Sierra Club

Guidance for the Siting of Renewable Energy, Transmission, Storage, and Related Infrastructure

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II. Introduction

This Guidance for Siting of Renewable Energy, Transmission, Storage, and Related Infrastructure accompanies and supplements Sierra Club's Policy for Siting of Renewable Energy, Transmission, Storage, and Related Infrastructure, as updated in May 2024 (Sierra Club 2024). The Renewable Energy Siting Policy makes it clear that the Club supports the growth of renewable energy while recognizing the critical need to protect natural ecosystems and human communities (also see the Climate Resiliency Policy, Sierra Club 2020). Together, the May 2024 policy and this Guidance are intended to implement and advance Sierra Club's Policies and its 2030 Strategic Goals, recognizing that the current and past impacts of a fossil fuel economy are unsustainable, unacceptable, and one of the largest contributors to the ongoing climate crisis and environmental injustices.

The Renewable Energy Siting Policy begins as follows:

> Consistent with the Board's 2030 Strategic Framework (Sierra Club 2022), it recognizes that a transformative expansion of renewable energy is necessary to meet Sierra Club's

> strategic priorities for climate action and to end our reliance on fossil fuel, including achieving 80% carbon pollution-free electricity by 2030 and achieving net zero emissions economy-wide by 2050. Siting renewable energy, storage, and transmission must be accomplished in concert with other, equally important priorities in Sierra Club's Strategic Framework, most notably our commitments: 1) to protect 30% of lands and waters in the United States by 2030 to address the extinction and climate crises, and 2) to ensure equitable treatment for all people. The Sierra Club's strategic priorities are based on the understanding that the climate, extinction, and equity crises are existential threats to the survival and well-being of all life on Earth, and are deeply interconnected.
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> These strategic priorities are equally important and can sometimes be in tension with each other. To meet these priorities, we will need active engagement at every level of Sierra Club to ensure our decisions reflect local conditions while maintaining nationwide consistency. Maintaining a unified voice will be crucial to our continued effectiveness and credibility as an organization committed to climate action, conservation, and equity. We are one Sierra Club (Sierra Club 2024).

To that end, the siting policy requires all Sierra Club entities, including Campaigns, Chapters, Field and the Environmental Law Program to consult with one another prior to adopting Sierra Club positions on renewable energy projects and policy proposals. **Any Sierra Club entity recommending that the Club take a public position in support or opposition of the siting of a specific renewable energy, energy storage or transmission project or policy proposal, or on the scope of environmental review applicable to such projects or policy proposals (collectively, "recommended action"), must first initiate consultation as expeditiously as possible by completing and submitting a Renewable Energy Siting on-line consultation form.** Instructions are included with the form, and the completed form is then routed to all parties in the consultation process.

Any communications initiating the consulting process should identify the relevant timeline, and identify a basis for expedited review if required. The entity initiating the consultation process should clearly articulate the justification for the recommended action, as well as any known concerns regarding conflicts or alignment with Sierra Club's Climate, Conservation, Equity, or other goals. The initiating entity should also identify reasons that the proposed action is likely to be non-controversial, if applicable. If the consulting entities cannot reach agreement, the siting policy establishes a process for dispute resolution. The involvement of volunteers and staff from all Sierra Club entities with relevant perspectives on renewable projects and policy proposals is critical to allow Sierra Club to speak with a "unified voice" and adopt balanced positions related to renewable energy siting.

Consistent with Sierra Club's Jurisdiction Within the Sierra Club Policy (2025), Guidance, unlike Policy, is not mandatory. Under Sierra Club's siting policy, entities are obligated to consult and seek consensus if feasible before determining whether to endorse or oppose a particular project. Entities are encouraged, but not obligated, to use this guidance as they work to comply with the Renewable Siting Policy.

Encouraging the rapid development of renewable energy in the right places and with the right technologies and mitigation measures will allow us to replace fossil fuels with renewable energy while ensuring we meet Sierra Club's strategic priorities of protecting 30% of U.S. lands and waters by 2030 and ensuring equity. The policy describes the key guiding principles and the

process for position-taking on specific projects and policy proposals. The Guidance accompanies and supplements the policy, explaining the factors that drive a decision to support, oppose, or remain neutral on a project or land use policy related to renewable energy siting. The potential impacts of specific renewable energy generating systems, along with the tools available to weigh the importance of the various factors involved are further elaborated in *Evaluating Renewable Energy Impacts*, available to Sierra Club leaders in Sierra Club Campfire (Sierra Club 2026).

This updated Guidance focuses on projects proposed on public as well as private lands. It supplants and replaces the prior Guidance on Transmission and Large Scale Renewable Development on Public Lands. The purposes of this Guidance are:

- To help Sierra Club members, committees, Groups, Chapters, and campaigns effectively evaluate and respond to proposals for the siting of renewable energy projects wherever they are proposed, and to advocate for and respond to policy proposals relating to siting renewable energy projects;
- To support and guide Sierra Club advocacy for the most advantageous, least-impact siting of renewable energy projects and related policy proposals; and
- To provide criteria to be used when evaluating renewable energy projects or policy proposals.

The Guidance and Policy focus on evaluation and decision-making for the *siting* of renewable energy projects, as well as on proposed public policies that guide siting decisions. This Guidance and related Policy do not supplant or replace Sierra Club's Energy Resource Policy (Sierra Club 2016) or the policies and Guidance documents that we have adopted on specific energy sources. A complete list of and links to Sierra Club's climate and energy policies can be found on Sierra Club's Energy Policies website.

As clarified in Sierra Club's Guidelines for Developing New Policy and Guidance Proposals (Sierra Club 2022) "While Board-adopted conservation policy is binding, and all Club Guidance and positions must be consistent with Club policy, guidelines or guidance documents provide elaboration, clarification and justification of policy including documentation." The intent of this Guidance document is to provide additional elaboration and clarification to staff and volunteers who are addressing renewable energy siting issues.

The authors of this guidance believe that in the vast majority of circumstances, Sierra Club's position on siting renewable energy and policies related to the siting considerations will be self-apparent. In most cases, projects can be clearly delineated into the categories provided in Section III, below. However, in rare cases, circumstances may make a siting consideration more complex or nuanced. This guidance is written to help identify and inform those marginal cases. Because the knowledge and experience of those collaborating to develop a Sierra Club position varies, the Guidance has been written to be accessible to both experienced staff and volunteers and for those who might benefit from greater elaboration and context. Critically, it cannot touch on all of the considerations for siting specific projects, but instead is written to flag issues that may necessitate review.

The scope of Sierra Club's May 2024 Policy for Siting of Renewable Energy, Transmission, Storage, and Related Infrastructure (Renewable Energy Siting Policy) requires collaboration among multiple Sierra Club entities and staff to develop Sierra Club positions on renewable

energy projects and policy proposals. The Renewable Energy Siting Policy establishes the circumstances that require consultation among Sierra Club entities:

> "A Sierra Club entity recommending a public position in support or opposition of the siting of a specific renewable energy, energy storage or transmission project or policy proposal, or on the scope of environmental review applicable to such projects or policy proposals (collectively, "recommended action"), must first initiate consultation as expeditiously as possible…."

The scope of the policy's consultation requirement is stated as follows:

> "renewable energy projects and policy proposals" shall include:
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> (a) renewable energy generating projects;
>
> (b) critical infrastructure required to advance renewable energy and displace fossil fuels and nuclear power in electricity generation, including energy storage and transmission needed to deliver renewable energy generation to load centers;
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> (c) federal, state and local renewable energy siting policy proposals pertaining to the siting, location, or development of renewable energy generation and critical infrastructure within that jurisdiction that deter siting of renewable energy projects; and
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> (d) renewable energy siting policies that advance renewable energy generation but do so in a manner that impacts the protection and conservation of natural system functions and individual species.

The criteria below apply primarily to large scale solar, wind, geothermal, storage, hydroelectric facilities, and transmission proposals. Also known as utility-scale, this guidance assesses "large scale" as projects greater than 1 megawatt (MW) in size. The guidance is not intended to address individual small scale renewable projects (less than 1 MW). However, the consultation process does apply to renewable energy *policy proposals*, such as city-wide or county-wide policies that might apply to multiple small scale renewable energy projects.

