Renewable Energy and Transmission Siting

California Energy Commission
DOCKETED
13-IEP-1
TN 70917
MAY 21 2013

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Context

Increasing America's renewable energy generation to 80 percent by 2050 will require a major expansion of infrastructure, including wind and solar farms and new transmission lines. This in turn will require new regulatory and business approaches to siting generation and transmission infrastructure. The obvious danger is that public opposition, environmental concerns, and bureaucratic inefficiency could combine to prevent the needed infrastructure investment. How can renewable energy providers avoid conflicts that can delay projects (like the offshore Cape Wind development, delayed for the past 11 years)? The answers lie in smart planning, including improved operation and expansion of the grid to better take advantage of existing infrastructure, early and meaningful engagement of stakeholders, better coordination among regulatory bodies, and specific strategies to reduce risks of environmental and cultural-resource conflicts – including pre-screened and pre-approved "energy resource zones."

Introduction:

The National Renewable Energy Laboratory's *Renewable Electricity Futures Study*[1] (*RE Futures*) finds that it's feasible to produce 80 percent of America's power from renewables by 2050. Yet doing so would require enormous changes in the way we plan for, site, permit, generate, transmit, and consume renewable electricity. Innovation—both technological and institutional—will be the cornerstone of this effort. Beyond more efficient solar cells and bigger wind turbines, American *businesses and institutions* will need to find innovative solutions for locating new generation and transmission.

The need to site and build a new generation of transmission infrastructure continues to increase. Current and expected investment trends suggest now is the time to act. Between 2000 and 2008, only 668 miles of interstate transmission lines were built in the United States. The past four years have seen a greater commitment to infrastructure improvement, but the nation continues to fall short. Annual investments during 2009 to 2018 are expected to reach three times the level of annual transmission additions in the previous three years. More than one quarter of transmission projects currently planned through 2019 are designed to carry power generated by new, non-hydro renewable resources. The Midwest Independent System Operator (MISO) estimates that up to $6.5 billion in transmission

[1] National Renewable Energy Laboratory (2012). "Renewable Electricity Futures Study." Hand, M.M.; Baldwin, S.; DeMeo, E.; Reilly, J.M.; Mai, T.; Arent, D.; Porro, G.; Meshek M.; Sandor, D. eds. 4 vols. NREL/TP-6A20-52409. Golden, CO: National Renewable Energy Laboratory. http://www.nrel.gove/analysis/re_futures/

expansion investment will be needed by 2021 in that region alone. In the West, estimates range as high as $200 billion over the next 20 years.[2]

It will be critical to implement reform ahead of the next wave of expected projects. America needs a new paradigm, one that removes barriers to new projects and takes into account lessons learned over the past ten years. Reform must reflect a new approach to siting -- one that recognizes the effect wholesale power markets have on transmission planning, and one that meets the needs of landowners, wildlife, and society as well as project sponsors and investors.

Finding the Sweet Spots for Renewable Energy

Modernizing America's electric grid will be a monumental job. While distributed generation will play a big role in America's clean energy future, on-site power alone cannot bring us to 80 percent renewables. The amount of energy needed is too vast, especially as the economy rebounds and economic growth continues. We will need major additions of centralized renewable energy generation, and some of the very best renewable energy resources are far from population and energy demand centers.

NREL calculates that a gross estimate of land needed for an 80% national renewable electricity future would be equivalent to less than about 3% of the U.S. land base, up to 200,000 square kilometers. Such large-scale developments must be located with extreme care for culturally rich areas, species protection, and wildlife habitat.

[2] Linvill, Carl, John Candelaria, and Ashley Spalding (2011). *Western Grid 2050: Contrasting Futures, Contrasting Fortunes*. Western Grid Group. <http://www.cleanenergyvision.org/wp-content/uploads/2011/08/WG2050_final_rev082211.pdf>

Table A-10. Land-Use Implications of Low-Demand Core 80% RE Scenarios and the High-Demand 80% RE Scenario[a]

Renewable Technology	Land Use Factor	Total Land Use (000s of km^2) Low-Demand Core 80% RE Scenarios	High-Demand 80% RE Scenario	Description[b]
Biopower	25,800 GJ/km^2/yr	44–88	87	Land-use factor uses the midrange estimate for switchgrass in Chapter 6 (Volume 2). Other waste and residue feedstocks are assumed to have no incremental land use demands.
Hydropower	1,000 MW/km^2	0.002–0.10	0.06	Assumed only run-of-river facilities, with land use based only on facility civil works with no flooded area. Although not evaluated here, inundated area associated with run-of-river facilities would increase these values.
Wind (onshore)[c]	5 MW/km^2	48–81 (total) 2.4–4 (disrupted)	85 (total) 4.2 (disrupted)	Most of the land occupied by onshore wind power plants can continue to be used for other purposes; actual physical disruption for all related infrastructure for onshore projects is approximately 5% of total.
Utility-scale PV	50 MW/km^2	0.1–2.5	5.9	Direct land use of modules and inverters.
Distributed Rooftop PV	0	0	0	Systems installed on rooftops do not compete with other land uses and no incremental land use is assumed here.
CSP[d]	31 MW/km^2	0.02–4.8	2.9	Overall land occupied by CSP solar collection fields (excluding turbine, storage, and other site works beyond mirrors).
Geothermal	500 MW/km^2	0.02–0.04	0.04	Direct land use of plant, wells and pipelines.
Transmission	See Description	3.1–18.6	18.1	Assuming an average new transmission capacity of 1,000 MW and a 50-m right-of-way.
Storage	See Description	0.017–0.030	0.025	Land-use factors of 1,100 m^2/MW, 500 m^2/MW, and 140 m^2/MW were assumed for PSH, batteries, and CAES, respectively. See Chapter 12 (Volume 2) for details.

Renewable Electricity Futures Study
Volume 1: Exploration of High-Penetration Renewable Electricity Futures

Figure 1. *RE Futures* land-use estimates

Given the scale of these projects, several important considerations can help guide developers, policymakers, and grid planners as they make decisions about where and how to locate new generation and transmission. These considerations include:

- Location of high-quality renewable resources,
- Impact on landscape, including both natural and cultural resources, and
- New options for siting on private lands.

The first consideration in siting generation and transmission is the presence of high quality renewable resources. Planners and developers can use some key questions to identify such sites: what is the solar insolation per square meter? What is the wind speed at 80 meters above the ground? How many hours per year is the wind blowing at the right speed to drive a turbine efficiently? These are extremely important questions; developing optimal sites means that fewer acres of land or nautical miles of ocean need be developed to produce the energy we require. But the location of these high-quality resources is just one piece of the puzzle.

