lands	United States	Allocation is on a "first come" basis. Competitive bidding is possible if called for in a land use planning decision or if two or more applicants have power purchase or interconnect agreements with transmission providers for a single area.
wind energy	ocean space	France	Government solicits fixed-price bids on a 500 MW offshore wind facility (directly contrary to the market-based incentive schemes preferred by the European Commission).[5]
wind energy	ocean space	Sweden	Still to be determined.
wind energy	public land	Japan	
wind energy	public land	Spain	Information on government policy not readily available. However, one source notes that development initially was strongly pushed by private initiatives and large companies, some of which enjoyed a monopoly in the distribution and grid connection sectors [2] The federal government has since passed various laws and policies aimed at full liberalization of the electricity market.
wind energy	ocean space	Ireland	First come, first served.

Activity	Resource	Jurisdiction	Allocation Method
wind energy	ocean space	Netherlands	For the govt-sponsored NSW facility, competitive bidding by four entities that submitted applications accompanied by a required project plan and budget. Selection made by the Minister, who was advised by his own commission established for the purpose. Beyond 12 nm, until recently the method has been first come, first served, based on the Public Works and Water Management Act, and national authorities had no real impact on choice of location. The procedure is slated to be changed by including a concession procedure; in the meantime, no applications for offshore wind farms are being taken.
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Two significant changes under the 2005 amendments, one aimed at increasing development/use of geothermal resources generally, the other at affording more equal treatment to leases for all types of geothermal applications. (1) New requirement that competitive lease sales be held at least every 2 years in each state that has nominations pending (addresses a longstanding backlog of unprocessed lease applications; see Management). (2) Increase the number of competitively awarded leases. Previously, the choice of a competitive vs. a non-competitive lease sale was dictated by whether the federal lands in question are, or are not, located in a "Known Geothermal Resource Area" (KGRA, an area where BLM determines that persons knowledgeable in geothermal development would spend money to develop geothermal resources. In practice, according to DOE, this means areas where the resource is sufficient to generate electricity.). Applications relating to KGRA lands were leased through competitive sale using sealed bids, while all non-KGRA lands were handled through non-competitive bids on a first-come, first-served basis. The 2005 amendments call for lease sales for all nominated lands (except those subject to a mining claim with an approved plan of operation) to be offered first on a competitive basis, and then for the Secretary to make available for noncompetitive leasing for a 2-year period any tract for which a competitive lease sale is held but no competitive bids are received within 90 days.
livestock grazing	public domain rangelands	United States	First-come, first-served. Conflicting applications for the same rangeland are allocated on the basis of BLM discretion using any one or more of the following factors: historical use; proper use; needs of the applicant's livestock operations; public ingress or egress across private lands to public lands; topography; other land use requirements; applicant's demonstrated stewardship to improve, protect, or maintain rangeland; applicant's past history of compliance.
electricity generation	ocean thermal energy	United States	Modified version of first come, first served. Administrator must publish in the Federal Register notice of the receipt of any application, together with a description of an "application area" encompassing the site proposed in the application and a call for submission of any other applications for licenses in the designated "application area." Prospective applicants must file a notice of intent within 60 days and a completed application within 90 days, which also must be published. Notices of intent and applications for the same application area filed after these deadlines will not be considered until action has been completed on any timely filed applications. If more than one application for the same area is submitted, they will be considered in the order they are received unless the Administrator, in consultation with the Energy Secretary, determines that one or a specific combination of the proposed facilities clearly best serves the national interest.

Activity	Resource	Jurisdiction	Allocation Method
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian	United States	Non-exclusive permits are granted upon submission and review of qualifying applications. Applications must be accompanied by an outline of the proposed work identifying the requesting institution, the period of proposed field work, and the person directly in charge of the field work. Application must also include an exact statement of the character of the work (examination, excavation, or gathering); the university, public museum, etc. in which the collected materials will be permanently preserved (in the case of permits pertaining to certain enumerated Indian reservations, collectively known as the "New Lands"); and a sketch plan or description of the particular site in question suitable for locating it on a map with reasonable accuracy.
port siting	ocean space	United States	First-come, first-serve to applicants who meet certain criteria related to financial responsibility, national security, and environmental protection. Judicial review of licensing decision is limited to 60 days from the issuance and only to plaintiffs who are adversely affected and who participated in the administrative proceedings.
offshore aquaculture	ocean space (EEZ)	United States	First come, first served.
ocean disposal of wastes	ocean waters/marine environment	United States	Permit applications considered upon receipt, approved or denied according to human health, environmental, and multiple-use criteria. Applicant must provide the information necessary to evaluate the application.
mineral extraction	placer and lode minerals	United States	First-come, first-serve.
hydrocarbon extraction	offshore oil and natural gas	United States	Competitive auction using sealed bids. Valid bids must exceed a minimum bid per acre (typically $150/acre or $864,000/lease tract).
hydrocarbon extraction	oil and natural gas	United States	"Notice of intent" for pre-lease geophysical (non-drilling) exploration permits; quarterly oral competitive auctions for leases; first-come, first serve for non-competitive leases (priority is established on the basis of the time of filing); lottery for simultaneous applications ("SIMOs") for non-competitive leases
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Applications are reviewed and licenses awarded on a first come, first served basis for a given area of the seabed. (Regulations set forth procedures and criteria for resolving potential spatial conflicts between "pre-enactment explorers" of the US and other countries and new US applicants applying under DSHMRA.)

Table A9. Instrument and Interests

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
wind energy/power plant siting	ocean wind	Germany	License for construction of wind farm; license for laying cable to connect to the power grid; permit from the relevant Lander for cable laying in the 12nmi territorial sea.	N/A.
wind energy	ocean space	Belgium	1.Offshore domain concession. 2. License to exploit the wind park. 3. Authorization to build wind park (requires public consultation and license to exploit)	
wind energy	submerged lands	North Carolina	State land lease (either at fair-market value or, more likely, below fair-market value for a project with a purpose that will benefit the general public). All requests for land leases that exceed three years in duration or $25,000 in annual rent require approval by the Council of State* and the Governor. *9 elected state officers, incl., Sec. State, Atty. Gen, Treasurer, Auditor, Commissioners and Superintendents	
wind energy	state waters and submerged lands	New York State	Power Purchase Agreement (PPA) between the state-owned utility and the commercial	Main right of interest is the Authority's "step-in right" to construct/operate the facility in the event of undue delay on the part of the developer. This and other rights are negotiated between the Authority (LIPA) and the successful bidder [5].
wind energy	state submerged lands	Texas	Three-phase lease agreement, covering meteorological testing, construction, and production [1]	No information.
wind energy	ocean space	Denmark	Permit for preliminary surveys. Building Permit for construction. License for operations.	
wind energy	ocean space	United Kingdom	Lease in UK territorial sea; license in UK EEZ	Agreements for lease (or license) give a developer a "development option." Options may be exercised to convert the option into a full lease.

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
wind energy	public lands	United States	Wind energy "right-of-way" grants for (1) wind energy testing and monitoring facilities (WET&M); (2) site testing and monitoring areas (ST&M); and (3) long-term commercial wind energy development	(1) Nonrenewable "site-specific" right-of-way grant for WET&M. (2) Renewable right-of-way grant for a ST&M project, which includes an "interest" (or an "option") in the relevant area. This interest/option precludes other grant applications during the 3-year term of the grant, but does not imply a right to develop or to exclude other compatible uses. (3) Right-of-way grant for a CWED project, including wind turbine facilities, access roads, electrical and transmission facilities, and other support facilities. Grants may contain stipulations concerning road construction and maintenance, vegetation removal, and the conduct of biological and cultural resource studies.
wind energy	ocean space	France	So far none applicable to windfarms. For other facilities in the Marine Public Domain, (1) concessions are required in the form of an authorization of temporary occupation and, if appropriate, a long-term occupational permit (aka "concession of containment and use of outbuildings of marine public domain maintained in this domain, harbours excluded"). The latter takes the form of a contract and typically applies to marinas and shipyards, but is considered equally applicable to windfarms. A fee is levied by the Directorate-General for Taxation, but there is no general rule as to the amount. (2) Building agreement with the departmental Prefect. The application must be accompanied by an environmental impact study. Also, an EIA is required for any wind park project the cost of which equals or exceeds E1.83 million (12 million francs), including taxes, the cost of land acquisitions, and all project phases. (3) Exploitation authorization or declaration for electricity-producing installation (choice of instrument depends on the operating capacity and the facility's status as entirely new, a replacement for an existing facility, a capacity upgrade, or a change of primary energy)	
wind energy	ocean space	Sweden	Construction/development permits from the relevant authorities (depending on location); concessions for access to the grid	?
wind energy	public land	Japan		