Proposals by Sierra Club entities to provide greater legal protections for lands and waters ("Conservation Proposals") are *not* subject to the formal consultation process under the Renewable Energy Siting Policy. Nevertheless, new conservation proposals, or proposals where Sierra Club does not yet have a position, involving specific areas where renewable energy projects have been proposed or where renewable energy has been designated as suitable under a land management plan the Sierra Club supports must be addressed collaboratively among staff and volunteers as appropriate in conformance with the Jurisdiction within the Sierra Club Policy. This policy, sometimes referred to as the "One Club Policy", requires Chapters and other Club entities to coordinate with the national campaign or campaigns involved and to reach a common position if possible when the matter involves a subject also addressed by a national campaign.

III. General Criteria for Siting Large Scale Renewable Energy Facilities

The criteria here represent overall guidance on where to prioritize large-scale projects, where projects are generally not acceptable, and where they may be acceptable if appropriate avoidance and mitigation measures are applied. More detailed considerations for specific generating technologies and renewable energy infrastructure can be found in the supplemental *Guide to*

Renewable Energy Impacts mentioned above in Sierra Club's *Campfire*. Advice for submitting scoping comments for environmental review of renewable energy projects is included in Section V.B.

When applying these criteria, Sierra Club entities must also be mindful of the existing cumulative impacts on wildlife, plants, and humans of fossil fuels, nuclear power, and large hydroelectric dams, as well as the climate crisis and our commitment to a rapid transition away from fossil-fuels, nuclear power and dams and toward 100% renewable energy across all sectors of our energy economy. Achieving our climate and emissions goals will necessarily require significant buildout of renewable facilities, and sometimes in areas that result in ecological or cultural impacts, and which may be in conflict with other Sierra Club goals. Therefore, careful consideration of direct, indirect and cumulative impacts from renewable energy facilities is important. Specifically, meeting our 30 x 30 conservation goals requires the protection and/or restoration of several hundred million acres of land and waters, while attaining our ambitious 50 x 50 goals will necessitate adding intact lands of quality habitat and ecological function relative to current land and water uses. Because our energy and conservation goals may intersect in undeveloped lands and waters or areas proposed for restoration, we must give careful consideration to whether and how we site renewable energy in areas meeting 30x30 criteria.

A. Areas Where Sierra Club Will Generally Support or Remain Neutral on Large Scale Renewable Energy Projects

The section below describes areas where Sierra Club generally will support or remain neutral on proposed renewable energy facilities.

Sierra Club entities proposing opposition to a project in the areas identified below should provide a detailed rationale expressing why a position opposing the project is appropriate based on applicable Sierra Club policy. Only if such disagreements are substantiated would Sierra Club typically take a position of opposition on such projects.

Areas where Sierra Club will generally support or remain neutral include the following areas, unless they are also high conflict areas as described in Section III B below :

1. Lands previously converted from their natural state and which remain impacted, disturbed, or degraded by human activities (such as brownfield sites, mines, degraded agricultural lands, etc.) and are not in the process of restoration or identified for restoration needed to protect critical habitat, wildlife corridors, or to meet 30 x 30 goals.
2. Public lands of comparatively low natural value, excluding any lands designated as high value in Section III B and C below, located adjacent to degraded and impacted private lands, outside landscape-level core areas and connecting corridors.
3. Urban or exurban locations, where development does not cause disproportionate negative impact to communities that have historically borne the brunt of the impacts of fossil fuel pollution.
4. Locations adjoining existing roads, especially those that minimize the need to build new roads.

5. Locations that allow connection to existing electrical substations and/or transmission and local distribution facilities with a minimum transmission distance, while still avoiding or minimizing impacts
6. Locations relatively close to load centers (major population and/or industrial centers) that do not pose issues of environmental justice.
7. Locations within or immediately adjacent to existing utility corridors with existing major transmission lines that are not in high conflict areas to avoid (Sec III B) or Areas Where Sierra Club Should Proceed With Caution (Sec. III C).
8. Agricultural lands. Agricultural lands, especially industrial agricultural monocultures, are generally compatible with renewable energy development when best practices for renewables are followed (Sierra Club 2026). Lands applying the best environmental agricultural practices recommended by our Agriculture Policy (see Agriculture and Food Policy) are less appropriate for siting.[1]
9. Locations designated by a local, state, or federal agency as more appropriate for large-scale renewable energy, where Sierra Club has previously supported those designations.

B. High Conflict Areas Where Sierra Club Will Generally Oppose Large Scale Renewable Siting

The section below describes areas where Sierra Club generally will oppose proposed renewable energy facilities.

Sierra Club entities proposing support or remaining neutral for a project in the areas identified below should provide a detailed rationale expressing why a position supporting the project is appropriate based on applicable Sierra Club policy. Only if such disagreements are substantiated would Sierra Club typically take a position of support or remain neutral on such projects.

According to the Sierra Club Energy Resources Policy:

> The Sierra Club opposes energy development on public and private lands and in waters that are currently protected by legislative or administrative designations or that the Sierra Club has proposed for special designation based on specific environmental or wilderness criteria. Exceptions are allowed only where the proposed development can be shown to have insignificant effect on the resources for which the special designation was, or would be, established. This overarching consideration applies to all energy resources covered in this policy." (Sierra Club 2016, Energy Resources Policy VI. Protecting Environmental Values and Communities, page 10.)

[1] In many instances and when following best practices (see Sierra Club 2026) solar development can be done in ways allowing continued or even enhanced agricultural production (often described as "agrivoltaics" or "agrisolar")or over aqueducts . Due to its limited footprint, wind has been shown to fit well with a wide range of agricultural land uses. Large solar applications, especially when implemented without best practices for agrivoltaics or agrisolar, may be less compatible with environmentally sustainable agriculture.

While proposed renewable energy, energy storage, and transmission development in designated high conflict areas should generally be avoided, there may be situations where such development is necessary and can be done consistently within existing laws. In some cases, the designation or management plans for the conservation areas may allow for such development. An example may involve long-distance transmission lines which may need to cross protected areas where there are no other viable alternatives and where development is not precluded by law.[2] In such cases, Sierra Club entities should work to ensure that siting is done in ways that minimize the development's impacts to the protected resources and that appropriate mitigation is required.

The high conflict areas where Sierra Club generally opposes large-scale renewable energy development are the areas referenced in the Club's Energy Resources Policy as statutorily or administratively protected from major development, including (but not limited to) the following federal, state and private protected lands:

1. National Parks and Preserves, National Monuments, National Conservation Areas, National Recreation Areas, National Wildlife Refuges, Marine Sanctuaries
2. Designated Wilderness Areas, Designated Wilderness Study Areas, BLM Lands With Wilderness Characteristics or Forest Service Recommended Wilderness Areas as inventoried
3. National Historic Sites and Historic Parks; and sites nominated for the National Register of Historic Places, or containing buildings on the Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey
4. Inventoried Roadless Areas or similar designations by agencies other than the Forest Service, except areas that have been designated as suitable for large scale renewable energy development following a transparent public process in which community members, stakeholders, and Tribal interests participated and agreed on the area designated and a conservation management plan for the designated area.[3]
5. Areas of Critical Environmental Concern and Forest Service Special Management Areas
6. Congressional and Administrative Mineral Withdrawals
7. Designated Critical Habitat Areas
8. Tribally designated locations of cultural importance and other tribally protected lands and tribal proposals supported by the Sierra Club
9. National Historic, National Scenic, National Recreation, and National Water Trails

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[2] For designations where development is not allowed or not allowed under the relevant circumstance, a change in our support for a law or administrative designation would involve a more detailed process outside of the renewable siting policy.

[3] Good examples of such public input processes include the process that led to the designation of the 2016 Desert Renewable Energy Conservation Plan (DRECP) Development Focus Areas; the 2012 BLM Western Solar Plan Solar Energy Zones (SEZs) (excluding the 2016 DRECP area); and the 2013 Restoration Design Energy Project Renewable Energy Development Areas (REDAs). A good example of an associated conservation management plan is the Conservation Management Actions in the 2016 DRECP.