The kind of centralized projects[3] we are talking about are very large, and can sometimes span several square miles (see figure 2). Large developments mean substantial physical impacts on the landscape, as well as impacts on valued natural and cultural resources. Wildlife habitat will be destroyed in the

[3] Centralized projects are defined here as projects larger than 20 megawatts.

process, at a time when many species are already under stress from overdevelopment and a changing climate. Decision-makers must factor these impacts into location selection.

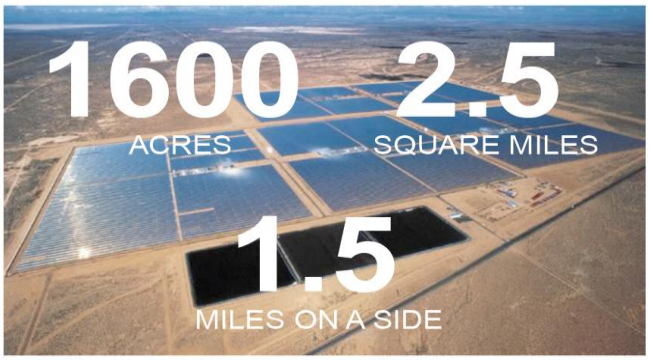


Figure 2. 354 MW Solar Energy Generating Station, California desert[4]

Additionally, decision-makers must pay special consideration to private land owners. Private landowners play an invaluable though often overlooked role in the siting and construction of both generation and transmission infrastructure. Particularly in the Eastern Interconnection, transmission projects are built almost exclusively on private land. How landowners are treated throughout this process can determine whether projects are more rapidly approved and developed or delayed and even halted.

Today's Process

To begin any discussion of how to improve siting practices in the United States, one must first consider today's approach. When a new project is conceived and drawings begin, transmission developers first apply to each state's own Public Utility Commission—or relevant siting authority—for a "Certificate of Need" and a route permit. The same process is used whether the project is being proposed by an investor-owned utility, a private investor, a public power district, or a rural cooperative. A typical application includes an estimate of costs, a justification of need, and at least one proposed route to study. If the proposed project crosses federal lands, as is typical in the Western Interconnection, it triggers the National Environmental Policy Act (NEPA) process. In most instances, the independent transmission developer will first pursue and complete NEPA on his project, at least through the Final Environmental Impact Statement (EIS) stage (or Record of Decision, in some cases) prior to initiating serious permitting activity in state jurisdictions. This is normally done to allow incorporation of the NEPA record by references in the state siting hearings and application process. California has a siting process under the California Environmental Quality Act (CEQA) that allows for more formal parallel activity with NEPA.

In deciding whether to grant a "Certificate of Need," state Public Utility Commissions overwhelmingly focus on two distinct sets of issues: 1) operational and economic need for the project and 2) environmental impact of the proposed project.

[4] Acres and Watts, Considering Scale and Renewable Energy, Kevin Sweeney, Haas School of Business, University of California, Berkeley and the Energy Foundation, July 2010.

Operational and Economic Need considers whether the line has significant market value, how it would fit into the state's integrated resource plans, whether new generation sources need it to deliver their power, and whether it is needed to ensure reliability or meet new demand.

Environmental Impact generally involves a full evaluation of the line's environmental impact, whether the construction will affect endangered species, whether it will open new areas to development, involve sensitive ecological areas, or give rise to visual or aesthetic concerns.

The Commission's final decision prioritizes benefits to in-state ratepayers. A Certificate of Need is granted once the project has been reviewed, tradeoffs have been evaluated, and the Commission has determined that the proposed line is in the public interest. This designation allows the applicant to begin building on public lands and negotiating easement terms with affected landowners. In most cases, it allows developers to exercise eminent domain authority if private land negotiations fail.

Several changes to today's process can help accelerate smart siting.

Recommendations for Policymakers

Policymakers have several options to accelerate siting for new generation and transmission needs. First, system operators must manage demand for energy, and take advantage of America's existing grid—these topics are touched on here, but covered in more detail in other papers in this series.[5] This paper focuses on the reforms needed to locate, coordinate, and expedite any new generation or transmission that the grid system requires.

In short, policymakers should:

- Optimize the existing grid infrastructure;
- Employ "Smart from the Start" criteria;
- Improve interagency, federal-state, and interstate coordination;
- Work with landowners to develop new options for private lands; and
- Refine the process to support siting offshore wind developments.

The following sections describe how policymakers can do each of these things.

Optimize the existing grid infrastructure

Any siting discussion should start with the idea of getting more out of infrastructure that has already been built. Optimizing grid management practices can save enormous amounts of time and capital, while reducing the footprint of development. Operating efficient markets for generation and other grid services can help,[6] as can adopting dynamic transmission line rating.[7] Grid optimization is the most efficient way to reduce the need for new generation and transmission lines. A next-best option is to site new renewable energy generation in places with feasible access to existing transmission. Once existing

[5] See other papers in this series: *Aligning America's Power Markets*, *Renewing Transmission: Planning and Investing in a Re-wired, High Renewables Future.*
[6] See another paper in this series: *Aligning America's Power Markets*.
[7] See another paper in this series: *Renewing Transmission: Planning and Investing in a Re-wired, High Renewables Future*.

infrastructure is maximized, decision-makers should begin to consider the actions outlined in the following sections.

Decision-maker	Recommendation
ISOs/RTOs[8], DOI, WECC, state authorities	Add grid optimization to siting criteria or the renewable zone formation process.

Fully Use Available Planning Processes

While the focus of this paper is siting, it is critical to fully consider the *planning* process as a precursor to siting. Many organizations, notably the Western Electricity Coordinating Council (WECC) in the western U.S., western Canada and Mexico, perform a variety of studies that attempt to understand infrastructure needs 10 or 20 years in the future. This process does not attempt to predict the future. Rather, it seeks to identify strategic choices that will guide infrastructure development needs. The planning process also does not attempt to supersede the siting process. Rather, it seeks to identify issues early in the process that will need to be addressed ultimately when a project enters siting consideration. One of the goals of the planning process is to expedite the siting process. By understanding and mitigating issues early on, detailed siting analyses should proceed more quickly. Specific issues that can be addressed in the planning process include:

- Transmission expansion needed to facilitate meeting expected load with available resources;
- Policy initiatives such as Renewable Portfolio Standards (RPS);
- Environmental and cultural risks;
- Economic variables such as fuel prices and emission costs and their effects on resource choices; and
- Resource and transmission capital costs.