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
wind energy	public land	Spain		
wind energy	ocean space	Ireland	Foreshore License for investigating site suitability (normally 4 yrs, no extensions); Foreshore Lease for construction and operation (applications must be filed within 12 months of License expiration). Maximum lease period is normally 60 years, but lease will automatically lapse if necessary authorizations to construct station or to generate or supply electricity should lapse. Applicants for Lease must have held a Foreshore License in good standing.	Licensee who first applies for license over a specific area has a legitimate expectation to first claim on a Foreshore Lease. (Multiple licenses may be granted for a particular site; the first applicant has first rights which are forfeited if the terms of the license are not upheld.) First applicant's right of first claim is subject to: -the license having been worked in accordance with all terms and conditions -valid application is made for a Lease within 12 months of license expiration -applicant holds (or has applied for and not been denied) authorizations to construct, generate, and supply; -local planning authority permission for the land-based elements; -clear evidence of contractual commitments to purchase the electricity generated when the developer intends to sell it outside the State; agreement of lease terms. "The term 'Legitimate Expectation' is used in this context to assure developers that 'gazumping' will not be allowed. It does not put a contractual obligation on the Minister to issue a Foreshore Lease for the development of an offshore electricity generation station to any applicant or in respect of any particular location." [1] [NOTE: "Gazumping" refers to the practice, common in the UK real estate industry, in which the seller breaks a verbal agreement with a buyer in order to take advantage of a subsequent, higher offer.] The holding of a Foreshore Lease or License does not preclude the Minister from issuing further ones to other parties either for the same purpose or for other purposes, provided that the activities do not interfere with the operation of the first Licensee's/Lessee's activities under the terms of the License/Lease. Second and subsequent applicants have the right to be told of the prior license/lease and to either: proceed as planned, have an "expression of interest" formally noted, or withdraw the application. Holding an "expression of interest" entitled the holder to reactivate the application and have it entered as having made on the data on which the "expression of interest" was made.

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
wind energy	ocean space	Netherlands	Building license and environmental license, to be obtained by the selected builder. Developments subject to an environmental license require an EIA and EI Report. A ground lease is required after the selection and licensing procedures have been followed. This entails a contract with the Ministry of Finance that pertains to use of the ground, and that is governed by private law.	?
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral	United States	In addition to drilling permit and exploration permit, the main instrument is a geothermal (operational) lease. (In some cases, a lease will not be granted without a "unit agreement" among interest-holders to explore for, produce and utilize separately owned interests in geothermal resources as a single consolidated unit. A unit agreement defines how costs and benefits will be allocated among the holders of interest in the unit area.)	In general, the right to exploit geothermal resources is based on ownership of mineral rights or surface rights, either by direct ownership or leasing. Operating rights (working interest) means any interest held in a lease with the right to explore for, develop, and produce leased
livestock grazing	public domain rangelands	United States	Grazing permit or grazing lease (renewable or non-renewable); crossing permits; exchange-of-use agreements; special permits for privately controlled indigenous animals	Exclusive permission to graze allotted public domain rangelands. The instrument specifies the class and breed of livestock, the allotment to be used, and the animal unit months (AUMs). By law, grazing permits or leases convey no right, title, or interest in any lands or resources. Permittees or lessees holding expiring rights are given first priority for new rights. "free use" grazing permits can be issued to applicants whose residence is adjacent to public lands or for conservation, vegetation control (including noxious weeds), or scientific research. Exchange-of-use agreements allow the redistribution for grazing purposes of intermingled private and public rangelands.
electricity generation	ocean thermal energy	United States	License for the ownership, construction, and operation of one or more of the following: -OTEC facility located in US territorial sea or connected to US by pipeline or cable -OTEC plantship documented under US laws -any OTEC plantship owned or operated by a US citizen and documented under the laws of another country in a manner consistent with US law	Use rights as defined in individual licenses (see Instrument), for initial terms of up to 25 years and with preferential right of renewal for up to an additional 10

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	Non-exclusive permit for the examination of ruins, the excavation of archaeological sites, and the gathering of objects of antiquity from federal and/or Indian lands.	Permittee gains non-exclusive access to specified areas to conduct archaeological activities specified in the permit. With written notice, the federal land manager can suspend or revoke a permit: (a) for failure to meet the permit terms and conditions; or (b) for "management purposes" (convenience of the government) without any liability on the part of the government when continuation of work under the permit would be in conflict with management requirements not in effect when the permit was issued.
port siting	ocean space	United States	License for the deepwater port; right-of-way for its associated pipeline. No other permits are required.	License authorizes a person to engage in the ownership, construction, and operation of a deepwater port. There is no "open access" requirement (i.e., that all shippers can potentially have access to the port); in other words, deepwater owners can utilize the entire capacity of the port or rent out the capacity to others. [A deepwater port is a fixed or floating manmade structure(s) other than a vessel located off the US coast beyond state seaward boundaries and intended for use as a port or terminal for the storage, transport, or handling of oil or natural gas.]
offshore aquaculture	ocean space	United States	Under 1980 Act: -Sec. 10 permit from Army Corps, which may take different forms depending on the nature of the installation: Letter of Permission (if the cage/structure does not interfere with navigation; or Anchoring/Mooring Structure Permit. Also required: NPDES permit from EPA covering point source discharges. (Also, NMFS will review for conformance with the new Essential Habitat National Standard of the Magnuson Act and perhaps with the Endangered Species Act, but NMFS does not issue permits.) Under proposed legislation: Two permits, applications for which could be submitted and reviewed concurrently: (1) site permit for a particular area of the EEZ; (2) operating permit for specific species and systems to be placed on the site.	As per the terms of the site and operating permits.

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
ocean disposal of wastes	ocean waters/marine environment	United States	Two types of permits: General permits, issued by EPA to agencies (e.g., Navy) for materials with minimal environmental impact that are generally disposed of in small quantities (typically issued for, e.g., burials at sea). Special permits are issued to specific applicants and have fixed expiration dates. Today, nearly all material dumped under special permits is dredge material (which in most cases has been removed by the Army Corps or its contractors). Other, much less common, instances of special permits include research permits and emergency permits.	Right to dispose of a specific type and amount of material at the place, in the manner, and during the timeframe specified in an ocean dumping permit.
mineral extraction	placer and lode minerals	United States	Claim; patent.	There is free access for prospecting in the US public domain lands. Individuals or firms making a discovery of a valuable mineral deposit have the right to stake (or locate) a claim for exclusive development of the deposit. One or more claims can be patented to give full title to the claimant. A patent entails the right to purchase surface and mineral rights on a claim. At least one (possibly more) millsites of no more than five acres may be sited on a claim.
hydrocarbon extraction	offshore oil and natural gas	United States	Permit (or a notice) for geological or geophysical research involving drilling or explosives; permit for conducting geological or geophysical exploration activities not under a lease; lease for exploration, development, or production	Exclusive use of lease tract for exploration, development, and production of hydrocarbons.
hydrocarbon extraction	oil and natural	United States	pre-lease geophysical (non-drilling) exploration permits; exploration, development, and production leases; post-lease well-drilling permits	pre-lease geophysical (non-drilling) exploration permitees must comply with any conditions for access to lands specified by the surface managing agency (SMA), which could be a federal or state agency or a private landowner. Exploration and production drilling on leases is allowed after the analysis and approval of a plan of operations in an application for a permit to drill (APD). Older producing leases that were issued under original RMPs may experience delays in the processing of APDs for new drilling due to the need to update the relevant RMPs. In 2003, BLM announced a strategy to expedite the APD approval process.

Activity	Resource	Jurisdiction	Instrument	Interests (rights)
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Two instruments: exploration license commercial recovery permit (any US citizen holding a valid existing exploration license is entitled to a permit for commercial recovery from an area selected from within the license area) The separation of these two phases and their relevant access procedures and regulations is in recognition of (1) the still-evolving nature of the industry and the need for flexibility to promote the development of its technology, and (2) the difference in scale and effects between exploration for and commercial recovery of hard mineral resources. [2]	Exploration license affords the exclusive right (and duty) to carry out exploration in a designated area and according to the terms of an approved exploration plan, which must demonstrate that the efforts will likely lead to the ability to apply for and obtain a permit for commercial recovery within 10 years. A commercial recovery permit authorizes the holder to engage in commercial recovery within a specific portion of the seafloor, as well as to own, transport, use, and sell hard mineral resources recovered under the permit. (Commercial recovery is defined to include [1] any activity to recover any hard mineral resource at a substantial rate for the primary purpose of marketing or commercially using it to earn a net profit; [2] any processing that will occur at sea; and [3] any waste that will be disposed of at sea.[1,2]

Table A10. Size and Tenure

Activity	Resource	Jurisdiction	Size	Tenure
wind energy/power plant siting	ocean wind	Germany	N/A.	N/A.
wind energy	ocean space	Belgium		20 years maximum, with the possibility of a single 5-year extension if approved by the Minister. [5]
wind energy	submerged lands	North Carolina		
wind energy	state waters and submerged lands	New York State	First proposed project specified as having a nameplate capacity of at least 100 MW. An installation of this size was expected to occupy an area of approximately 5 sq mi. [5]	At least 15 years. RFP for the south-LI windfarm specified that proposers develop scenarios and bids for tenures of 15 years, 20 years, plus any other tenure >15 years that they wished to propose. [5]
wind energy	state submerged lands	Texas	First lease is for 11,355 acres, 150 MW, about 50 turbines. No information on whether Texas has size limits or guidelines.	No information.
wind energy	ocean space	Denmark	0	
wind energy	ocean space	United Kingdom		
wind energy	public lands	United States	(1) "Minimum necessary area" for the construction and maintenance of temporary wind energy testing and monitoring facilities. (2) "Reasonable amount of land" to support a possible application for a wind energy development project. (3)	(1) 3-year grant (nonrenewable) for site-specific wind energy testing and monitoring (meteorological towers and instrumentation facilities). (2) 3-year grant (renewable) for site testing and monitoring facilities. This grant is renewable only if an application for a right-of-way grant for a commercial wind energy development facility and a plan of development (PoD) is filed before the expiration of the 3-year term. (3) Unlimited for a commercial wind energy development right-of-way grant, although the useful life is recognized as 30 to 35 years. Commercial grants my be renewed.