10. National Wild, Scenic, and Recreational Rivers, both designated and river segments deemed eligible or suitable
11. Federally inventoried old growth and mature forests.
12. State, county, or regional parks, protected conservation areas of state forests, state land board lands designated as conservation areas, and other designated and managed conservation reserves or wildlife habitat management areas, designated by government agencies, land trusts or other community non-profits
13. Within conservation proposals supported by Sierra Club to protect sensitive natural, cultural, and/or historic resources; or to sustain habitat, carbon sequestration, or other conservation or biological resources supporting sensitive biological communities or land areas critical for achieving Sierra Club's 30 x 30 goals.These include but are not limited to proposals for designations listed above.

C. Potentially Critical Resource Areas where Sierra Club Should Proceed with Caution

In addition to the areas specified in subsection III B above, additional areas may be critical to preserving ecosystem components and processes that are important to our conservation and climate resilience goals. In these areas Sierra Club entities are advised to proceed with caution prior to making a decision to support or remain neutral on a renewable energy project. In general, these are areas which, although they have not received formal designation or proposals from the Sierra Club for protection, may be vital to protecting habitat resiliency, include landscape-level undeveloped core areas, buffer zones and connecting wildlife corridors, or which are required for the continued functioning or protection of biological and ecological processes.

Additional areas where Sierra Club should proceed with caution prior to supporting or remaining neutral on renewable energy projects include the following:

1. Publicly available proposals by allied organizations identifying wilderness eligible lands, old growth and mature forests, and lands eligible for state designations equivalent to wilderness. Such areas shall be reviewed by Sierra Club before a decision to support the location of a renewables facility. Unless the Sierra Club determines the area does not meet the size (sufficient to be managed as wilderness, generally 5,000 acres or larger) and naturalness requirements for Wilderness, it is subject to Sections B4 and 13 above. Special attention is important for BLM lands which lack the comprehensive inventory done for Forest Service Roadless lands. Where proposed projects fall within roadless areas the agency has not inventoried for wilderness characteristics those lands should revert to Section B pending results. In addition to checking with organizations working in the area, the Southern Utah Wilderness Alliance (2025) maintains a database assembled from other organizations pertinent to BLM lands.
2. Areas of public or private ownership essential for ecosystem protection and restoration.
3. Locations containing populations of federal or state threatened and endangered species, including candidate species under federal or state law, where the proposed taking by the project or proposal would "appreciably reduce the likelihood of the survival and recovery of the species in the wild" (ESA §10(a)(2)(B)(iv)) [or fail to meet the additional requirements of §10((a)(2) or §7. (U.S. Fish and Wildlife Service 2025).

4. Locations containing populations of sensitive, rare and special status species as recognized by federal and/or state agencies, where the project or proposal would materially and negatively impact the viability of the population or the likelihood of recovery of the species.
5. Locations containing rare or unique plant communities as defined by state native plant societies and/or by federal, state and county agencies, where the project or proposal would materially and negatively impact the viability of that community or the likelihood of recovery of the species.
6. Public or private lands included in the U.S. Protected Areas Database (U.S. Geological Survey 2021) or lands classified as GAP 1 or 2 lands by the Gap Analysis Project (GAP), and not already addressed in section B above. Some undeveloped GAP 3 lands also maintain ecological integrity and merit caution for renewable energy development.
7. Lands purchased or leased for conservation including, but not limited to, compensation lands purchased for mitigation directly by the BLM or transferred to the BLM by other parties, to the extent that the proposed project would interfere with the mitigation objectives.
8. Wetlands and riparian areas, including the upland habitat and groundwater resources required to protect the integrity of seeps, springs, streams or wetlands and species dependent on them when the proposed project would have a potentially significant negative impact.
9. Tribally identified locations of cultural importance where Sierra Club has not taken a position.
10. Projects sited on or dependent on diminishing or over-allocated hydrographic basins where such projects are likely to result in the net reduction of surface or ground water.

While this guidance and these criteria relate to the *siting* of proposed large-scale renewable facilities, some technologies also have significant impacts due to their *operations*. For example, groups of large wind turbines or "wind farms" can cause a significant number of bird and bat fatalities, depending on their location, design characteristics, and on how they are operated. Thus, in reviewing the criteria it's also important to understand how the local populations, as well as migrating groups, of a species may be impacted by project operations. Club entities are encouraged to comment on any proposed permit or rule or other action affecting the lands encompassed within the criteria listed above, including but not limited to proposed incidental taking permits and statements to help ensure standing to challenge any that are awarded without meeting these standards.

IV. Background and Context

A. Three Key Goals

While the Guidance provides support for Sierra Club's updated Renewable Energy Siting Policy, it is also rooted in Sierra Club's 2030 Strategic Framework (Sierra Club 2022), which establishes key goals for all our work. Truly each of these goals is relevant to renewable energy siting decisions and needs to be harmonized as we make decisions regarding renewable energy projects and transmission. Perhaps foremost among the goals are the following.

1. Clean, Renewable Energy is Essential to Fight the Climate Crisis

The 2030 Strategic Framework states that

> "To address the climate crisis, we must halt the expansion of fossil fuels and accelerate the transition to a just, clean energy economy. We must rapidly develop clean energy for a carbon-free power grid, while simultaneously electrifying our cars, trucks, homes, and factories. Central to our success is our investment in a growing movement to bring about an end of the era of fossil fuels."

The Strategic Framework (Sierra Club 2022) establishes a specific goal of achieving "80% carbon pollution-free electricity by 2030" and dramatically increasing the amount of clean electricity to displace fossil fuels in transportation, buildings, and industry. These near term goals are part of our commitment to decarbonize the electric sector by 2030 and the entire economy by 2050.

It is also important to note that Sierra Club's definition of clean electricity is narrower than that contained in many existing federal and state laws and decarbonization studies. Sierra Club's precautionary approach to fission-based nuclear power, most biomass power generation, new large-scale hydro development, and some other sources of low-carbon electricity depart from other definitions of clean energy. As a result, we will need even more renewable energy to meet our climate goals than would be required under policies that allow non-renewable sources. Our modeling shows that we will need both distributed and large-scale renewable energy, coupled with aggressive gains in energy efficiency, conservation, new and upgraded transmission, and storage to provide reliable energy for all communities while eliminating the need for fossil fuels.

At the same time, we need to develop flexible and reliable systems of renewable energy and transmission, connecting projects geographically distant from one another and in different time zones. In this way, evening wind in, for example New Mexico, can help with California load demand as solar declines in the early evening. Storage will also play a critical role and in many cases can be accessed to serve evening loads as solar production decreases at the end of the day. These are extremely ambitious goals and will require substantial changes in all our energy uses including the electric sector, transportation, industry, and the built environment.

2. Sierra Club's 30 x 30 Goal as a step toward a sustainable relationship with nature.

Another essential element of the 2030 Strategic Framework involves our commitment to protect 30% of America's critical lands and wildlife habitat by 2030. The Strategic Framework states:

> "Working through our chapters and groups, and centering and partnering with frontline and local communities and tribal nations we will build power to protect priority lands critical to climate solutions and provide connected wildlands and waters where wildlife, plants, and people thrive."

The Strategic Framework embodies our commitment to "push for vastly increasing protections of public green spaces, waters, and wildlife," both for their own sake and for the critical services that they provide to people. This goal is based on the fact that human actions have already degraded three-quarters of the land-based environment and about 66% of the marine environment, resulting in a biodiversity and extinction crisis, the loss of nature-based carbon sequestration capacity, the release of previously sequestered carbon and the increasing release of methane from warming wetlands and melting permafrost. We must find solutions that address these issues

in a holistic, transformative way. Protecting 30% of our lands and waters by 2030 is a vital step toward protecting and restoring critical ecosystems, and promoting nature-based solutions to the climate crisis.

Advancing Sierra Club's 30 x 30 goal means siting renewable energy projects in a manner that avoids or minimizes significant negative impacts to existing ecosystems, and intact wildlands. Sierra Club's renewables siting policy supports concentrating new renewable energy projects in already settled, developed, disturbed, or contaminated areas, and compatible working agricultural lands whenever and wherever possible.