Employ "Smart from the Start" criteria

Locating new generation carefully and strategically can avoid most conflicts. This approach has become known as "Smart from the Start." The Interior Department has adopted many of the concepts inherent in this approach to guide both onshore and offshore renewable energy development. Originally introduced in 2005, many Smart from the Start criteria have been put into practice in federal, state and regional generation and transmission siting processes in recent years. Projects and organizations using these criteria include: the Department of the Interior's Solar Program, the Department of Energy Regional Transmission Expansion Policy Project, the Western Governors Association, the Bureau of Land Management's Arizona Restoration Design Energy Project, the Bureau of Ocean Energy Management's offshore wind Smart from the Start program, and the WECC's Transmission Planning and Policy Committee.

[8] See Appendix 1 for a list of acronyms.

Smart from the Start Siting Policies and Criteria

- Consult stakeholders early and involve them in planning, zoning and siting
- Collect and use geospatial information to categorize the risk of resource conflicts
- Avoid land and wildlife conservation conflicts (including national parks and other protected areas) and prioritize development in previously disturbed areas
- Avoid cultural resource conflicts (historic sites, tribal resources, etc.)
- Identify excellent renewable energy resource values
- Establish, when possible, pre-screened resource zones for development
- Incentivize resource zone development with priority approvals and access to transmission
- Consider zones or development sites that optimize the use of the grid
- Maximize the use of existing infrastructure, including transmission and roads.
- "Mitigation that matters" (durable and planned conservation improvements at larger scales)
- Where zoning is not feasible (as in much of the Eastern Interconnection) use siting criteria based on the above principles

The Smart from the Start approach is valuable for siting both generation and transmission, but is most effective when used for both at the same time. It can also be helpful in delivering efficient use of existing transmission resources.

Two of the Smart from the Start principles are particularly important for accelerating renewables:

- Establish, when possible, pre-screened resource zones for development.
- Where zoning is not feasible (as in much of the Eastern Interconnection) utilize siting criteria based on the above principles.

Establish Renewable Energy Zones

Pre-screened zones for renewable energy can dramatically accelerate time to market for new generation. This streamlines siting hurdles for all projects involved, and can help government agencies prioritize projects and work together to assess impacts efficiently and bring new infrastructure online more quickly.

Texas pioneered renewable energy resource zoning in 2005 to develop transmission for remote wind energy projects. Today, nearly 11,000 megawatts of wind capacity have already been constructed in Texas, and the state expects to add at least 18,500 megawatts more. The Electricity Reliability Council of Texas (ERCOT) is responsible for developing the transmission, and has estimated that up to 3,500 miles of new lines are needed to bring the new wind capacity to the state's load centers. Texas' proven renewable energy zones will be critical to making this happen.

Building on Texas' model, many other states have found renewable energy zoning to be an important strategy for prioritizing environmentally desirable, lower conflict sites for new generation and transmission. Some form of renewable energy zoning has since been adopted by state and federal agencies in California, Arizona, Colorado, Nevada, Utah and across the west. California's Renewable Energy Transmission Initiative identified renewable energy development zones statewide and recommended transmission upgrades to serve them. The California process enhanced the environmental values portion of the zoning process, as compared to Texas' process, by developing the first-ever environmental screening process for ranking the relative risk of environmental and cultural conflicts in new transmission proposals (see figure 3).

WECC's Regional Transmission Expansion Project is a zoning process funded by a stimulus grant from the DOE. The project uses 10 and 20 year plans for its zones – horizons previously unheard of in the electricity industry – developed by an unusually diverse set of stakeholders to forecast transmission needs in the Western Interconnection under a variety of futures.

But zoning remains in its infancy in the Eastern Interconnection, owing to the fact that the region is far more complex: with three times as many states, far less federal public land, and a much more diverse set of wildlife and environmental management regimes. Ownership in the East is so complex that resource zoning is often impractical if not impossible. Still, the Eastern Interconnection Planning Collaborative is attempting a zoning initiative, funded by the DOE. The project is engaging diverse stakeholders to develop scenarios of future transmission needs. Siting criteria will likely be the default approach for these areas, and will be extremely valuable in avoiding areas at high risk for environmental and cultural resource conflicts.

Argonne National Laboratory has undertaken an innovative mapping effort to cut through the complexity of the Eastern Connection at a system level, and the lab's work is very promising for renewable energy zone and environmental risk modeling in the region. For example, Argonne's tool has numerous layers of data that could be used to identify more optimal, lower-conflict sites for renewable energy and transmission development. Even more promising: the WECC Environmental Data Task Force is currently considering the possibility of populating the Argonne platform with data from the west to create a uniform national database to ease renewable energy and transmission siting for planners, project developers and the public.

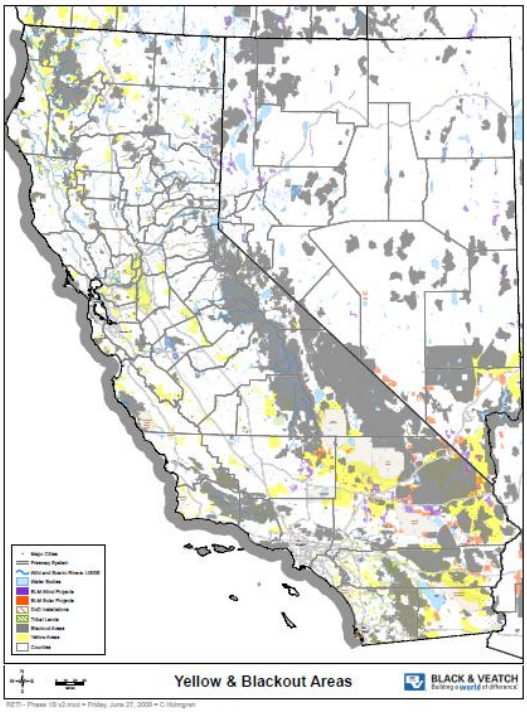


Figure 3. Ranked environmental and cultural risk zones for the state of California. [9,10]

[9] Yellow areas are areas in which development is constrained and challenged by environmental conflicts. Gray areas are areas off limit to development by statute, rule or policy.