Activity	Resource	Jurisdiction	Size	Tenure
wind energy	ocean space	France	500 MW offshore; 12 MW ceiling for onshore projects.[5]	30 years maximum for a long-term occupational concession
wind energy	ocean space	Sweden	?	?
wind energy	public land	Japan		
wind energy	public land	Spain		
wind energy	ocean space	Ireland	Lease covers only the area immediately beneath the site of each foundation and a "reasonable amount" of ground surrounding the foundation (usually 5-meter radius) and the area above and immediately surrounding cables within the farm area and from the farm to the shore (usually 5 m on each side of connecting cables).	License period is 4 years. Leases ordinarily have a maximum period of 60 years.
wind energy	ocean space	Netherlands	Unclear, but current policy favors offshore farms in the 600 MW range.	?
power generation, heating (hot water,	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Lease offers for commercial electricity generation must cover all lands available for leasing in a section (as depicted in the public land rectangular survey system). Previously, the smallest allowable lease was 640 acres, or all lands available for leasing in the section, whichever is less. Under 2005 amendments, however, any "direct use" lease (see Allocation Method and Financial Terms) no longer has a numerical minimum, but instead shall not cover more than the acreage determined by the Secretary to be reasonably necessary for the proposed purpose. At the upper end, acreage limitations on a single lease (2,560 ac, or 4 sq. mi.) have been repealed. Total interests held by any person, association, or corporation within a single state were previously limited to 20,480 acres (32 sq. mi) and were revised in 2005 to 51,200 acres (80 sq. mi.).	Primary term of 10 years. Under 2005 amendments, a lease can be extended for 5 years if, for each year after the 10th year, the Secretary determines that the lessee satisfied the work commitment requirements or paid the required annual payments (see Performance). A second 5-year extension can be authorized if the Secretary determines that the lessee satisfied the minimum work requirements that applied to the lease for that year. (Prior to 2005 amendments, the rules governing lease extensions were as follows: If steam was produced or utilized in commercial quantities within the initial 10-year term, a lease could continue for as long as production/utilization in commercial quantities continued, up to an additional 40 years. If after the end of this period the production/utilization still continued and the lands were not needed for other purposes, the lessee had a preferential right of renewal for a second

Activity	Resource	Jurisdiction	Size	Tenure
livestock grazing	public domain rangelands	United States	Average allotment is about 7300 acres, but information on the range of allotment sizes, if any, is not available.	10 years, unless otherwise specified. Permittees or lessees holding expiring renewable permits or leases are given first priority for new rights.
electricity generation	ocean thermal energy	United States	No specifications, except that Coast Guard must designate and enforce an appropriately sized "safety zone" around any OTEC facility and is authorized to establish such a zone around any OTEC plantship..	Licenses issued for initial terms of up to 25 years. Any licensee has a preferential right to renew for up to an additional 10 years, at discretion of Administrator.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	Depends on objectives of the project in question; project area is proposed by permittee.	No permits granted for more than 3 years, but if work has been diligently prosecuted, the time may be extended for proper cause upon application.
port siting	ocean space	United States	Variable.	
offshore aquaculture	ocean space (EEZ)	United States	To be specified in permit, at the discretion of the Secretary.	Most site permits would be for 10 years, renewable in 5-yr increments. The duration of permits for demonstration projects, and for aquaculture operations on leases or easements authorized under the OCSLA, or within 1 mile of any other facility for which a permit has been issued under the OCSLA, shall be developed in consultation with the Interior Sec. Permits of the latter two types (I.e., OCSLA-related) shall expire no later than the date that the oil and gas lessee, or the lessee's operator, submits to the Secretary of the Interior a final application for the removal of the facility upon which the offshore aquaculture facility is located.

Activity	Resource	Jurisdiction	Size	Tenure
ocean disposal of wastes	ocean waters/marine environment	United States	Varies according to material to be disposed, but precise area is detailed in each individual permit. Further, "[[t]he sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation or designation study." [1]	Not applicable. (Technically, each permit has a uniquely determined expiration date, which typically allows for a very limited window of time in which to dump.)
mineral extraction	placer and lode minerals	United States	About 20 acres. A placer claim is up to 20 acres. A lode claim may be (slightly) more than 20 acres.	Claims have an indefinite tenure, subject to payment of the annual maintenance fee.
hydrocarbon extraction	offshore oil and natural gas	United States	Each lease tract is 5,760 acres (~9 square miles).	Five years for shallow water. Ten years for deep water. Once a lease is producing, tenure is limited only by its ability to produce in paying quantities (unless additional drilling or well-reworking is underway to allow additional production to occur).
hydrocarbon extraction	oil and natural gas	United States	The maximum acreage for a competitive lease is 2,500 acres (5,760 acres in Alaska). The maximum acreage for a non-competitive lease is 10,240 acres.	The term for a competitive lease is 5 years. The term for a non-competitive lease is 10 years. Production can continue on either type of lease as long as oil or natural gas is being produced in paying quantities.

Activity	Resource	Jurisdiction	Size	Tenure
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Up to 150,000 sq km, unless a larger size is successfully justified by the applicant based on factors such as topography, nodule abundance, distribution, and ore grade.	Exploration license: normally 10 years, with possibility of multiple extensions for up to an additional 5 years each. Commercial recovery permit: 20 years (within which to initiate commercial recovery) and for so long thereafter as hard mineral resources are recovered annually in commercial quantities from the area to which the recovery plan associated with the permit applies. The Administrator may make allowance for deviation from the recovery plan for good cause, such as significantly changed market conditions, but a request for extension must be accompanied by an amended recovery plan.

Table A11. Monitoring

Activity	Resource	Jurisdiction	Monitoring
wind energy/power plant siting	ocean wind	Germany	Monitoring is required before, during, and after installation of a wind energy facility. Monitoring includes: bird and marine mammal counts, stock assessments of fish and benthic organisms, analyses of geological conditions. Monitoring of environmental impacts during operations may be a condition of the license.
wind energy	ocean space	Belgium	Ongoing throughout the operational life of the installation. Developer/operator is responsible for costs of monitoring.
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	Under Art. X of the NYS Public Service Law, state agencies perform continuous operational monitoring for compliance with air and water permits and other technical and environmental conditions specified during the certification process. [1]
wind energy	state submerged lands	Texas	No information (but see Environmental Review)
wind energy	ocean space	Denmark	Denmark's offshore wind-farm demonstration programmed requires the implementation of an ongoing environmental measurement and monitoring program. Environmental measurement and monitoring is implemented prior to the initiation of a project and will continue after it has been discontinued.
wind energy	ocean space	United Kingdom	
wind energy	public lands	United States	A commercial wind energy development right-of-way grant ordinarily will include stipulations for wildlife and avian resources monitoring.
wind energy	ocean space	France	Generally not determined for operational phase, other than operating data used to calculate the buy-back rates (see Subsidies).
wind energy	ocean space	Sweden	All developers typically required to conduct regular monitoring and reporting concerning construction, environmental impact
wind energy	public land	Japan	
wind energy	public land	Spain	The Law on EIA requires wind farm promoters to observe bird movement on a planned windfarm site for one year. Some environmentally minded third parties have agreed to monitor functioning farms themselves.

Activity	Resource	Jurisdiction	Monitoring
wind energy	ocean space	Ireland	Every two months, licensees must send to the Dept. of Marine and Natural Resources a summary of all information relating to wind or wave strengths, nature of sea bed (including obstructions, flora and fauna, wrecks or other archaeological remains, etc.). [Licensees are also required to report bi-monthly on the making of applications for the necessary development authorizations and permissions, as well as on its negotiation with the Duchas (Dept. for the Environment, Heritage, and Local Govt) and the making of an EIA.] In addition, licensee must enter into an agreement with the Meteorological Service that requires the supply of certain minimum information on wind and wave conditions encountered.
wind energy	ocean space	Netherlands	Requirements as to technical and environmental monitoring exist but are not readily available in English.
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Separate, extensive requirements for drilling and operational phases and for utilization facilities of different types. Drilling reports to be submitted upon completion, operational reports during production/utilization to be submitted monthly. In addition to routine reporting requirements, all accidents that affect operations or create environmental hazards must be verbally reported within 24 hours, and BLM may require a written report. BLM may inspect operations and records at any time, and leases may be cancelled for findings of non-compliance.
livestock grazing	public domain	United States	
electricity generation	ocean thermal energy	United States	NOAA required to establish a program to assess the effects on the environment of OTEC facilities and plantships. Program to include baseline studies of locations where OTEC facilities and plantships are likely to be sited or operated; research; monitoring of operational effects. Purposes are to assess the effects of individual facilities/plantships as well as the cumulative environmental effects of large numbers of operating units. Licensees must (1) allow Federal officers/employees aboard facilities and plantships to assess compliance; (2) cooperate in their monitoring activities; (3) conduct their own monitoring and submit whatever information the Administrator requires to assess environmental impacts and to develop and evaluate mitigation methods and options.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	For permits issued for periods of more than 1 year, the permittee's performance is subject to review by the federal land manager at least annually.
port siting	ocean space	United States	Licensees must maintain records and report to the USCG as required.
offshore aquaculture	ocean space (EEZ)	United States	Sec. Commerce would be authorized to monitor the effects of aquaculture and to take appropriate measures to ensure compliance with environmental requirements, including suspending, modifying, or revoking permits.
ocean disposal of wastes	ocean waters/marine environment	United States	For each designated disposal site, Sec. 102.3 of the Ocean Dumping Act requires EPA and Army Corps to develop a site management plan, which must include (among other elements) a baseline assessment of conditions; a monitoring program; special management conditions or practices needed to protect the environment; and a schedule for review and revision of the plan at least every