The significant potential of energy production on such previously disturbed lands was confirmed by the U.S. Department of Energy (DOE) in its 2021 Solar Futures Study, which concludes that solar development to meet the U.S. 2050 clean energy goals can be met using "less than 10% of potentially suitable disturbed lands, thus avoiding conflicts with high-value lands in current use." In 2022 the DOE issued a subsequent report, Environmental and Circular Economy Implications of Solar Energy in a Decarbonized U.S. Grid, that determined land requirements for renewable energy development on a regional basis and then aggregated the land requirements to each state's inventory of potentially suitable disturbed lands.

Human land-use and development have favored human communities over biodiversity and ecosystem health for centuries. This has been particularly true for our existing energy system, which prioritizes extraction and use of fossil fuels and ignores their impacts. Stopping and ultimately reversing this relationship with nature will be extremely difficult but is, nevertheless, both necessary and consistent with Sierra Club's legacy as an environmental leader and with our 2030 Strategic Framework. The U.S. Department of Energy (2022) report identified several opportunities to improve solar-environmental synergies with regard to land use and ecosystem health.

3. Promoting Equity and Justice

The 2030 Strategic Framework identifies the need to "transform our society from one where the burden of pollution and climate impacts is borne by communities of color to one where communities are clean, democratized, healthy and equitably resourced." This priority builds on the commitment Sierra Club made in adopting the Jemez Principles for Democratic Organizing, co-authoring and signing onto the Equitable and Just National Climate Platform, and taking other steps to formally center equity and justice in our policies and work. We recognize that the pollution, health impacts, climate disruption, and other harms created by our existing fossil fuel energy systems have fallen disproportionately on low-income communities generally and people of color, Tribes, and other frontline communities who have too often been treated as sacrifice zones by extractive industries. Moreover, these historically marginalized communities are the ones who have contributed the least to the climate crisis. We advocate for policies to improve affordable and reliable energy for marginalized communities, invest in energy efficiency upgrades in low-income housing, promote community-based renewable energy projects, and aid underserved populations to have an equitable role in energy decision-making processes. In building the foundations for a new energy system, Sierra Club is committed to working "with communities to ensure a just transition as those communities move from a fossil fuel based economy to one that embraces clean energy and justice." The Biden Administration Interior Department's co-stewardship policies for Indigenous people's participation in land and water management provides models for just transitions in energy development.

Renewable energy projects can have significant impacts on a variety of environmental justice and equity concerns. Projects are sometimes proposed on landscapes of importance to Indigenous peoples or frontline communities, and critical minerals for renewables projects are often mined from these areas. Sierra Club is committed to actively promoting and advocating for the rights of Indigenous peoples, supporting their efforts for Free Prior and Informed Consent (FPIC) in governmental processes, honoring treaty rights, increasing access on federal lands for cultural practices and gathering, protecting of sacred sites, and building power for tribal partners at the grassroots and all levels of government. Sierra Club advocates for inclusive and open planning processes that provide impacted Tribes and indigenous tribal people the opportunity to meaningfully participate in project planning processes, and government-to-government consultation when relevant (Sierra Club Indigenous Co-stewardship Policy 2025b). Special attention should be paid to recognizing and supporting the sovereign status of Tribes while also being aware that as in any society, there may be significant disagreements between activists and governments. Sierra Club participants should exhibit care and sensitivity when working with Indigenous peoples given the complex legacies of settler colonialism.

Renewable energy, transmission, and storage projects can also have impacts on other traditionally marginalized communities, including black, hispanic, and other communities of color. Too often, energy projects and other major infrastructure have been sited in areas that are deemed to have less political power. Large-scale renewable energy projects, as other large energy projects, can have equity impacts for the underserved communities through potentially limiting green space, outdoor access, or other economic opportunities. Such equity impacts can often be avoided if underrepresented community members are engaged during community planning or in the early stages of a project's development. Past impacts on marginalized communities may have been exacerbated by local land use codes. Public participation in special use permit and utility rate making proceedings and a legislature's consideration of laws affecting those may be critical for preventing "equity impacts", that is, negative or unequally distributed burdens upon low income or minority communities or workers. For this reason, local knowledge of the history of land use planning, utility rate settings, and knowledge of any coalitions that include underrepresented community members or groups can help avoid new or address long-standing environmental justice impacts.

Sierra Club encourages project developers to seek input and consent from local communities and believes that all communities should share in both the benefits and impacts of energy development. The Jemez Principles, which were adopted by the Board in 2014, are an important guide to navigating these tensions.

Although the Trump Administration has moved to eliminate environmental justice procedures under the National Environmental Policy Act (NEPA) process (Harvard Regulatory Tracker 2025), the NEPA process for many years incorporated environmental justice from beginning to end and beyond, because if agencies promise in a Final Environmental Impact Statement (EIS) to take steps to mitigate negative effects on EJ communities, those promises are enforceable. State "mini-NEPAs" are likely to mirror this process and may have different approaches in doing so. (Congressional Research Service 2023). A critical part of transitioning to a clean and democratized energy system is to listen to the concerns and priorities about project development coming from the impacted communities themselves. A good example of such a statement is the Alliance for Tribal Clean Energy's (2024) comments on the recent BLM Western Solar Plan. Their stated lenses for review of the BLM plan were:

- Preserving and enhancing Tribal sovereignty of Tribal lands while increasing collaboration and co-stewardship of public lands;
- Increasing early, often, and meaningful consultation among the BLM, project contractors, and affected tribes; and
- Strongly encouraging the increased utilization of Tribal Ecological Knowledge (TEK) and expertise in managing public lands.

Led by the 2022 White House Memorandum on Uniform Standards for Tribal Consultation, the largest and most often-reiterated priority in the Alliance's comments was to seize every opportunity to improve consultation. Recommended steps included providing early information and appropriate notice, keeping quality records, working to build institutional memory, collaborating across agencies to reduce the consultation burden for tribes, and clarifying how tribes can participate in plan revision during the long period between plans.

The tribes also prioritized increased efforts and funding for co-management and co-stewardship of projects and lands, including tribal information in communications to and from developers, funding to tribes for participating in NEPA processes and natural resource management training, developing a compensatory mitigation policy, working to build trust and confidence for the agency within the tribes, and more (Sierra Club 2025a). While every project is different, these priorities illustrate important steps toward assuring justice and equity in renewable energy site planning.

4. One Sierra Club

The Strategic Framework also emphasizes the need for the Sierra Club to be unified in order for us to be "Powerful Together." This includes efforts to strengthen our chapters and groups as primary hubs for our place-based organizing and advocacy work. In determining positions on renewable energy siting, it is these place-based units of the club that have standing to collaborate with national campaigns. Grassroots Network Teams may comment in the collaboration process but are not authorized to take or propose positions. It also means increasing collaboration among national campaigns, the environmental law program, and national advocacy program staff with our activists in chapters and groups around the country. The Strategic Framework commits us to greater collaboration:

> "to ensure **chapter, state, and national plans are deeply aligned** to achieve collective outcomes and goals. Aligned structures and equitable policies result in effective collaboration, equitable decision making, and shared accountability to live our organizational values."

The Guidance and the associated Policy on renewable energy siting are designed to increase collaboration and communication. They encourage working toward common objectives, and reducing potential areas for friction and conflict. For these reasons, it is important that the process of consultation be initiated at the beginning of any consideration to take a position on a particular project. The Renewable Energy Siting Policy states:

> A Sierra Club entity recommending a public position in support or opposition of the siting of a specific renewable energy, energy storage or transmission project or policy proposal, or on the scope of environmental review applicable to such projects or policy proposals

> (collectively, "recommended action"), must first initiate consultation as expeditiously as possible. . .

While the Policy states that the proposer should "clearly articulate the justification for the recommended action, as well as any known concerns regarding conflicts or alignment with Sierra Club's climate, conservation, equity, or other goals," the most important priority is to initiate the consultation process right away. The consultation form permits modification as more information becomes available, and proposed positions can change.