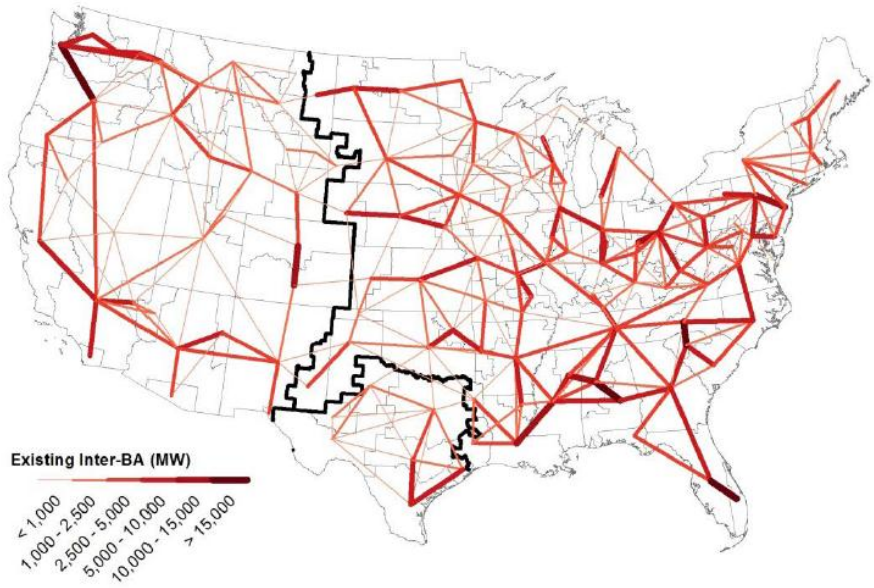
Other states are using landscape-level analysis to locate renewable energy and transmission projects. Oregon is currently developing a landscape-level renewable energy planning analysis that could result in the identification of promising low impact resources areas, or de facto zones.

Decision-maker	Recommendation
WECC, state authorities, Power Marketing Administrations, FERC, transmission sponsors, utilities	Fully utilize available planning processes to identify issues early in the process that will need to be addressed ultimately when a project enters siting consideration. One of the goals of the planning process is to expedite the siting process. By understanding and mitigating issues early on, detailed siting analyses should proceed more quickly.
FERC, RPEs, BLM, DOE, DOI, EIPC, state authorities	Use Smart from the Start principles in choosing development sites and corridors.
FERC, RPEs, BLM, DOE, DOI, EIPC, state authorities	Consider renewable energy generation and transmission development and siting simultaneously.
Congress, DOE, national labs	Create and maintain national cultural and environmental conflict risk data and mapping capabilities to support federal, regional and state-level generation and transmission siting.
State and local authorities	Develop clear siting criteria where zones are not possible.

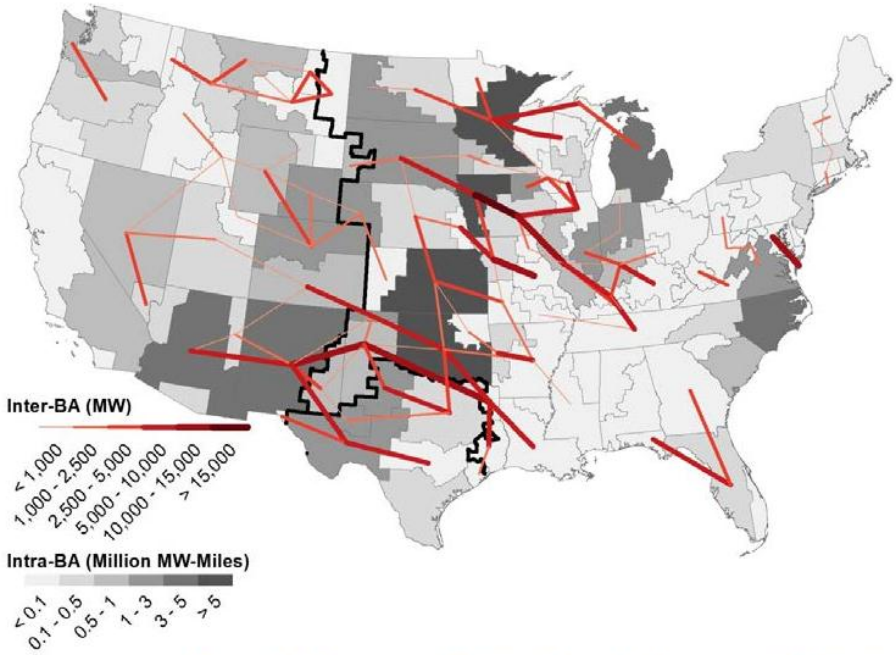
Improve interagency, federal-state, and interstate coordination

The lack of coordination within federal agencies and between the federal and state agencies has been a major hindrance to siting renewable energy projects, but substantial progress has been made in the last four years. The Obama administration took action in 2009 to address the coordination issues raised by both environmental and renewable energy development stakeholders. A Memorandum of Understanding (MOU) delineated how federal land managers and the Energy Department would coordinate on project approvals for both generation and transmission siting on public lands. The MOU was signed by the heads of U.S. Department of Agriculture, Department of Commerce, Department of Defense, Department of Energy, Environmental Protection Agency, the Council on Environmental Quality, the Federal Energy Regulatory Commission, the Advisory Council on Historic Preservation, and Department of the Interior. Leadership at the Secretarial level in the Interior Department resulted in the establishment of four Renewable Energy Coordination Offices tasked with focusing agency resources on managing siting issues on public lands. The offices reached out to several states that were expecting large amounts of renewable energy, and useful partnerships were established to facilitate joint permit activities. By coordinating these permitting activities, sequential environmental reviews can be eliminated while still addressing all the requirements of both state and federal processes. The resulting uptick in project approvals has been dramatic.

[10] RETI Phase II Report, CEC .



(a) Existing transmission grid representation in ReEDS



(b) New transmission estimated to be required by ReEDS by 2050 in the 80% RE-ITI scenario

Figure 4. Existing transmission (a) and potential 2050 transmission (b).

For example, a partnership between the Departments of Interior and Energy and the state of California, as well as leading environmental stakeholders, resulted in permits for more than 4,000 megawatts of renewable generating capacity in less than a year. The largest solar projects ever developed are under construction in California, as are the transmission system upgrades needed to bring their power to customers. They are collaborating on large scale resource conservation and infrastructure planning,

drafting the largest Habitat Conservation Plan ever attempted. The plan is being prepared through an unprecedented collaborative effort between the California Energy Commission, California Department of Fish and Game, the U.S. Bureau of Land Management, and the U.S. Fish and Wildlife Service. When completed, this joint effort will identify resource areas (essentially zones) that will be interconnected to the grid and that will enjoy swift siting approval for new renewable energy generation.

One of the most important lessons from this work has been that land and wildlife conservation efforts – and new mitigation strategies – need to be developed in tandem with project planning. Taking these impacts into account early enhances stakeholder participation. Getting the right parties involved as early as possible is an essential element of success.