Activity	Resource	Jurisdiction	Monitoring
mineral extraction	placer and lode minerals	United States	
hydrocarbon	offshore oil and natural gas	United States	Lessees must submit monthly progress reports to MMS. MMS may perform spot inspections of offshore facilities.
hydrocarbon	oil and natural gas	United States	Monitoring of environmental parameters may be a condition of a lease or may be encouraged in the development of a plan of operations.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Exploration license: Licensee must monitor the environmental effects of the exploration activities in accordance with a monitoring plan approved and issued by the Administrator as license terms, conditions and restrictions (TCR); and to submit such info as the Administrator finds necessary and appropriate to assess environmental impacts and develop and evaluate possible methods of mitigating adverse environmental effects. Monitoring strategy will be devised to insure that the exploration activities do not deviate significantly from the approved exploration plan, and to determine if the assessment of the plan's acceptability was sound. The plan will include environmental parameters relating to verification of NOAA's finding about potential impacts and, especially, to the three unresolved concerns with the potential for significant environmental effect (destruction of benthos, blanket of benthic fauna and dilution of food supply away from mine areas, and surface plume effect on fish larvae.) Commercial recovery permit: Each permit must require the permittee to monitor environmental effects of activities in accordance with guidelines issued by the Administrator, and to submit information that the Administrator finds necessary and appropriate to assess environmental effects and to develop and evaluate possible methods of mitigating adverse effects. The Administrator may also require that licensee accept the placement of on-board monitors on ships.

Table A12. Transferability

Activity	Resource	Jurisdiction	Transferability
wind energy/power plant siting	ocean wind	Germany	N/A.
wind energy	ocean space	Belgium	Concessions transferable with the Minister's approval. Parties must jointly notify authorities and the public. [5]
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	?
wind energy	state submerged lands	Texas	No information.
wind energy	ocean space	Denmark	
wind energy	ocean space	United Kingdom	
wind energy	public lands	United States	Not transferable. Concern is expressed in the performance requirements to curb the practice of land speculation through the holding of right-of-way grants.
wind energy	ocean space	France	
wind energy	ocean space	Sweden	?
wind energy	public land	Japan	
wind energy	public land	Spain	

Activity	Resource	Jurisdiction	Transferability
wind energy	ocean space	Ireland	Licenses for investigating site suitability are not transferable. Any significant change in ownership (45% or more shareholding) of a company holding or applying for a license or lease requires the Minister's consent, which shall not be unreasonably withheld. Leases may be assigned with the Minister's consent, but consideration will not normally be given during the period of application, construction, or the first two years of electricity generation. A fee may be charged for assignment of a lease. These rules do not prevent the assignment of a lease to a financial institution as security for borrowing capital for the project, subject to the Minister's approval of financial terms. Similarly, they do not prevent the assignment of a lease to a parent company, wholly owned subsidiary, or other company within the same group as the lease-holding company.
wind energy	ocean space	Netherlands	?
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Record title or operating rights may be transferred, with approval of Secretary and a filing fee of $50 per lease. Original lessee remains responsible for rents, royalties, compensatory royalties and other obligations accrued before the transfer became effective, and for plugging and abandoning any wells drilled or existing on the lease while held under his/her interest.
livestock grazing	public domain rangelands	United States	BLM may alter, suspend, or cancel a permit if range conditions are being degraded or permit conditions are violated.
electricity generation	ocean thermal energy	United States	Licenses may be transferred if the Administrator determines that the transfer is in the public interest and the transferee meets all relevant requirements.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	Permits not transferable.
port siting	ocean space	United States	Transfer possible with MarAd approval.
offshore aquaculture	ocean space (EEZ)	United States	Site and operating permits would be transferable.
ocean disposal of wastes	ocean waters/marine environment	United States	Permits are not transferable.
mineral extraction	placer and lode minerals	United States	

Activity	Resource	Jurisdiction	Transferability
hydrocarbon extraction	offshore oil and natural gas	United States	Lease rights can be transferred with the permission of MMS.
hydrocarbon extraction	oil and natural gas	United States	Leases may be transferred at the discretion of BLM [check on this].
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Licenses and permits are transferable

Table A13. Termination Requirements

Activity	Resource	Jurisdiction	Termination
wind energy/power plant siting	ocean wind	Germany	There must be a plan and evidence of financial means (e.g., a bond) for the removal of turbines at the end of the project life.
wind energy	ocean space	Belgium	Original licenses and authorizations specify the required procedures for decommissioning, especially demolition and removal procedures and environmental impact mitigation and rehabilitation. [1]
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	Windfarm decommissioning and site restoration to be at the expense of the state-owned power authority.
wind energy	state submerged lands	Texas	No information.
wind energy	ocean space	Denmark	Ocean wind energy projects must be decommissioned (removal of the plant and cable connections) at the end of the license period. Termination requirements are not general; they are specific to each individual license.
wind energy	ocean space	United Kingdom	An approved decommissioning program is required prior to construction of the facility and prior
wind energy	public lands	United States	At the discretion of BLM, A "reclamation bond" may be required for site-testing and monitoring grants. A developer's lack of due diligence provides BLM with the authority to terminate a right-of-way authorization.
wind energy	ocean space	France	Not determined. No specific procedure or guarantee related to demolition and rehabilitation generally applies, but such terms can be defined in the concession agreement. [4]
wind energy	ocean space	Sweden	Required fulfillment of agreed conditions under which original permissions were granted, such as demolition and removal procedures, environmental impact and rehabilitation, etc.
wind energy	public land	Japan	
wind energy	public land	Spain	
wind energy	ocean space	Ireland	Lease applicants are required to provide plans for eventual decommissioning and site clearance. A bond or other suitable instrument (to be agreed during lease negotiations) may be required and is subject to review every 5 years to ensure its continuing sufficiency.

Activity	Resource	Jurisdiction	Termination
wind energy	ocean space	Netherlands	Developer is required to submit a security for the full amount of decommissioning costs as estimated by the government. The amount is non-negotiable.
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Upon termination, lessee must: (1) Pay all rents and royalties due (2) Plug and abandon all wells (3) Restore the surface and other resources; and (4) Comply with the requirements of 43 CFR 3200.4 (list of regulations, notices, lease terms and conditions, etc.)
livestock grazing	public domain rangelands	United States	
electricity	ocean thermal energy	United States	Licensee must dispose of or remove all components of the OTEC facility or plantship as directed by NOAA. NOAA has discretion to establish bonding requirements or other assurances as it deems necessary, and to waive disposal or removal requirements (a) for components that another applicant or licensee desires to use and (b)) for components lying on or below the seabed if such removal is not otherwise necessary and the components do not constitute any threat to the environment, navigation, fishing, or other uses of the seabed.
protection and lawful excavation/removal in the public	archaeological resources on public and Indian lands	United States	Permits are terminable at the discretion of the Secretary having jurisdiction. Permittees shall, after completion of the work, restore the lands to their customary condition, to the satisfaction of the field officer in charge. Detailed provisions and definitions apply to the liability of permittees to cover the cost of restoration and repair of archaeological resources damaged as a result of violation of permit conditions.
port siting	ocean space	United States	Licensees must provide financial guarantees or post bonds sufficient to meet the costs for removal of the deepwater port components upon termination or license revocation.
offshore aquaculture	ocean space (EEZ)	United States	Upon expiration or termination of a permit for any reason, the permit holder must remove all structures, gear, and other property and take all other necessary measures to restore the site. (In cases where the site is leased under the OCSLA, this termination responsibility is shared by the original lessee [OOG operator] and the holder of the aquaculture permit.)
ocean disposal of wastes	ocean waters/marine environment	United States	EPA may withdraw (or "de-designate") designated sites from use based on an evaluation of disposal impacts or changed circumstances concerning the use of the sites. Those holding valid permits for a site at the time of its de-designation may complete their permitted activities, but such permits may not be renewed.
mineral extraction	placer and lode minerals	United States	New rules promulgated in 2001 require that reclamation bonds equal to all of the estimated cleanup costs anticipated upon the shutdown of mining operations must be posted by mining
hydrocarbon extraction	offshore oil and natural gas	United States	Secretary of the Interior has the discretion to terminate any lease for environmental negligence or financial incapacity.