In sum, Sierra Club endorses a significant ramp-up of responsibly located, large-scale renewable energy development as a critical piece of achieving 100% clean energy. This Guidance and the associated Policy, however, recognize that some proposed projects will have unacceptable impacts and should be substantially modified or even opposed. As reflected in our Energy Resource Policy, we also advocate for much greater deployment of energy efficiency, conservation, distributed generation (smaller scale, localized production as in rooftop solar or small-scale wind), and storage technologies in cities and states across the nation. It is important to note, however, that this Guidance and Policy are not intended to supplant our other policies on energy generation, the mix of energy resources, conservation, and use.

This Guidance is primarily focused on larger scale renewable energy projects. However, in or near population centers most opportunities will be for small to medium scale ground mount solar applications on private land, brownfield sites, or solar over parking lots or on existing or new building rooftops and structures. The growing development of logistics centers in suburban and exurban locations, where building size may be as large as a few hundred acres, creates opportunities for installed rooftop generating capacities in the 10 to 30 MW range. Because local land use policies or zoning ordinances can enable or stifle renewables siting, this Guidance summarizes local government policy considerations that reflect opportunities in such locations and that are consistent with Sierra Club's siting Policy and its underlying principles.

The General Criteria included in Section III above are not ranked by importance. They are intended to inform planning processes, guide evaluation of specific project proposals, and provide ecosystem level protection to both public and private lands important to optimum ecosystem function and climate resiliency. Sierra Club prefers siting projects on disturbed lands wherever possible, steering development away from lands with high environmental values, and avoiding large undeveloped cores.

Because Sierra Club's Strategic Goals are coequal, we recommend supporting renewable energy proposals where they are consistent with best practices and are not likely to delay achieving our conservation goals or to harm frontline communities as defined above.

The general criteria in Section III were developed with input from field scientists, land managers, and conservation professionals. As noted in the previous section, the criteria are intended to guide position taking related to *siting* of renewable energy projects and policy proposals that affect siting options. The focus should be on site characteristics and on the impacts arising from the proposed renewable technology. If Sierra Club entities agree to oppose a renewable energy project, any statements should make clear that opposition is based on the site characteristics or other project-specific impacts, and that the Sierra Club generally supports development of renewable energy resources (Sierra Club 2016; Sierra Club 2024).

B. Decision-Making Venues

While the issues in this guidance are specifically focused on siting characteristics, it is important to know where and how decisions are made. Decisions about which types of renewable energy are pursued, where they are sited, the speed at which they are authorized, who pays, and who receives benefits are often constructed in energy regulatory proceedings and local government land use regulation.

1. Utility Regulation

The energy regulatory landscape is complex, with different entities having oversight depending on the offtaker of the energy, and the regulatory structure of the state. In many states, investor-owned utilities are overseen by state utility regulators, while wholesale markets are overseen by federally-authorized nonprofit Regional Transmission Operators (RTO). Smaller cooperatives and municipal utilities may be overseen by private and/or public boards, and in some cases are also subject to forms of federal oversight. In some states, renewable developers may be effectively independent of utility processes (such as in wholesale markets in eastern states, or in Texas), while in other states renewable development directly flows from utility planning decisions. Renewables may be built by a utility, but are often built, and even operated by, private developers who have offtaker agreements or power purchase agreements with utilities or other customers. It is helpful to understand these decision processes to know where intervention is likely to be effective.

The Club and its chapters can help draft state and federal legislation and regulations to implement legislation. The siting and operational decisions can affect and be guided by these. So, know the terrain when you launch a campaign.

Drivers of utility-scale renewable energy include:

- Economics
- Consumer demand for renewable and decarbonized generation sources.
- Tax credits or other program-specific incentives;
- Utility energy resource plans for least cost planning and procurement;
- Developer assessments of profit opportunity;
- State-mandated Renewable Energy Portfolios or Clean Energy Standards
- Corporate renewable procurement strategies; and
- Utility optional clean procurement programs (e.g. green tariffs)

Governments set limits or controls on supply and demand in energy in general and in the siting and operation of utility-scale facilities. To be effective at shutting down fossil fueled power plants, removing large dams and opposing nuclear power and replacing them with well sited, well run wind and solar we must know and use the legislative, administrative, and judicial processes.

2. Review under NEPA, ESA, NHPA, or State Counterparts

Renewable energy projects on Federal Lands, projects that receive federal programmatic money, or that are built by or for a federal agency must undergo review under the National

Environmental Policy Act (NEPA[4]), the Endangered Species Act (ESA) and the National Historic Preservation Act (NHPA) respectively and their state counterparts, where present.[5] Club members and staff, in coordination with national Club staff, can engage in these processes to assess, seek to mitigate, or oppose inappropriately sited projects. For example, a Sierra Club entity may be able to show that a proposed project may affect a listed species (under the ESA) or is likely to have a significant impact on the environment (under NEPA).

A similar process involving public comment is required under Section 106 of the NHPA. Section 106 of the NHPA requires that each federal agency identify and assess the effects its actions may have on historic buildings and sites. Under Section 106, each federal agency must consider public views and concerns about historic preservation issues when making final project decisions. (U.S. General Services Administration 2025).

Sierra Club entities may petition with the presentation of relevant information if assessments are not begun by the agency planning to permit, fund or build a renewable project.

Under Federal law, projects subject to NEPA must either conduct a full Environmental Impact Statement (EIS) study, a less rigorous Environmental Assessment (EA) for projects deemed less likely to be impactful, or meet requirements for a Categorical Exclusion (CE) (For a review of NEPA and its Categorical Exclusion process, see National Telecommunications and Information Administration (2025). If the initial assessment shows no significant risk, then the project can proceed without a full EIS under NEPA or Incidental Take Statement for agency actions or an Incidental Take Permit for private actions under the ESA. The assessment process, short or longer, can provide opportunities to achieve mitigations such as appropriate locations and operational requirements, or when applied to a proposed dirty energy project, can serve to highlight renewables as an acceptable alternative.

The 2022 Inflation Reduction Act provided additional resources to key agencies to assist them in implementing the assessments and EISs that may be needed for the renewable energy projects and greenhouse gas removal projects that were funded in the IRA. After that, the Fiscal Responsibility Act of 2023 that raised the Federal debt ceiling included a number of amendments to NEPA that were intended to make it easier for agencies to complete or avoid having to assess projects. One had to do with the extent to which the affected agency controls the permitted or funded project. Another exempted projects the effects of which are solely outside the U.S. That concept would be alien to most ecologists, climate scientists, and migratory bird conservationists. The CEQ announced on September 29, 2025 its new guidance streamlining the EIS process. (The White House 2025).

One relatively straightforward 2025 change in NEPA itself is the limit on the length of time it takes to complete an EIS along with a limit on the number of pages in the main body of an EIS[6]. It is important, however, to check with the "action agency" as well as with CEQ and the Club legal staff to ensure that you or the chapter or group have an up to date understanding of the CEQ Guidance and agency NEPA regulations. This is also true for the regulations for implementing the ESA via the US Fish and Wildlife Service or the National Marine Fisheries Service, depending on

[4] https://ceq.doe.gov/laws-regulations/laws.html

[5] https://ceq.doe.gov/laws-regulations/states.html

[6] https://ceq.doe.gov/laws-regulations/fra.html

the species affected, as these are subject to change with each Administration. Sierra Club recently adopted a policy of restoring and enhancing the scope of the assessment processes for both state and Federal NEPA and Endangered Species Acts to transition them toward procedures that would require the most restorative option practicable be chosen by the action agency (Sierra Club 2025c). This new policy encourages us to shape this practice through comments and litigation, for example, when ESA-mandated recovery plans are ignored during the interagency consultation process.

In 2010 mitigation promises in any Final EIS became enforceable via CEQ Guidance, so a Club entity should check to ensure it is aware of changes in the implementing Guidance or agency regulations from the current federal administration[7]. In any case, it is important to recommend mitigation actions and see that any steps that are promised in the Final EIS are kept. Many examples of on-site mitigation actions are included in the accompanying Campfire document (Sierra Club, 2026) to this Guidance. These include such actions as curtailing wind turbines in light winds when bats are active, or colored paint on blades and flashing lights on the perimeters of wind farms to deter birds from approaching.