Interagency coordination

A federal Rapid Response Team for Transmission (RRTT) was established in 2009 to close the gap between new renewable energy generation and the transmission to bring it to market. The RRTT seeks to improve the overall quality and timeliness of the federal government's role in electric transmission infrastructure permitting, review, and consultation through:

- Coordinating statutory permitting, review, and consultation schedules and processes among federal and state agencies, as appropriate, through Integrated Federal Planning,
- Applying a uniform and consistent approach to consultations with Tribal governments, and
- Resolving interagency conflicts to ensure that all involved agencies are meeting timelines.

Federal-state and interstate coordination

While some progress has been made in coordinating federal and state actions, much more remains to be done. Long-distance transmission lines crossing several states face the most acute problems. For example, a project usually needs to go through a review in each jurisdiction, and the reviews often happen in series rather than at the same time. This can add huge costs and delay projects for years.

Public Utilities Commissions hold the authority to approve transmission line siting in most states. But some states have three or four separate entities involved in transmission approvals and siting. And while most states have some statutory recognition of the need to coordinate on transmission with their neighbors, eleven states are still statutorily silent on this topic.[11] The variation in the way states handle siting presents an unnecessary level of complexity that frustrates public interest groups, landowners, and project developers alike. Project developers are often overwhelmed by having to coordinate with many agencies—from natural resource departments to land-use entities. A single agency could be established in each state to ensure that permit requirements are not duplicated, but that the process includes all important considerations. A one-stop-shopping approach to siting in each state would greatly expedite and enhance siting for interstate transmission.

Congress took steps to address interstate coordination via the Energy Policy Act of 2005 (EPAct 2005), encouraging collaboration between states in two important ways. First, it authorized them to form interstate compacts to create their own rules to govern siting of new lines. This authority has not been used successfully to date, but it may yet prove important in expediting transmission projects that cross state lines. For example, the Council of State Governments is currently exploring ways to improve interstate coordination and better take advantage of this interstate compact tool. Second, the EPAct

[11] Colorado, Montana, Iowa, Oklahoma, Nebraska, Louisiana, Pennsylvania, Virginia, West Virginia, Maine and Massachusetts. See: http://www.ncouncil.org/Documents/Transmission_Siting_FINAL_41.pdf

2005 gave the Federal Energy Regulatory Commission (FERC) "backstop" siting authority for certain transmission corridors that DOE identified as critical to grid reliability. This meant that if states did not reach a siting agreement within a year, FERC was allowed to site the line. This provided a strong incentive for state coordination, but subsequent court rulings undercut the FERC's backstop authority as granted in EPAct 2005.

Two years later, FERC's Order 890 opened up transmission planning to all stakeholders and tied payments ("open access tariffs") to developers' ability to meet nine transmission planning principles: coordination, openness, transparency, information exchange, comparability, dispute resolution, regional participation, congestion studies, and cost allocation. But interconnection-wide programs either did not exist or lacked the authority to allocate costs or select projects, until last year.

Then, FERC took decisive action to reform transmission planning by adopting Order 1000 in 2012. This is the most beneficial FERC policy ever adopted for renewable energy development. Order 1000 requires regional and interconnection-wide planning, enabling broader benefits and wider and fairer cost distribution for new transmission. The order also requires that the need for states, utilities and system operators to comply with public policy mandates, such as state and federal laws such as renewable portfolio standards, must be considered in selecting transmission options eligible for federal cost allocation. Moreover, Order 1000 requires that incumbent utilities surrender their right of first refusal to build certain kinds of transmission lines in their service territories. This can save time and money for independent transmission investors, driving down the risk they see in new transmission projects. In addition to requiring regional planning and driving down investment risk, Order 1000 requires planners to consider alternatives to transmission that can meet system and energy needs. These alternatives might include demand side management, distributed generation, and energy efficiency programs. These requirements are likely to result in vast improvements in planning coordination across broad geographies and better resource choices for the grid system as a whole.

The FERC's Order 1000 emphasizes stakeholder involvement, public policy goals, and transmission competition. It also encourages grid planners to assess alternatives (distributed generation, demand-response, etc.) on equal footing. Here are some reasons why this Order could unlock transmission siting for remote renewables:

1. Non-traditional stakeholders (consumer advocates, environmental groups, Native American tribes, etc.) have a seat at the table. The result: more buy-in throughout the process, as well as better solutions with fewer conflicts.
2. States are treated as key stakeholders. They can help make choices about transmission alternatives, giving them a greater interest in siting lines quickly while resolving local land use conflicts. State involvement in selecting the needed transmission and allocating costs reduces the likelihood of FERC having to exercise backstop siting authority.
3. Planners must identify beneficiaries. Concerns about paying for other states' benefits could be reduced if not eliminated.
4. The transmission planning process is required to be more transparent and open.

FERC backstop siting authority can play an important psychological role in encouraging states to coordinate and lead in transmission planning, making it a useful siting tool. The best value of backstop siting is not in its exercise, but in the *possibility* of its exercise. One of the most potent arguments against FERC's backstop siting authority was the indiscriminate way that DOE originally defined its

National Interest Electric Transmission Corridors (NIETC) in EPAct 2005. Those "corridors" encompassed entire eastern states as well as most of Arizona and southern California. State and public opposition was understandable and should have been expected. But FERC backstop siting authority could be very effective for Order 1000 transmission lines. The Order 1000 process involves states and regional planners, mitigates environmental and cultural risks, and ensures that alternative solutions are weighed.

Decision-maker	Recommendation
Congress, DOE, FERC	Facilitate the participation of non-traditional stakeholders in regional and federal (FERC Order 1000) transmission planning by providing financial support to stakeholder representatives (DOE, Congressional appropriations, and/or FERC approval of Federal Power Act section 215 funding for this purpose (Western Interconnection)).
Congress, state authorities	Congress should redefine FERC backstop siting authority to apply to lines selected through and whose costs were allocated in Order 1000 planning.
DOE, FERC	Adopt the use of environmental and cultural risk screens in federal corridor designation processes required under EPAct 2005 and federal transmission planning efforts, such as the implementation of FERC Order 1000.
State authorities	Neighboring states with renewable energy resources and transmission needs should act to harmonize siting requirements and explore the possibility of creating interstate compacts for this purpose and to facilitate regional planning for renewable energy transmission.
State authorities	States should consider the establishment of a one-stop siting agency for large energy and transmission projects. Applicants are overwhelmed with having to deal with multiple agencies, from natural resource departments to land use entities. Because one of the main goals of this project is to save time for permit applicants without sacrificing important considerations, having one agency ensure that permit requirements are not duplicated can substantially shorten an applicant's timetable.