Activity	Resource	Jurisdiction	Termination
hydrocarbon extraction	oil and natural gas	United States	Leases may be terminated for lack of diligent conduct of exploration, development , or production activities or violation of federal laws.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Licenses and permits may be relinquished at any time without penalty, but the holder will remain liable with respect to all violations and penalties incurred, and any damage to persons or property. In the case of substantial failure to comply with the terms of a license or permit, the instrument may be suspended or revoked by the Administrator.

Table A14. Financial Terms

Activity	Resource	Jurisdiction	Financial Terms
wind energy/power plant	ocean wind	Germany	License applicants must pay for the administrative costs of processing a license. These costs will be lower to the extent that data used to identify the area as a suitable area for offshore installations can be utilized. E2,000 is required up front; E8,000 is paid at the time of the application conference; the remainder is due upon license approval.
wind energy	ocean space	Belgium	Basic financial assurances/references are required; special assurances or fees may be required at the discretion of the Minister. [5]
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	FPL pays for construction and assumes risks to completion. LIPA (the Authority) to purchase all energy, capacity, and related environmental attributes (I.e., "green" bona fides and credits) produced by the wind park. LIPA will also purchase all qualified Ancillary Services (e.g., scheduling, system control and dispatch, etc.), if any, produced by the wind park under the applicable rules of the NYISO. Developer required to demonstrate adequate financial assurance for completion and operation of the wind park. Proposers must specify the type(s) of credit support or financial security they propose (credit ratings, guaranty by an independent entity or affiliate, standby letter of credit, etc.). Significant weight was given to such financial assurance in the Authority's evaluation of proposals.[5]
wind energy	state submerged lands	Texas	Annual rental fee of $10,000 during Phases I and II (I.e., until production begins). Royalties of 3.5 percent for the first 8 years of production, 4.5 percent for years 9-16, and 5.5 percent for years 17-30. [1] (State expects to earn a minimum of $ 26.5 million in royalties over the production life of its first 30-year lease. [1])
wind energy	ocean space	Denmark	
wind energy	ocean space	United Kingdom	Rent charged at 2 percent of gross revenue. Rent level is to be re-evaluated in 20 years. Fees will be charged to recover the costs to government of administering the program.

Activity	Resource	Jurisdiction	Financial Terms
wind energy	public lands	United States	Cost recovery payments to BLM to cover administrative costs. Wind energy applications and authorizations are subject to "appropriate" cost recovery and rentals. (1) Rental of $50/yr for site-specific wind energy testing and monitoring grants. (2) Rental of the greater of $1/acre or $1,000 per year for the public land acreage occupied by a site-testing and monitoring grant. (3) Two-tier system of rentals on commercial production: annual minimum rent and annual production rent. The annual minimum rent is $2,365/MW of installed capacity, regardless of whether the capacity is utilized. This rent is phased in over the first three years. (This value is based on a calculation of estimated gross revenues from installed capacity.) The annual production rent is assessed on operations greater than the annual minimum rent. It is determined by the "authorized officer" using a gross proceeds methodology.
wind energy	ocean space	France	Not determined. (Secretariat General of the Sea has suggested that tariffs and other financial arrangements for offshore wind should not necessarily be the same as for wind installations on land.) [2] (Cf. Subsidies)
wind energy	ocean space	Sweden	?
wind energy	public land	Japan	
wind energy	public land	Spain	
wind energy	ocean space	Ireland	Licenses are issued at a nominal rate of E5 annually, subject to a deposit of E100,000. (It may be that the nominal rate has been raised to E20; see RD Incentives below.) For Leases, the Minister may choose between normal commercial rents based on the nominal output of each turbine (E3,800/yr on a rating of 1 MW), subject to review every 5 yrs; or a % of gross revenue (2-2.5%).
wind energy	ocean space	Netherlands	Information not readily available (but see Termination).

Activity	Resource	Jurisdiction	Financial Terms
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral	United States	2005 amendments introduced greater financial incentives for resource development by each of the two main classes of leaseholders: those engaged in commercial electricity production vs. so-called "direct use" applications--i.e.., steam/heat/ energy production, other than electricity, that the lessee does not sell. (Note: These "end-use-based" categories parallel a more long-standing distinction based on the assessed quality of the resource within a given lease area--i.e.., known geothermal resource area, or KGRA, vs. non-KGRA. Previously all leases for KGRAs were awarded competitively and all non-KGRA leases were awarded non-competitively, whereas under the 2005 amendments all lease applications are potentially subject to competitive bidding. [See Allocation Method.]) The Amendments also introduced a requirement that 25 percent of all moneys from sales, bonuses, rentals, and royalties be paid to the county where resources are leased (in addition to the longstanding requirement that 50 percent of receipts be paid to the state). The following summary highlights the main financial terms, including both the old terms and the key changes introduced with the 2005 amendments. 1. Lease Rents Previous rates: $1/acre non-competitive, $2/acre competitive As of 2005 Amendments: $1/acre non-competitive for first 10 years; $2/acre competitive for the first year and $3/acre for each of years 2-10; $5/acre for each year after the 10th for both categories of leases 2. Lease Royalties and Fees Previously both competitive leases (those for commercial electricity generation in KGRAs) and non-competitive leases (for so-called "direct uses" in non-KGRAs) were subject to royalties of between 10 and 15 % of the heat or energy value generated. 2005 Amendments call for the following changes: For direct uses: a schedule of fees in lieu of royalties. Fees may be based on the quantity, or the thermal content, or both, of the resources used, and they also shall (1) ensure a fair return to the US, (2) facilitate development of the resource, and (3) contribute to sustainable economic development opportunities in the area. If lessee is a tribal or local government, only a nominal fee shall be charged. For commercial electricity: Royalties are reduced to between 1 and 2.5 percent of gross proceeds during the first 10 years of production, and to between 2 and 5 percent of gross proceeds during each year after the initial 10 years. In issuing relevant regulations, Secretary must seek (1) to provide lessees a simplified administrative system, (2) to encourage new development, and (3) to achieve the same level of royalty revenues over a 10-year period as was achieved under the previous regulations. Also, where a state or county government is entitled to a portion of such royalties, the Secretary may provide the lessee a credit against any royalties owed in an amount equal to the value of the electricity provided under contract to such other governmental entity. The maximum credit will be equal to the royalty value owed, and the electricity received will serve as an in-kind royalty payment from the federal government. Lessees with existing leases can apply to have their financial terms modified in accordance with the new royalty regulations/fee schedule within 18 months of establishment of relevant new rules. 2005 Amendments also introduced a near-term production incentive for the first 4 years of new commercial production of energy under existing leases: The royalties required to be paid shall be 50 % of the amount otherwise required if the existing lease does not convert to new royalty terms applicable to either (1) commercial production by a

Activity	Resource	Jurisdiction	Financial Terms
	rights		facility that begins such production within 6 years of enactment of the 2005 amendments; or (2) qualified expansion geothermal energy. The latter term means geothermal energy produced from a facility where (1) production is increased by more than 10 percent as a result of facility expansion carried out within 6 yrs of enactment; and (2) the production increase is greater than 10 percent of the facility's average production during the 5-yr period preceding expansion. 3. Other Royalties and Fees (generally unchanged in 2005) Filing Fee: $0 for competitive; $75 for non-comp Lease Assignment (transfer) filing fee: $50 Demineralized water royalties: 5% Byproduct royalties: 5% Minimum royalty: $2/acre Advanced royalties for cessation of production (new in 2005): If production ceases once commenced, the lease remains in force for a period of not more than an aggregate number of 10 years beginning on the date production ceases, if, during the period when production is ceased, the lessee pays royalties in advance at the monthly average rate that applied during production. The amount of any production royalty paid for any year shall be reduced (not below 0) by the amount of any advanced royalties paid under the lease.
livestock grazing	public domain rangelands	United States	Grazing fee of $1.43 per animal unit month (AUM) on the BLM lands. The fee is adjusted annually as a function of the price of cattle, the costs of livestock production, and private grazing land lease rates. Annual fee adjustments cannot exceed 25 percent of the previous year's
electricity generation	ocean thermal	United States	Non-refundable application fee of $250,000 (amount established by the Administrator to reflect reasonable costs of application review and processing. According to NOAA's 1996 Proposed Rule to withdraw its OTEC licensing regulations, NOAA's "minimum regulation" approach was intended to make for "relatively modest" incremental costs to NOAA to process each application
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	N.A.
port siting	ocean space	United States	Licensees pay the "fair market rental value" of the subsoil and seabed of the US outer Continental Shelf used by the deepwater port and the pipeline right-of-way, as determined by MMS. Applicants must reimburse the federal and state governments for the costs incurred in processing license applications. Adjacent coastal states may set "reasonable fees" for the use of a deepwater port, which cannot exceed its economic, environmental, and administrative costs. These fees must be approved by the USCG.
offshore aquaculture	ocean space (EEZ)	United States	Application fees and annual permit fees to be established by the Secretary. Also, permit holder must post a bond or other form of financial guarantee, in an amount sufficient to cover any unpaid fees, the cost of removing an offshore aquaculture facility at the expiration or termination of a site permit, and other financial risks.