Due to the typical brief time period allowed for scoping comments, Sierra Club entities proposing comments on the scope of environmental review should complete and submit our form to initiate consultation as soon as possible. When proposed scoping comments are to inform agencies about issues and alternatives to be considered in a Draft Environmental Impact Statement (DEIS) (rather than recommending a position of support or opposition to a project), the form used to initiate consultation should identify the request as "non controversial" and an "expedited review" should be requested.

An early initiation of the consultation process will help ensure that Sierra Club does not forfeit its opportunity to comment on the environmental review scope. Standing is important to ensure that Sierra Club maintains the right to participate in future proceedings to support, oppose, or otherwise engage with proposed projects. Early engagement in the consultation process will inform Sierra Club legal staff and help establish and maintain Sierra Club's Standing.

We advise all Club entities to become involved in siting processes as early as possible. It is to our advantage to prevent developer investments in high-conflict areas as soon as possible, and to steer development to areas with the fewest environmental impacts. Research on possible conflicts is critical in the early stages. Although this early review may not be conclusive or include detailed analysis as found in an EIS pursuant to NEPA, or state-level processes such as the CA Environmental Quality Act, it will flag potential problems such as endangered species habitat.

3. Local Government Planning

It is exciting to see a maturing collection of best practices embraced by professional planners and advocates that balance the urgent need for a large renewables build-out with the protection of ecosystem integrity and viable working lands. The American Planning Association has developed several Guidance documents that summarize these practices. Are You Solar Ready? (Day, 2020) lays out seven recommended broad steps for local government management of utility-scale renewable energy:

1. Lay the groundwork;

[7] Environmental Law Institute 2025

2. Recognize large-scale PV as a unique land use;
3. Identify a development pathway;
4. Focus on Impacts;
5. Avoid treating PV like a building;
6. Address community concerns; and
7. Avoid overly burdensome decommissioning requirements.

Environmental advocates can play important roles in assuring that these steps are undertaken by the local planning department and elected officials. The principal opportunities for input and influence happen at three stages:

1. Public input to ***the comprehensive plan***, sub-area plans, and sustainability or climate action plan;
2. Public input to the process of adopting ***text amendments to the land use code*** addressing utility-scale renewables; and
3. Public input and hearings for ***special use permits*** for specific installations.

It is important, as usual, to engage in the process early: To advocate for a fast build-out of renewables while still maintaining balance in the priorities for locating projects, it really is important to engage at all three of the above stages in the process. As we know, all wins are temporary, and losses can be decidedly permanent.

It is important for activists to understand state and local open meetings laws and to ensure that they are followed by local governments. Transparency in government is a key feature of any free society, and U.S. law encourages government agencies to provide public input opportunities and make their records available to the public whenever possible. Some exceptions apply, such as in certain situations involving individual privacy and national security, but federal and state laws establish broad guidelines for the disclosure of information and records by administrative agencies (Justia, 2025). Meetings and hearings held by local government agencies are also generally open to the public with some exceptions, and the agencies are required to provide public notice in advance.

In many states, state law requires that every county and city adopt a General or Comprehensive Plan for the physical development of that county or city. The state may also recognize the importance of local government plans in reducing emissions to achieve long-term statewide goals. A General Plan serves as the jurisdiction's "constitution" or "blueprint" for future decisions concerning a variety of issues including land use, health and safety, and resource conservation (Sierra Club, 2023). When it is time for a comprehensive plan revision or adoption of a new plan, it is important for energy activists to monitor the planning process and take action when public input to the process is solicited. The comprehensive plan is the best place to lay out a philosophy balancing industrial, agricultural and residential land uses, and describing how and where renewable energy fits in. Given that conservation plans are in many states not binding, Club entities should also be involved in the development of zoning ordinances and building codes as explained below.

Beyond engagement with local government plans, it is important to play a role in the public input required for adoption of new or revised land use codes that address renewable energy development. There are now many model codes available for review, and several of the best are

described by Coffey (2019). What is critical, however, is that utility-scale renewable energy be addressed directly and specifically in a jurisdiction's land use code, as its omission signals to developers and financiers that the jurisdiction's approval process will not be easy or straight-forward. Consistency and transparency are the most important characteristics of local government permitting.The zoning or land use code that provides the framework for permitting should address utility-scale renewables directly, encouraging interest from developers (National League of Cities 2022). Best practices include:

- The text amendment to the Zoning code should specifically address the permitting details for utility-scale solar;
- Details of the permitting process and performance standards should be elaborated, similar to other large scale development permit processes; and
- Utility scale solar and wind should be permitted as a use by review (special use permit) in agricultural, some residential and non-residential districts in addition to industrial zones.

The public input to special use permits also provides an excellent opportunity for advocates to intervene in specific project proposals, and to highlight problems and opportunities with individual projects. During this process, advocates can negotiate for community benefits that may mitigate potential impacts of large installations.

The land use planning process can be complicated and messy, especially in addressing new land uses not previously regulated. The keys to establishing a smooth process are clarity and consistency across all the steps and documents—from the comprehensive plan to the on-line permit application forms. It is often difficult for activists to know the appropriate points in the process to intervene with specific environmental concerns. The best practices here are to wait until the issues warranting our concern are clear and consistent, and intervene at every point in the planning process when it is permitted.

1. Conclusion

Our experience has supported our assumption that the majority of decisions under the Renewable Energy Siting Policy and Guidance will be relatively easy and can be resolved with limited volunteer and staff time. For projects that are proposed in "grey areas" (section IIIc) under the Policy and Guidance, we recommend that if possible, staff and volunteer leaders seek to learn about the site, either through site visits, engagement with community members, or knowledgeable partners. For the vast majority of projects on private or non-conflict areas, such visits, while still useful and encouraged if possible, may not be necessary. Please see Appendix A, "Ground-truthing," for more ideas on what to look for on a site visit.

Sierra Club staff and volunteers are encouraged to engage with Tribal governments and consult with expert organizations, educational institutions, and state agencies that may have expertise on conservation, cultural and historic preservation, renewable energy and equity issues.

Finally, where possible Sierra Club staff and volunteers should work with and discuss concerns with renewable energy developers prior to taking positions or making public comments on large scale developments. The Energy Campaign and Field staff often have relationships with renewable energy development companies, and it can be mutually beneficial to coordinate in such outreach. Given the urgency of the climate and biodiversity crises, and given Sierra Club's policies supporting rapid development of renewable energy resources, we should be doing

everything possible to help renewable energy developers find ways to build projects that meet our environmental, habitat, environmental justice and other concerns.

V. Advice for Applying the Criteria

The following section provides advice on how to apply the criteria to particular projects. Given the volume of renewable energy projects that are being proposed and are needed to meet our climate and clean energy goals, the capacity of Campaigns and Chapters will likely not be sufficient for to-the-letter application of this advice but these provisions should be consulted when applying the Process wherever possible.

A. Assessing Proposals

The first step in determining our position on a proposal will be to assess if the project meets the criteria in Section III. For example, if the proposal is located within a conservation proposal area supported by Sierra Club, then this is a proposal we would recommend opposing unless it falls under the exceptions in the Energy Resources Policy. Projects on lands that have been recently farmed, have been permanently degraded by livestock grazing, or have been plowed, bulldozed or otherwise abused by mechanical impact are generally proposals we would recommend supporting, unless there are specific, identified species of special concern or conservation designations.

As soon as it appears likely that your Sierra Club Group, Chapter or other unit of the Club might wish to take a position on a specific project, the consultation process described in the Renewable Energy Siting Policy should be initiated by completing the consultation form. The final decision about a position must be a collaborative one, and it is important to reach out right away, well before any deadlines for comments or public statements occur, and before the bulk of the investigative work gets accomplished.

Many projects will fall in between the above extremes. For these, we will need to be thoughtful in applying and responding to the criteria.