Work with landowners to develop new options for private lands

The past decade has seen increased investment in transmission. More lines now traverse state boundaries. The scope of each proposed transmission project continues to grow. Now more than ever transmission lines are affecting private land and productive agricultural ground, at a time when commodity prices are at all-time highs and land prices are reaching unprecedented levels. Considered in tandem with the growth of renewable resource development, these changes indicate that the function of the electric grid has evolved. For the most part, however, each state's approach to transmission siting has stayed the same. Typically, states are required to legally review issues of project cost, environmental impact, size, type, timing, cultural and historical impacts, among others. These fall generally into the two categories: need and environmental impact. By focusing primarily on project need and environmental impact states often undervalue the interests of the landowner when approving and subsequently siting a proposed transmission line.

If negotiations break down between the transmission provider and a landowner, the transmission provider can most often fall back on eminent domain. Intended as a reflection of fair market value, eminent domain in fact often fails to adequately compensate landowners. Eminent domain does not account for the subjective value each landowner places on a parcel of ground, nor does it compensate

landowners based on the heightened land values that come from land assembly and potential development. Eminent domain also fails to account for the decrease in value of each landowner's remaining land, as prospective buyers often find encroaching infrastructure aesthetically troubling.

Prominent recent cases such as the Montana-Alberta Tie-Line and the Keystone XL pipeline show that opposition to eminent domain remains intense. Attorneys in the Upper Midwest and the Great Plains are now handling more eminent domain cases than ever before. Each time a new project is proposed, transmission developers in these regions are faced with a bevy of opponents. This can have a dramatic effect on the cost of siting as project developers pay millions for litigation and state agency administrative costs. Just one holdout can delay development for years.[12]

Eminent domain, however, is not always available. "Determination of need" – the most important prerequisite for eminent domain – requires the transmission developer to demonstrate that the proposed project is needed and the siting authority to confirm that construction of the project will serve the public interest. Because many state siting statutes and regulations have not been updated to account for expanding interstate balancing areas, they continue to base the determination of need on benefits to in-state ratepayers only. Often state statutes prohibit non-utilities from applying for a determination of need, or refuse to grant non-utilities eminent domain even if their application is successful. Siting authorities in states such as Massachusetts and Mississippi have declined to site proposed projects that cross state lines but do not deliver ratepayer benefits exclusively to in-state citizens. Moreover, eminent domain is not an option for merchant transmission lines in several states (e.g., Illinois, Maryland, New Hampshire, and Nebraska), making it very difficult to build new transmission to support renewable energy development.

While eminent domain must remain available as a necessary last resort, providing viable alternatives will accelerate siting of the infrastructure needed to deliver renewable energy. Several options exist:

- *Special Purpose Development Corporations* (SPDC) focus on providing landowners with another option for just compensation. The condemning authority creates an SPDC, allowing the landowner to choose between two options. Either the landowner can opt to receive the traditional fair market value for the parcel or s/he can elect to receive shares in the SPDC. The value of these shares is commensurate with the fair market value of the parcel the landowner has committed to the project. The condemning authority then sells the SPDC to a transmission developer at auction. The sale increases the value of the SPDC, and the landowners' shares are transferrable on the open market. Each shareholder is entitled to project dividends. The result is that the landowners' compensation is tied directly to market value, unlike traditional "just compensation." By giving landowners a stake in the project's success, the process can move more quickly and fairly. This framework is applicable to utility-owned transmission projects; a merchant developer does not have a mechanism for recovering equity dilution from rates and may instead prefer to offer landowners annual payments tied to project royalties.

- *Landowner Associations* refer to groups of landowners that come together with a shared interest. They have been particularly successful for wind development, and are also suitable for shorter transmission lines. Each participating landowner is given a proportional share of ownership in the association based on the amount of land they want to make available for development. As an association, landowners then approach developers for projects. Members of the association that

[12] http://www.ncsl.org/issues-research/env-res/summary-of-kelo-v-new-london.aspx

physically host turbines or transmission infrastructure are given a premium, but all members of the association receive a portion of profits.

- *Tender Offer Taking* enables developers to test landowner interest in several corridors by drawing proposed boundaries for a given project, and offering an above-market price for all landowners within the boundary. The developer then confidentially monitors acceptance, and goes forward with the project once a predetermined threshold is met (applying eminent domain authority to any remaining holdouts). If the threshold is not met, the developer shifts attention to a different corridor. Tender offer taking is well-suited to large projects that can be broken into discrete segments.

- *Good Neighbor Payments* represent ongoing payments to landowners that are near enough to a new project that it affects them even if it does not require taking over their land. For example, wind farm opposition sometimes comes not from direct landowners but from neighbors who are affected; thus wind developers often pay neighbors annually for noise impact. This concept could be applied to transmission development by providing annual payments to aesthetically affected landowners and neighbors. In the case of a landowner, good neighbor payments would be in addition to any easement negotiation made. Developers could also pay bonus payments to farmers who are affected by infrastructure on the land they cultivate.

- *Self-assessment* enables landowners to report the value of their land once a plan to condemn is announced. The landowner's tax liability is then adjusted to the reported value. The condemning authority then decides whether to take the land at the reported price or look elsewhere. If the developer chooses to look elsewhere, the landowner is thereafter prohibited from transferring his land for less than the announced value. This solution allows the landowner to assign a personal value to the benefit or deterrent of hosting new infrastructure. A variation of self-assessment involves an opt-in mechanism whereby a landowner can choose to receive a property tax break in exchange for agreeing to be subjected to condemnation.

- *Annual payments* allow landowners directly impacted by transmission projects to receive compensation tied to the amount of power transmitted on the line. Under this scenario, payments are distributed each year the project is in service. Payments can be adjusted yearly, to account for inflation, and can be augmented in the event that the agreed upon right of way is used for an additional purpose. A move toward annual payments will provide the landowner with a greater sense of ownership in the project, decrease the incidence of landowner hold outs, and ensure compensation commensurate with the growing value of land. The Colorado-based Rocky Mountain Farmers Union has proposed a version of this concept for both transmission and wind farm development.

Any significant change in siting policies will require action on the part of the relevant state legislature or siting commission. However, there are steps that utilities and developers can take right now to repair their relationship with affected landowners. At a minimum, each utility or developer should engage landowners early and often. Today, landowners are often not even notified until the developer has submitted a proposed route and been granted the power of eminent domain. Meeting with landowners before a route is submitted allows affected parties to point out problematic areas and suggest a new approach. Open communication before a route is approved can help mitigate concerns, speed the process, and solidify the role of the landowner as a participant rather than a spectator.