Activity	Resource	Jurisdiction	Financial Terms
ocean disposal of wastes	ocean waters/marine environment	United States	$1000 permit application processing fee if proposed site is among those already designated by EPA (great majority of cases); additional $3000 processing fee if proposed site is not already so designated. Financial penalties may be assessed if permit terms are violated (or if dumping occurs without a permit): up to $50,000 for each violation (or each permit condition that is violated), except up to $125,000 if the violation involves medical waste. No permittee will be assessed a penalty before receiving written notice of the violation(s) and an opportunity for a public hearing. For permit violations, exact amount of penalty is at the discretion of the EPA Administrator, who must assess the gravity of the violation, the permittee's previous compliance record, and whether the permittee demonstrates good faith in attempting to achieve rapid compliance after notice of violation has been issued. (See Performance for additional penalties for criminal violations.)
mineral extraction	placer and lode minerals	United States	There is a $32 fee for locating and recording a claim and a $126 annual maintenance fee per claim. Patent applications involve a $250 fee plus a charge of $50 per claim within each application. Upon the approval of a patent claim, minerals on the claim may be purchased for $2.50 per acre for placers and $5.00 per acre for lodes. [These prices are thought to have been based on the market prices of land used for grazing and farms in the 1870s.] There are no annual fees on patents.
hydrocarbon extraction	offshore oil and natural gas	United States	Upfront payment of the bonus originally bid to obtain a lease. (In some cases, bonus payments may be deferred by as much as ten years.) Lessees must pay an annual rental fee (also known as a "minimum royalty") of $3.00/acre or $17,280/lease tract. Variable cash bonus with fixed royalty rate of 16.6% on a five-year lease and 12.5% on a ten-year lease. The annual rental is credited against the payment of royalties on production. (By law, royalties may be set between 12.5% and 33%.) Royalties may be renegotiated (usually as a lease is playing out) at the discretion of MMS. Under the Deep Water Royalty Relief Act (DWRRA) of 1995, royalty relief was made available for all western Gulf of Mexico deep-water leases issued between Nov. 1995 and Nov. 2000 ("new" leases) and for those "pre-Act" deep water leases that, in the judgment of the Secretary, would not be economically viable without royalty relief. For "new" leases, water depth determined the minimum volume of gas/oil that was exempted from royalty payment: 200-400 m: 98.5 bn cu ft gas/17.5 mn bbl oil 400-800 m: 295.6 bn cu ft gas/52.5 mn bbl oil >800 m: 492.6 bn cu ft gas/87.5 mn bbl oil These terms of the DWRRA expired in November 2000, after which MMS offered a revised incentive plan that provided for royalty relief at the discretion of the Secretary for leases purchased after November 2000. Congress established a new set of deep water royalty relief categories in the 2005 Energy Policy Act. The new categories (see below) reflect the increase in operating depths since the DWRRA was first passed and increase the incentives for deep water production. The new minimum volumes for which royalties may be suspended are as follows: 400-800 m: 5 mn bbl oil equivalent 800-1600 m: 9 mn bbl oil equivalent 1600-2000 m: 12 mn bbl oil equivalent > 2000 m: 16 mn bbl oil equivalent The 2005 legislation also authorizes the Secretary to limit the royalty relief granted based on

Activity	Resource	Jurisdiction	Financial Terms
hydrocarbon extraction	oil and natural gas	United States	A competitive lease requires the payment of a bonus bid up front (the bid must exceed a $2.00/acre minimum bonus), a rental of at least $1.50/acre for the first 5 years and $2.00/acre for each year thereafter, and a royalty of at least 12.5 percent in the amount or value of production removed from the lease. A non-competitive lease requires a $75 application fee, a rental of at least $1.50/acre for the first 5 years and $2.00/acre for each year thereafter, and a royalty of at least 12.5 percent in the amount or value of production removed from the lease.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	A fee of $100,000 must accompany each license application and each permit application. (Fee is to cover "reasonable administrative costs"; if significantly at odds with actual costs, adjustments will be made.) Info submitted with exploration license application must show that applicant is reasonably capable of committing or raising sufficient resources to cover the estimated costs of the exploration program and will be financially responsible to meet all obligations that the proposed activities may require.

Table A15. Subsidies

Activity	Resource	Jurisdiction	Subsidies
wind energy/power plant siting	ocean wind	Germany	A complicated "feed-in tariff" regime is in place, which guarantees the price for offshore wind energy. Ion 2002, the tariff was E0.09/kWh for up to nine years for installations located more than 3nmi from the coast (it lasts only five years for those within 3nmi). After nine years, the tariff is lowered. Starting in 2002, the tariff is to be reduced by 1.5% annually. Tariffs are paid by the grid operators, not utilities. The wind farm operator is guaranteed access to the electrical grid, and the grid operator must pay the cost of reinforcing the grid, if necessary. R&D programs supporting offshore wind energy have been established, particularly those relating to the collection of data and the conduct of studies relevant to environmental assessments.
wind energy	ocean space	Belgium	Most recently (2004), federal govt has promised to provide one-third of the costs of the cable connecting wind installations to the shore, but the promise has not been made official through publication [7] Under a Royal Decree, there is an operational subsidy in the form of a fixed price (green certificates) for offshore wind (0.09E/kWh as of 2003). In addition, all renewables projects are given guaranteed access to the grid, but in practice the guarantee has been undermined by limited grid capacity. [1] Other federal programs for RES generally include investment subsidies of 10% for medium to large companies and 20% for small companies; production subsidy of E0.025/kWh for RES electricity, plus an additional "green franc" (same amount) for first 10 years to wind & hydro installations with a capacity of 10 MW or more.[4] Note: For land-based windfarms and other RES installations, the regional govts. provide the following: Flemish govt: Green certificates, priority access to grid, fines on energy suppliers who fail to meet RES objectives. Walloon: Green certificates, priority access to grid, production subsidies, and fines for not meeting RES objectives. Brussels-Capital: Green certificates and guaranteed purchases of surplus RES electricity from independent producers [4]
wind energy	submerged lands	North Carolina	State Energy Office designed and in 2003 NC legislature approved NC GreenPower program, under which electric consumers can elect to pay an extra $4 a month for blocks of electricity produced from renewable resources. (The program provider is a non-profit, and consumer payments are tax-deductible and non-refundable.) The utilities, under special "tariffs," would agree to purchase that amount of electricity from NC companies producing electricity from renewables.

Activity	Resource	Jurisdiction	Subsidies
wind energy	state waters and submerged lands	New York State	State (NYSERDA) offers a wide variety of incentives to renewables developers/operators. This includes cash incentives and tax breaks for small (up to 80MW) wind projects and various programs to link NYSERDA-developed technologies to private capital. All solar, wind, and biomass facilities eligible for property tax exemption.
wind energy	state submerged lands	Texas	No.
wind energy	ocean space	Denmark	
wind energy	ocean space	United Kingdom	
wind energy	public lands	United States	Some grantees may be exempt from paying rents pursuant to the Rural Electrification Act of 1936 or other laws.
wind energy	ocean space	France	Electricity Law guarantees access of renewable energy producers to public transportation and distribution networks. Decree 2001-366 of 26 April 2001 provides that the costs of grid reinforcement will be integrated into the general tariffs for grid use and will not fall on electricity producers.[4] Under Article 10 of the Electricity Law of 10 Feb 2000, producers of electricity from renewable sources can benefit, under certain circumstances, from a purchase obligation or feed-in tariff, which are to be based on the avoided cost of the electricity-generation system. The government has proposed fixed buy-back rates for wind energy, including offshore, which are dependent on the median load factor (in hours) of the installation in relation to a given full load reference. Each producer signs a 15-year contract in which he receives a higher price for energy during the first 5 years and a lower price thereafter, adepending on the performance of the system compared to the initial 5-year period. In order to benefit from this arrangement, the producer must obtain a certificate entitling him to benefit from the measure, which is issued by the Prefect representing the Ministry for Industry. [4]

Activity	Resource	Jurisdiction	Subsidies
wind energy	ocean space	Sweden	-Govt. grants for electricity generation from renewable sources (about E5 million/yr for wind) will be phased out and ultimately replaced by a green certificate system introduced in 2003 that aims to increase the proportion of energy generated from renewable sources with an end-user quota obligation.. -Wind power production tax exemption introduced in 1994, recently extended through 2009. -Utilities must purchase electricity from small generators at agreed prices; since late 1998 biomass and wind have been sold at the market price plus a temporary govt. subsidy of E0.009/kWh - -National Program established 1997 to support municipalities' investments in technology to achieve lower environmental impacts, more efficient use of energy and resources and to promote use of renewable resources (SEK 7.2 million for 1998-2003).
wind energy	public land	Japan	As of 2003, a renewables portfolio standard was adopted (specifics not available) in the Law to Promote New Energy Use. Also, NEDO subsidizes renewable energy projects at the local level. Public entities, private sector companies, and NGOs are eligible for a subsidy to promote PV, biomass, waste and wind power generation, fuel cells, etc. The subsidy rate is up to 50% of the cost of installation, deployment, promotion of public awareness, and related activities. Expenditures have totaled $103 m (13.79 b yen) in 2001, similar amounts in 2002, 2003 (NEDO = New Energy and Industrial Technology Development Organization, a branch of the Ministry of Economy, Trade and Industry [METI]) [3]
wind energy	public land	Spain	"Generous capital and output subsidies": 1. Feed-in tariffs for renewables over first 5 years of a project 2. State and regional subsidies available as capital grants, up to 30% of eligible project costs. (As of 1999, regional Autonomous Governments distribute all such funds.) 3. Favorable buy-back rates for electricity produced from facilities under 100
wind energy	ocean space	Ireland	The National Development Plan 2000-2006 includes E67 million for infrastructure investment in the electricity grid to accommodate renewable energy project; for small-scale renewable projects; and for CHP projects. In some cases small-scale renewable projects have benefited from national, regional, and/or local enterprise funds. Much more general and indirect, corporate tax relief is written into Irish energy policy.[2]