For example: A large-scale solar photovoltaic project is proposed on several thousand acres of BLM lands near roads and transmission corridors. While much of the project area has no special designations and does not contain significant species, wildlife corridors, water features, etc., about a quarter of it contains some rare plant communities that include state species of special concern. How do we respond to a project like this?

The first step is to reach out to partners and allies already aware of the project and read any documentation available. Once the stakeholder coalition has coalesced, communication with the project proponents can begin. Where feasible, a site visit may be helpful to understand the location and any potential issues. Project applicants are often willing to take you to the site to show you the location, and discuss potential impacts and/or proposed mitigation they are contemplating. We can also access additional site information, some of which will likely be in Geographic Information Systems data, from local land managers, state and federal wildlife agencies and other environmental groups and their allies such as the Native Plant Societies.

B. Assessing Impacts and Potential Mitigation Measures

We should explore how to mitigate possible damage that this development may cause, either by avoidance (not disturbing a particular area), "compensatory mitigation"[8], reducing the scope of a project in sensitive locations, creating specific corridors for fauna, or implementing fencing or a monitoring plan. Other forms of on-site mitigations may include changing the way that a project is built to reduce damage, such as minimizing grading or surface crush, or maintaining on-site vegetation. True compensatory mitigation is difficult to achieve, but may include elements such as private land acquisition of fee title (i.e. shifting from public to privately held lands), conservation easements and ongoing protection of adjoining lands; or possibly through intensified management on public lands here in the same ecosystem. Avoidance may be as simple as shifting a project location.

Thus, in many cases, our approach can be to work to find solutions to real impacts, where we deem those impacts to be crucial to our conservation or equity outcomes. Our internal consultation process, with reference to Sierra Club policies and strategic goals, will determine if the resulting proposals are sufficiently protective, and what our organizational stance on the project should include.

Individual situations may be more nuanced than the example above. There may be cultural, nature access, or other environmental justice impacts, and there may be questions about support or opposition from frontline or Tribal communities. Part of a project analysis should include learning more about whether the project may have other potential impacts that may be of concern to us. As noted above, this Guidance is accompanied by a more detailed summary of the potential impacts of renewable energy organized by generation source located in Campfire (Sierra Club 2026), which may be a valuable tool in project assessment.

Since at least 2010, the Council on Environmental Quality (CEQ) and various agencies had developed a detailed set of regulations through the NEPA process on how agencies develop and enforce steps to mitigate negative effects that cannot reasonably be avoided or reduced in implementing the alternative action that the agency finally chooses and presents in the Final Environmental Impact Statement and Record of Decision. A list of those regulations is available from the National Archives Code of Federal Regulations. Affected persons could propose mitigation steps and monitoring in their comments during the scoping process and in comments on the Draft EIS. In such comments the commenters are advised to note how they would be harmed or helped by the agency adopting their proposals. Such comments are valuable to retain one's standing in subsequent proceedings.

The Trump Administration is currently (in 2025) proposing to repeal NEPA regulations and CEQ Guidance on them that were adopted before and during the Biden Administration in 2024, including mitigation guidance established under these regulations. Other changes addressed CEQ Guidance and individual agency regulations designed to apply NEPA to each agency's operations (Page 2025). If the CEQ changes its mitigation guidance so as to reduce the conservation effectiveness of that guidance, or if a Federal agency reduces the conservation effectiveness of its mitigation regulations, such as the BLM has done as of February 2025 (Bureau of Land Management 2025), the Sierra Club and its chapters should still propose effective mitigation measures at each stage of the impact assessment process. This will help guide the

[8] Making up for the damage by land and resource protections on similar lands elsewhere

agency and help ensure standing to sue to enforce any underlying legal obligations that may be recognized during judicial review of agency action under NEPA, or arise under such laws as the Federal or state Endangered Species Acts, the Migratory Bird Treaty Act or the several migratory bird treaties, the Marine Mammal Protection Act, and the like. The 2025 Sierra Club Policy on Restoring and Enhancing the Federal and State Environmental Impact and Endangered Species Acts (Sierra Club 2025c) requires Club entities to seek, when the opportunity presents itself, to restore and enhance the scope of the assessment processes at the state and federal levels.

Additional resources for assessing the viability of and designing mitigation measures are included in Appendix B.

Sierra Club supports area-wide efforts to identify appropriate sites and potential conflicts for renewable energy including programmatic environmental impact statements. Where possible, Sierra Club entities are encouraged to support and participate in efforts to minimize the potential for impacts and conflicts at the project stage in accordance with the general criteria described above.

C. Guarding against Disinformation and False Narratives about Clean Energy

Sierra Club entities should be vigilant to disinformation about renewable energy that is being funded and spread by fossil fuel advocates and climate-science deniers. As documented recently in an article in Sierra Magazine (Burns 2024):

> . . . as both the science and the tangible effects of a warming planet become irrefutable, it's increasingly rare to encounter… outright denial…. Instead, it's being replaced by what misinformation experts call 'climate delayism' –a coordinated campaign to undermine climate solutions. For fossil fuel advocates, sowing misinformation about wind and solar power is proving to be an effective stall tactic.

Opponents are promoting unfounded myths about renewable energy, such as linking whale deaths to offshore wind, claiming that wind turbines cause cancer, or asserting that solar development will destroy agriculture. Additionally, opponents sometimes use half-truths and cherry pick facts that lack necessary context, such as arguing that wind turbines cause excessive bird deaths, are too expensive, or use excessive materials. Anti-renewables advocates are using these arguments to block specific projects as well as to promote state and local regulations that essentially block renewables development, while leaving extraction of fossil fuels unchecked. Moreover, opposition to local large-scale renewable siting is fueled by mis- and dis-information and is growing at an alarming rate. It represents the largest barrier to decarbonizing the grid at the pace and scale needed to avert climate catastrophe.

Sierra Club strongly supports responsibly sited renewable energy development as an essential element of our strategic goals to transition off fossil fuels and stop emissions of climate warming pollutants. As discussed extensively in our Policy and throughout this Guidance, there will be situations where we oppose specific projects that will have unacceptable impacts and support reasonable land-use or siting regulations to guide these projects toward appropriate areas. We need to be targeted and strategic in these decisions, however, and must be careful neither to minimize the real harms renewable energy projects may cause in specific situations, nor to promote the arguments or rhetoric used by the opponents of renewable energy and climate action. This is particularly important at the time that this Guidance is being drafted, given that we

are confronting an Administration that is overtly hostile to our renewable energy, conservation, and climate goals.

D. Record Keeping

To maintain and build institutional knowledge pertaining to renewable energy siting, the policy requires that "brief sharable records for each position taken shall be kept of chapter and campaign participants, relevant issues, and final positions taken." These records, along with copies of comment or sign-on letters agreed to during the consultation process, or other public statements, "shall be made available to Chapters and members in a timely manner to facilitate shared knowledge of Sierra Club's voice on renewable energy and transmission siting." The documents described above are the records to be archived. They are saved in an accessible digital archive, accessible through the consultation form.

The consultation records are critical to building knowledge and capacity within Sierra Club and are expected to save staff time and facilitate knowledgeable Chapter and member engagement. Chapters or Groups wishing to comment on proposed renewable energy project siting or policy proposals should review the archive of previous consultations to identify issues, justifications, and other information that can serve as precedent and context for any new request for consultation.

E. Geographic Information Systems and Spatial Data for Site Analysis

Making an informed decision about a proposed renewable energy project will be greatly assisted by the collection of relevant, authoritative datasets that allow a reviewer to weigh potential pros and cons. By gathering comprehensive environmental, social, and cultural data, project reviewers can better assess the potential for renewable energy projects to harm or help local human and natural communities, and options to mitigate those risks. A local chapter review team for a project ideally should include at least one member conversant with GIS. Fortunately, many of these datasets are spatial, regularly updated, and publicly available through on-line readers.

To aid in the identification of geospatial datasets and tools, Sierra Club staff (Stricker, Ver Beek, and Saraswati 2025) provided technical assistance for this Guidance and developed a list of potentially useful spatial datasets. Some of these datasets, alongside other supporting data (e.g. jurisdictional boundaries) have also been included in an interactive Conservation x Clean Energy Mapping Platform ArcOnline map, readily available to chapter staff and volunteers. This map is available for informational purposes only; national staff are not available for assistance or troubleshooting of this map, the data, or its potential uses.