For example, many utilities have learned that the biggest impediment to an efficient siting process is landowner concern. They have since adopted a practice of soliciting early feedback. When feedback is solicited at the same time as the siting process, concerns are greatly reduced and the entire procedure becomes much more efficient. Many utilities now realize that holding landowner meetings more often than required can dramatically improve project efficiency. When new rights of way are needed, affected landowners and community stakeholders may be able to outline a developable route. These early steps can save developers and utilities time and money.

Decision-maker	Recommendation
State authorities	Enable condemning authorities to create Special Purpose Development Corporations.
State authorities	Enable local governments to implement a self-assessment policy.
PUCs, state authorities	Approve developer and utility costs to work with Landowner Associations, employ Tender Offer Taking, allow for annual payments, and make Good Neighbor Payments.
Developers	Engage landowners early and often.

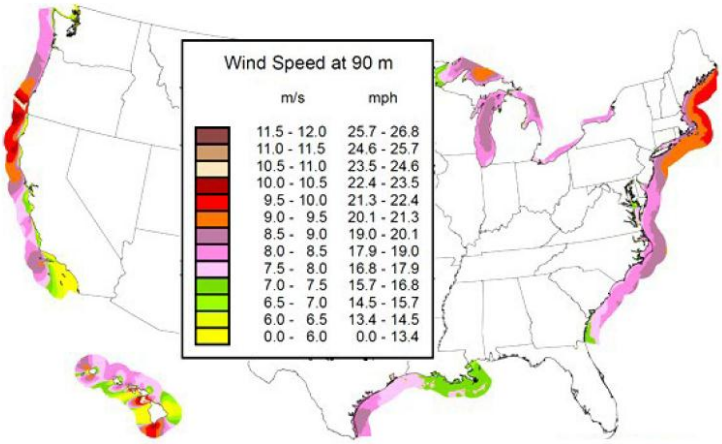
Refine the process to support siting offshore wind developments

America's spectacularly rich offshore wind potential is located relatively close to major load centers—especially along the Atlantic coast. Offshore wind can be a balancing resource, and is well-suited to replace fossil generation now being retired in ever-larger amounts. In part to facilitate this opportunity, the Obama Administration has created a series of initiatives to support offshore wind development, under the authority of the Bureau of Ocean Energy Management (BOEM).

Important initiatives under BOEM include:

- The National Oceans Council, a new body under BOEM, is developing nine Coastal and Marine Spatial Plans using ecosystem-based planning techniques that rely on the best available information.
- BOEM's version of "Smart from the Start" for offshore wind begins by identifying promising areas via planning and analysis then opens them for competitive leasing. Developers must submit a Site Assessment Plan and a Construction and Operation Plan. These Smart from the Start areas are still subject to Coastal Zone Management Act review, and developments are subject to full NEPA review.

These BOEM initiatives have streamlined the leasing program by eliminating redundant NEPA requirements, speeding up adoption of vast amounts of new renewable energy in the Eastern Interconnection, the most coal-dependent part of the nation. The first lease sales under the program were announced by the Interior Department in November 2012 in the waters off of Rhode Island, Massachusetts, and Virginia.



Source: National Renewable Energy Laboratory

Figure 4. America's offshore wind resources[13]

Still, BOEM's version of Smart from the Start lacks a cornerstone of its land-based counterpart: early and meaningful participation from a broad range of stakeholders. To date, BOEM's Smart from the Start process has been a purely intergovernmental effort, largely excluding public interest stakeholders and traditional users of coastal resources during the planning process—a divergence from land-based Smart from the Start programs. This flaw could undermine the success of the program. Early buy-in from affected stakeholders will strengthen the program, so they do not hear about the project for the first time during the required public comment period under NEPA. By involving stakeholders earlier in the process, developers can benefit from decreased opposition and early identification of major conflicts and proposed solutions.

BOEM's offshore wind program also currently lacks data regarding marine and avian wildlife migration and behavior. Addressing this data gap should be a priority, and can help avoid NEPA issues during project development. Obtaining better information early on will make the site selection, planning, and analysis process much more reliable. This data would also be valuable during the more stringent NEPA review that wind development projects must pass before beginning construction.

Decision-maker	Recommendation
BOEM	The Interior Department and its BOEM should prioritize data gathering, research and monitoring for marine and avian wildlife populations, behavior, and migration—both baseline and related to wind energy development. This research should be immediately initiated and incorporated into environmental assessments used to establish Wind Energy Areas.
BOEM	The Interior Department through BOEM should require more open stakeholder participation as part of the intergovernmental task force processes for Wind Energy Area identification as part of the BOEM Call for Nominations.

[13] Schwartz, Marc, Heimiller, Donna, Haymes, Steve and Musial, Walt, June 2010, Assessment of Offshore Wind Energy Resources for the United States, NREL, *Technical Report* NREL/TP-500-45889, p 10, http://www.nrel.gov/docs/fy10osti/45889.pdf

Final Recommendations

Decision-maker	Recommendation
ISOs/RTOs, DOI, WECC, state authorities	Add grid optimization to siting criteria or the renewable zone formation process.
WECC, state authorities, PMAs, FERC, transmission sponsors, utilities	Fully utilize available planning processes to identify issues early in the process that will need to be addressed ultimately when a project enters siting consideration. One of the goals of the planning process is to expedite the siting process: by understanding and mitigating issues early on, detailed siting analyses should proceed more quickly.
FERC, RPEs, BLM, DOE, DOI, WECC, EIPC, state authorities	Use Smart from the Start principles in choosing development sites and corridors.
FERC, RPEs, BLM, DOE, DOI, WECC, EIPC, state authorities	Consider renewable energy generation and transmission development and siting simultaneously.
Congress, DOE, national labs	Create and maintain national cultural and environmental conflict risk data and mapping capabilities to support federal, regional and state-level generation and transmission siting.
State and local authorities	Develop clear siting criteria where zones are not possible.
Congress, DOE, FERC	Facilitate the participation of non-traditional stakeholders in regional and federal (FERC Order 1000) transmission planning by providing financial support to stakeholder representatives (DOE, Congressional appropriations, and/or FERC approval of Federal Power Act section 215 funding for this purpose (Western Interconnection).
Congress, state authorities	Congress should redefine FERC backstop siting authority to apply to lines selected through and whose costs were allocated in Order 1000 planning.
DOE, FERC	Adopt the use of environmental and cultural risk screens in federal corridor designation processes required under EPAct 2005 and federal transmission planning efforts, such as the implementation of FERC Order 1000.
State authorities	Neighboring states with renewable energy resources and transmission needs should act to harmonize siting requirements and explore the possibility of creating interstate compacts for this purpose and to facilitate regional planning for renewable energy transmission.
State authorities	States should consider the establishment of a one-stop siting agency for large energy and transmission projects. Applicants are overwhelmed with having to deal with multiple agencies, from natural resource departments to land use entities. Because one of the main goals of this project is to save time for permit applicants without sacrificing important considerations, having one agency ensure that permit requirements are not duplicated can substantially shorten an applicant's timetable.
State authorities	Enable condemning authorities to create Special Purpose Development Corporations.