Activity	Resource	Jurisdiction	Subsidies
wind energy	ocean space	Netherlands	After considerable policy flux since 2000, country settled on a policy in 2005 that relies on feed-in tariffs on renewable electricity imports to fund subsidies of domestic renewable production. (The 2002 parliamentary elections and a weather-induced electricity supply crisis in 2003 set the stage for a major policy shift.) Recent policy evolution can be summarized as follows: (1) Until 2002, a complex range of instruments was available to provide support for the different phases of renewable energy projects: R&D (subsidies), demonstration (subsidies and tax breaks), investment (tax breaks), and exploitation (green labeling programs; ecotax on non-renewable energy consumption, with fee paid to renewable energy producers from ecotax collections). (2) After the 2002 elections, the new government pledged to alter this system, beginning with drastic reductions in the green labeling and ecotax elements (which were encouraging consumption of imports and reducing energy tax revenues while depressing investment in domestic capacity). (3) By 2003, shift was under way to a "dual system" in which the ecosystem tax was substantially reduced, the production subsidy was abolished, and feed-in tariffs were introduced. (4) As of Jan 2005, ecotax exemption was discontinued and feed-in tariff was increased to completely offset the previously eliminated production subsidy.
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	Short-term production incentives introduced in 2005 amendments can be characterized as constituting subsidies (see Financial Terms)
livestock grazing	public domain rangelands	United States	Grazing fee is seen to be too low by some environmental groups. For example, the average private grazing fee is approximately $13.40 per head compared to the AUM of $1.43. (An AUM is one cow and her calf, one yearling, one horse, or four sheep or goats.) One estimate of the total federal grazing subsidy is on the order of $200 million per year.
electricity generation	ocean thermal energy	United States	OTEC Act authorized federal loan guarantees to assist with financing of up to 5 commercial demonstrations. All other federal assistance has been exclusively for R&D, as no commercial applications have been filed.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian	United States	No
port siting	ocean space	United States	The absence of an "open access" requirement could be interpreted as a subsidy.
offshore aquaculture	ocean space (EEZ)	United States	

Activity	Resource	Jurisdiction	Subsidies
ocean disposal of wastes	ocean waters/marine environment	United States	No
mineral extraction	placer and lode minerals	United States	In general, the absence of royalties and the minimal fees levied on mining claims is perceived by critics as a giveaway of publicly owned resources. It can be argued that the sale of minerals from the public domain at prices that are below market is an implicit subsidy. Mining firms also receive subsidies in the form of percentage depletion allowances and immediate expensing of the costs of exploration and development.
hydrocarbon extraction	offshore oil and natural	United States	The annual rental (minimum royalty) is credited against the payment of royalties on production.
hydrocarbon extraction	oil and natural gas	United States	A federal tax credit for unconventional fuel production (enacted in 1980) boosted investment in coalbed methane (CBM) development.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	No.

Table A16. Research and Development Program

Activity	Resource	Jurisdiction	R&D Program
wind energy/power plant siting	ocean wind	Germany	German government's "Investment Programme for the Future" has initiated R&D projects for offshore wind energy, including the construction of three platforms in "potentially suitable areas" to collect data on environmental conditions, ecology, and human uses (E15.4 million from 2001-2003). Another E4.2 million is being spent by the Federal Environment Ministry to provide technical information for the identification of protection areas. This information will include studies of bird and bat migrations and resting populations and the potential for ocean noise pollution affecting small cetaceans
wind energy	ocean space	Belgium	
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	NYSERDA pursues its own R&D programs and supports private energy R&D through a variety of grants and services to renewables developers at all stages of development.
wind energy	state submerged lands	Texas	No information.
wind energy	ocean space	Denmark	Denmark has three research programmers for funding R&D in energy supply, totaling under E20m: the Energy Research Programme and two public service obligation (PSO) programs funded by the two main transmission system operators. (These programs have established renewable energy R&D as a priority, but it's not clear how much of their total budgets are directed at ocean wind.)
wind energy	ocean space	United Kingdom	
wind energy	public lands	United States	None.
wind energy	ocean space	France	ADEME provides financial and technical support, including financial assistance for pre-feasibility studies. Also, in cooperation with ADEME, the DGEMP establishes multi-year programs with the specific objective of facilitating the use of renewable
wind energy	ocean space	Sweden	Natl. Energy Admin. works with industry to gain experience building wind farms in "difficult areas," such as offshore or mountain locations. About E38.6 million has been devoted to this effort.[3]

Activity	Resource	Jurisdiction	R&D Program
wind energy	public land	Japan	(New Energy and Industrial Technology Dvlpt Org) established by government in 1980 to develop new oil-alternative energy technologies. In 1988, NEDO's activities were expanded to include industrial technology R&D, and in 1990 environmental technology R&D. New energy and energy conservation technologies were added in 1993. As of 2003, NEDO is responsible for R&D project planning and formation, project management, and post-project technology evaluation functions. Provides grants to universities, subsidies to private companies, and R&D management services to universities, industry, and public research laboratories.[3]
wind energy	public land	Spain	Federal government initiated the resource assessment and promoted the first experimental wind turbine, which began operation in 1985. Various other incentives, provided at all levels of government, have been driven by the realization that Spanish firms could become global leaders in wind technology.
wind energy	ocean space	Ireland	"As an incentive to development of our marine energy resources," foreshore licenses are issued at a nominal rent of E5 per annum, subject to a refundable deposit of E100,000. [NOTE: This is taken from the Summary of the relevant guidelines; the section providing more detailed information on rentals says that licenses are issued without payment of rental, "other than a taken E20 . . "]Also, licensee may claim confidentiality over any information furnished during the license period and for 12 months after expiration, which shall be honored subject to the provisions of the Freedom of Information Act, a court order, or a formal inquiry into loss or threatened loss of life. If no lease application is made within 12 months after license expiration, confidentiality expires and information is thereafter in the public domain.
wind energy	ocean space	Netherlands	Subsidies were in place until 2002, when the focus shifted to market-based instruments to promote domestic capacity expansion (see Subsidies).
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral	United States	DOE funding for geothermal R&D was $106.2 million (1995 dollars) in fiscal year 1978, marking the first time the funding level surpassed $100 million. It remained above $100 million until fiscal year 1982, when it was reduced to $56.4 million (1995 dollars). As of 2003, the budget was in the range of $30 million to $40 million. [8] The 2005 Amendments established the Intermountain West Geothermal Consortium, a regional consortium of institutions and government agencies that focuses on science and science policy issues surrounding the expanded discovery and use of geothermal energy. Hosted and managed by Boise State University, its other member institutions include other regional universities, state agencies, and the Idaho National Laboratory, which is authorized to provide financial assistance for R&D and other authorized activities of the consortium members.
livestock grazing	public domain rangelands	United States	

Activity	Resource	Jurisdiction	R&D Program
electricity generation	ocean thermal energy	United States	OTEC Act (Sec. 116) exempts demonstration projects qualified by the DOE, as well as non-permanent test platforms, from all provisions of the Act that the Secretary of Energy deems appropriate [4]. OTEC Act also authorized federal loan guarantees to assist with financing of up to 5 commercial demonstrations. Total federal R&D investment of more than $200 million (one source says $260 million in 1970s alone [5]) by the time that DOE phased out its ocean energy program in 1993; spending peaked at about $40 million/year in 1980-1981 [2]. Since the end of federal involvement in ocean-energy collaborative research with industry, state of Hawaii has been the main public sponsor of OTEC R&D.
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	N.A.
port siting	ocean space	United States	None.
offshore aquaculture	ocean space (EEZ)	United States	Legislation would authorize the establishment of an R&D program, including demonstration projects, in support of offshore aquaculture. Also, it provides that "The Secretary may reduce or waive applicable fees or other payments established under this section for facilities used primarily for research or for raising cultured stock for the replenishment of wild fisheries."
ocean disposal of wastes	ocean waters/marine environment	United States	No
mineral extraction	placer and lode minerals	United States	
hydrocarbon extraction	offshore oil and natural gas	United States	Development of 5-year schedule of lease sales involves collection and analysis of environmental, economic, and social data; research has been funded on oil spill modeling and clean-up
hydrocarbon extraction	oil and natural gas	United States	None.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	No.