State authorities	Enable local governments to implement a self-assessment policy.
PUCs, state authorities	Approve developer and utility costs to work with Landowner Associations, employ Tender Offer Taking, and make Good Neighbor Payments.
Developers	Engage landowners early and often.
BOEM	The Interior Department and its BOEM should prioritize data gathering, research and monitoring for marine and avian wildlife populations, behavior, and migration—both baseline and related to wind energy development. This research should be immediately initiated and incorporated into environmental assessments used to establish Wind Energy Areas.
BOEM	The Interior Department, through BOEM, should require more open stakeholder participation as part of the intergovernmental task force processes for Wind Energy Area identification as part of the BOEM Call for Nominations.

Conclusion

America has made substantial progress deploying and interconnecting new renewable energy resources, with thousands of megawatts of renewable power having entered the grid in recent years. The U.S. Energy Information Administration estimates that in 2012, wind power additions alone outstripped additions from other sources, including even the natural gas sector with its historically low prices.

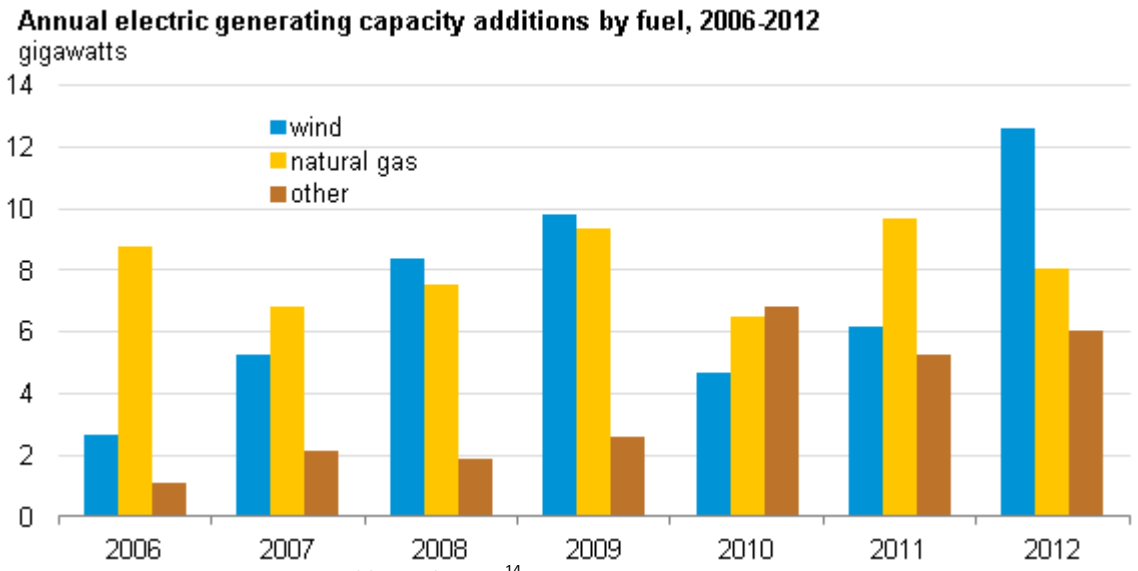


Figure 5. New power capacity additions by year[14]

Yet while this data is encouraging, renewables still comprise a relatively minor share of America's overall electricity generation. Reaching 80 percent renewable energy by 2050 will require a major expansion of both generation and transmission infrastructure. In order to accomplish such a shift, new approaches to siting will be necessary. As described in this paper, these new approaches will require the early engagement of stakeholders, innovative policy and business models, better coordination among

[14] Cite EIA data source. U.S. Energy Information Agency, (February 11, 2013). *Wind industry installs almost 5,300 MW of capacity in December*, http://www.eia.gov/todayinenergy/detail.cfm?id=9931

regulatory bodies, smart strategies to avoid the risk of environmental and cultural-resource conflicts, and improved operation and expansion of the grid to take better advantage of existing infrastructure and reduce costs of integrating more renewable energy. We already know how to do much of this – and most importantly, we know that accelerating renewable energy adoption needn't cause harm to landowners, cultural sites, or wildlife. On the contrary, as a part of the effort to remedy climate change and stem the profound economic and environmental consequences it will cause, taking action today will provide long lasting benefits.

We would like to offer sincere thanks to our knowledgeable group of reviewers:

Allison Clements, The Sustainable FERC Project
Liese Dart, The Wilderness Society
Linda Davis, Western Governors Association
Randy Fordice, Great River Energy
Gary Graham, Western Resource Advocates
Mike Gregerson, Midwest Governors Association and the Great Plains Institute
Jimmy Glotfelty, Clean Lines Energy Partners
Kit Kennedy, NRDC
Ginny Kreitler, National Audubon Society
Rob Marmet, Piedmont Environmental Council
Julia Prochnik, JAS Consulting
John Shepard, Sonoran Institute
Byron Woertz, Western Electricity Coordinating Council
Tom Wray, Sun Zia

Comments to ensure the accuracy of references to the *Renewable Electricity Futures Study* were provided by Doug Arent and Trieu Mai of the National Renewable Electricity Laboratory.

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Appendix 1. Acronyms

BLM: Bureau of Land Management

BOEM: Bureau of Ocean Energy Management

DOE: U.S. Department of Energy

DOI: U.S. Department of the Interior

EIPC: Eastern Interconnection Planning Collaborative

FERC: Federal Energy Regulatory Commission

IPPs: Independent Power Producers

ISOs: Independent System Operators

PMAs: Federal Power Marketing Administrations

PUCs: State Public Utilities Commissions

RPEs: Regional Planning Entities (other than ISOs or RTOs)

RTOs: Regional Transmission Organizations

WECC: Western Electricity Coordinating Council