Table A17. Performance Requirements

Activity	Resource	Jurisdiction	Performance Requirements
wind energy/power plant siting	ocean wind	Germany	Areas cannot be provisionally reserved by merely submitting a license application at an early stage. There must be a plan and evidence of financial means (e.g., a bond) for the removal of turbines at the end of the project life.
wind energy	ocean space	Belgium	Concession/license will be terminated if no execution for 2 consecutive years. (Also, developers must adhere to principles of pollution prevention, precaution, sustainable development.) [5]
wind energy	submerged lands	North Carolina	
wind energy	state waters and submerged lands	New York State	Eligible proposers limited to entities with commercial wind-energy operational experience. RFP specified that performance guarantees (as well as limitation/exceptions and proposed penalties) be proposed by bidders. Guarantees must cover: contract capacity; minimum annual Net Energy Output; minimum Wind Park Availability; and Commercial Operation Date. [5]
wind energy	state submerged lands	Texas	No information.
wind energy	ocean space	Denmark	DEA identifies a relevant Supervisory Authority for ocean wind projects. Regular reports are required on the extent to which ocean wind farm operators are complying with permit or license conditions. An economic guaranty (bond) must be provided by the developer to ensure decommissioning of the plant at the end of its useful life.
wind energy	ocean space	United Kingdom	
wind energy	public lands	United States	Rental fees as above. 3-year interest/option for site testing and monitoring. Applicants must demonstrate the "technical capability" and "sufficient capitalization" to construct, operate, and maintain wind energy facilities. 3-year term of site-testing and monitoring right-of-way grant. Facilities must be installed according to an approved Plan of Development. Any delays in development greater than two years or inconsistent with the Pod timeframe require the developer to demonstrate "just cause." A developer's lack of due diligence provides BLM with the authority to terminate a right-of-way authorization.
wind energy	ocean space	France	Not determined.
wind energy	ocean space	Sweden	?
wind energy	public land	Japan	
wind energy	public land	Spain	

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wind energy	ocean space	Ireland	Investigations of site suitability must be completed within 4 years. Licensee is expected to: -carry out all necessary tests on wind and/or wave strength and tidal and sea bottom conditions, as appropriate; -seek permission of local planning authority for land-based components; -obtain necessary wayleaves (ROWs) on land; -apply for authority to construct a generating station; -apply for licenses to generate and supply electricity; -consult with interested parties; -consult, on an ongoing basis, with the Duchas in relation to protection of habitats, bird life, archaeological artifacts and monuments -carry out an EIA leading to an EIS. At the end of the license period, the licensee can have his E100,000 deposit refunded by either (a) making a Foreshore Lease application to allow development within the licensed area or (b) proving to the satisfaction of the Minister that the site is unsuitable.
wind energy	ocean space	Netherlands	Information not readily available.
power generation, heating (hot water, steam)	geothermal resources on public lands and private lands where govt retains mineral rights	United States	As of 2005 amendments: Lease shall be eligible for up to two 5-year extensions after the 10-yr primary term if the Secretary determines that the lessee has satisfied the work commitment requirements or paid the required annual payments. The Secretary shall issue regulations prescribing minimum work requirements that: (1) establish a geothermal potential; and (2), if a geothermal potential has been established, confirm the existence of producible resources. In lieu of these minimum work requirements, the Secretary shall establish annual payments that the lessee can make for a limited number of years that the Secretary determines will not impair achieving diligent development of the resource. (Previous rules were as follows: During primary 10-yr lease period, lessee must perform diligent exploration activities to yield new geologic information until either: (1) the approved expenditures on the lease total at least $40 per acre, or (2) BLM places the lease in an additional term. During the first five years of the primary term, lessee only had to pay rents. If efforts were made during the first five years that would qualify as diligent exploration expenditures and were approved as such, BLM would count them toward the requirements of future years. Lessee had to begin diligent exploration by the sixth year of the primary term and continue until there was a well capable of production in commercial quantities. Some examples of activities that would qualify as diligent exploration are geochemical surveys, heat flow measurement, core drilling or drilling of test wells. To qualify as diligent exploration expenditures in lease years 6 through 10, expenditures per acre had to meet specified minima (ranging from $4 in yr. 6 to $12 in yr. 10). Payments above the minima would be credited to subsequent years. If lessee chose not to conduct diligent exploration, or if total expenditures did not fully meet the requirement for any lease year, the due diligence requirement for that year could still be met by paying an additional rent of $3 per acre or fraction of an acre.
livestock grazing	public domain rangelands	United States	Temporary non-use of grazing rights may be approved on an annual basis (for not more than 3 consecutive years) because of financial conditions or fluctuations in livestock. Temporary "conservation use" of grazing lands may be approved for up to 10 years.

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electricity generation	ocean thermal energy	United States	Requirement that the licensee pursue diligently the construction and operation of the OTEC facility or plantship to which the license applies. No licenses issued, transferred, or renewed unless licensee or transferee first agrees in writing that (a) there will be no substantial change from the plans, operational systems, and methods, procedures, and safeguards set forth in the application without prior written approval of NOAA; and (b) licensee will comply with the conditions
protection and lawful excavation/removal in the public interest	archaeological resources on public and Indian lands	United States	Applicants must adhere to the terms of their permit, which include (1) fulfillment of the proposed activities and other commitments outlined in their work proposals; (2) any conditions that the Federal Land Manager deems necessary to protect public safety and other values and/or resources, to secure work areas, and to safeguard other legitimate land uses; and (3) in the case of "New Lands," any terms and conditions requested by the Indian landowner and the Navajo Nation. Initiation of work or other activities signifies an applicant's acceptance of the permit terms and conditions. The permittee may not be released from the terms of the permit until all outstanding obligations have been satisfied, whether or not the term of the permit has expired.
port siting	ocean space	United States	Detailed plan for deepwater port construction and operation must be submitted to USCG and MarAd. Fair market rentals assessed by MMS. Licensees must provide financial guarantees or post bonds sufficient to meet the costs for removal of the deepwater port components upon termination or license revocation.
offshore aquaculture	ocean space (EEZ)	United States	
ocean disposal of wastes	ocean waters/marine environment	United States	Permit terms must be strictly adhered to as to the nature and amount of the material to be dumped and the timeframe, manner, and exact location of the dumping. A copy of the permit must be displayed in a conspicuous place in the vessel and furnished to the Secretary of the department in which the Coast Guard is operating. A penalty of up to $50,000 may be assessed for each violation of the law or of any condition of the permit, except $125,000 if the violation involves medical wastes. In addition to financial penalties, any person who knowingly violates the relevant laws, regulations, and/or permit terms (except in an emergency) is subject to up to 5 years' imprisonment, the seizure by the US government of any property used in and/or derived from the criminal dumping activity, and, potentially, the requirement to cover the litigation costs of the US government or any other party that the court deems entitled to such compensation.
mineral extraction	placer and lode minerals	United States	There is a $126 annual maintenance fee per claim. [This requirement superseded an earlier requirement that at least $100 of development work be performed each year.] At least $500 of development work must be performed prior to filing a patent application. Litigation in 1986 reaffirmed the rights of claimants to oil shale claims to apply for patents to those claims, even where the $100 annual work requirement had not been met.
hydrocarbon extraction	offshore oil and natural gas	United States	Lessees must pay an annual rental fee or minimum royalty of $3.00/acre or $17,280/lease tract. Firms are required to post "performance bonds" of approximately $3 million per area or $300,000 per lease. These bonds may be forfeited if firms do not exhibit due diligence in exploring, developing, or producing a lease. Lessees must begin exploring a lease within the first two and a half years for a five-year lease and within the first five years for a ten year lease.

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hydrocarbon extraction	oil and natural gas	United States	Both competitive and non-competitive leases require the payment of a rental of at least $1.50/acre for the first 5 years and $2.00/acre for each year thereafter. Rental payments during producing years are credited against royalty payments.
exploration and commercial recovery	deep seabed hard minerals	US EEZ and "the Area"	Exploration license: Licensee must pursue diligently all activities described in his approved plan; this applies to the full scope of the plan, including environmental safeguards and monitoring systems. To help assure such diligence, the terms, conditions and restrictions (TCR) that the Administrator issues with a license will require periodic reasonable expenditures (which may not be established at a level that would discourage exploration by persons with less costly technology than is prevalently in use). Ultimately, the diligence requirement will involve a retrospective determination by the Administrator, which will take account of legitimate periods of time with no or very low expenditure and will allow for a certain degree of flexibility for changes encountered in such factors as resource knowledge and financial considerations. Licensee must submit a report annually reflecting his conformance to the schedule of activities and expenditures contained in the license. Also, licensee must adhere to the requirement for conservation of natural resources, encompassing due regard for the prevention of waste and the future opportunity for the commercial recovery of the unrecovered balance of resources in the area to which the license applies. Additional requirement for the submission of collector track and nodule production data, to enable NOAA to develop info needed for future decisions. Commercial recovery permit: Similar diligence requirements, again to be assessed via annual reporting and a retrospective determination by the Administrator. Other performance requirements of a commercial recovery permit: permittee must initiate recovery of nodules in commercial quantities within 10 years of issuance of permit, unless Administrator extends deadline for good cause. Once commercial recovery is achieved, permittee must (within reasonable limits/relevant factors) maintain commercial recovery throughout the period of the permit. Administrator may authorize temporary suspension of recovery activities for good cause, but no suspension may last more than one year unless the Administrator determines that conditions so justify.