Use of spatial data for clean energy siting generally centers on finding the areas of greatest renewable energy production potential, while also avoiding collateral damage to other ecological and human systems. That is, reducing impacts to biodiversity, natural carbon sequestration potential, and wilderness values, while also avoiding harm to marginalized communities and reducing costs.

Spatial models frequently output static or interactive maps to visualize data across the landscape. Oftentimes, these maps are used to prioritize conservation lands, identify critical species habitats, or create jurisdictional boundaries. Most critically, GIS maps help decision-makers

determine where and how to allocate limited resources. With the rapid growth of geospatial technologies and available real-time data, agencies, organizations, and researchers across the globe have used these datasets to inform and create maps of key conservation areas and/or priority renewable energy placement.

Appendix C includes descriptions of some of the spatial datasets and tools used in the interactive map for clean energy siting and potential tensions or synergies with lands and biodiversity conservation. This data may help with locating *where* clean energy infrastructure has potential and the fewest known tensions but does not address *how* the process should be enacted, including best practices for ground-truthing, assessing local nuances (such as state-endangered species or small-scale archaeological sites), engaging with local and/or marginalized communities, or locating local restored habitats of ecological significance.

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Appendix A: Ground-Truthing Sites

Ground-truthing is as important with proposed renewable projects as it is with traditional power plants and other facilities or with a proposed wilderness area. We need to understand and know the characteristics of proposed renewable energy sites in order to keep our credibility relative to supporting or opposing a proposed facility.

Many times project proponents will be willing to provide access to their environmental consultants and the work they are doing as part of their outreach to the environmental community. Local federal land managers may also have significant information about the resources in a location. In particular, obtain a copy of the agency land use plan or equivalent that covers the project area so that the current management direction can be fully understood. These contacts provide valuable opportunities to get specific information on project areas, as well as to develop working relationships with project proponents and land managers. We encourage leaders to avail themselves of such opportunities, which can often result in productive problem-solving.

Prior to the site visit, it is important to contact community advocacy organizations interested in Tribal concerns, environmental justice, recreation access, cultural resources or other specific community issues with the project that may inform the data collection on the visit.

Ground-truthing entails assessing the land at the site itself and making observations about what is there. While GIS layers can and do provide a great deal of information, seeing the site, what is there, and how it is situated is extremely important.

For example, in desert areas, washes are vital for many species of wildlife. Some smaller washes may not appear on maps, especially if the topographic information is at a coarse scale. Siting facilities to accommodate natural drainage and avoiding washes that are essential for wildlife in the area will be an important consideration. This information may not be readily apparent on a map. You may be able to ask agencies or proponents to produce maps at the topographic scale needed to assist your assessment.

Ground-truthing helps us better assess the effectiveness of a particular technology for a specific site. At times developers have recommended areas based largely on maps, without onsite evaluation which gives a fuller understanding of the resource.

Ground-truthing can help provide information to support, modify or oppose projects. It may just help you to ask more informed questions and ensure that an agency and an applicant have done their due diligence.

<u>What to consider when ground-truthing a site</u>

Some things you might consider in your ground-truthing:

- Prior to visiting the site, review the maps and information provided by the agencies and applicants. Catalog important values and features. Understand the current management direction for the area.
- Do the maps and information provided by the agency and/or applicant accurately reflect what is on the ground? Some major topographic features may be depicted inappropriately or not be reflected at all on the maps provided. Note major washes, drainage patterns, seeps, springs, streams, etc.

- Regarding wildlife, note any evidence of wildlife activities including nests, wildlife trails, scat, etc. Is what you observe consistent with the information that has been provided? (Note that some wildlife assessments may not accurately reflect the significance of an area depending on the time of year the assessment was done.)
- Observe the vegetation. Any unique or unusual plants? Protected plants? Are there invasive non-native plants in the area?
- As noted above, prior to the site visit, it is important to contact community advocacy organizations interested in Tribal concerns, environmental justice, recreation access, cultural resources or other specific community issues with the project. On-site, assess and note any archaeological/cultural and other specific conditions relevant to the impact questions.
- Photograph the site and take careful notes on observations. Whenever possible, bring along someone who knows the wildlife, plants, and hydrology of the area.
- Note if there are any impediments to generating the energy on site, for example a major feature that would shade solar collectors during a critical portion of the day. Page | 42
- Note any key evidence of bird and bat habitat. This is especially important with wind projects.
- Establish and record your plan to return to the site to enjoy it and the elements you seek to protect. Update the plan to return as often as necessary, for example in annual Chapter Outings or Conservation Committee plans.

Appendix B: Resources for Choosing and Applying Mitigation Requirements:

*The following citations and links are from the Renewable Energy Wildlife Institute, a cooperative effort of industry and conservation groups that conducts research and publishes that research in peer reviewed scientific journals. (*Renewable Energy Wildlife Institute 2025*)*

As always, Club entities should check to see the status of the NEPA regulations of the "action agency" and its cooperating agencies if any as the entity prepares to participate in the NEPA (or ESA review) process. There have been changes and are likely to be additional changes to these in recent years.

Compensating for Adverse Impacts

- Huso MP et al. 2015. Estimating wind-turbine-caused bird and bat fatality when zero carcasses are observed. Ecological Applications 25(5):1213-1225.
- Shaffer JA et al. 2019. Estimating offsets for avian displacement effects of anthropogenic impacts. Ecological Applications. Ecological Society of America. 29(8):e01983.
- United States Department of Agriculture Natural Resources Conservation Service: Banking on Sage Grouse Habitat.
- U.S. Fish and Wildlife Service: Eagle Management.
- Western EcoSystems Technology, Inc. 2016. Technical Memorandum: Mitigation Banking-Style Option for the Headwaters Wind Farm Habitat Conservation Plan.

How is Compensatory Mitigation Implemented?

- Cochrane JF, et al. 2015. Modeling with uncertain science: estimating mitigation credits from abating lead poisoning in Golden Eagles. Ecological Applications 25(6)1518–1533.
- LeBeau CW, et al. 2018. Landscape-Scale Approach to Quantifying Habitat Credits for A Greater Sage-grouse Habitat Conservation Bank. Rangeland Ecology & Management 71(2):149-158.
- Lonsdorf E, Sanders-Reed CA, Boal C, Allison T. 2018. Modeling Golden Eagle-Vehicle Collisions to Design Mitigation Strategies. The Journal of Wildlife Management.
- U.S. Fish and Wildlife Service. 2011. Habitat Conservation Plans Under the Endangered Species Act.
- U.S. Fish and Wildlife Service. 2013. Eagle Conservation Plan Guidance.
- U.S. Fish and Wildlife Service. 2016. Eagle Permits; Revisions to Regulations for Eagle Incidental Take and Take of Eagle Nests.
- U.S. Fish and Wildlife Service. 2016. Midwest Wind Multi-Species Habitat Conservation Plan.
- U.S. Fish and Wildlife Service: Eagle Management.
- U.S. Fish and Wildlife Service: Endangered Species Act.
- United States Department of Agriculture Natural Resources Conservation Service: Banking on Sage Grouse Habitat.

- Van Pelt WE, et al. 2013. The Lesser Prairie-Chicken Range-wide Conservation Plan. Western Association of Fish and Wildlife Agencies.

Appendix C: Spatial Datasets and Tools Available for Clean Energy Siting and Compatibility With Land Conservation

Spatial data refers to any data that is associated with or describes the physical location of geographic features of objects, phenomena, or events on Earth's surface. This type of data is often represented in the form of coordinates (latitude and longitude), addresses, postal codes, or other geographic identifiers. Spatial data can include various attributes such as boundaries, distances, shapes, and relationships between different geographical elements. It is commonly used in geographic information systems (GIS) and other mapping technologies to analyze, visualize, and understand patterns and relationships within geographic space.

Spatial datasets and the spatial models that use them are excellent tools in conservation decision-making. Spatial datasets typically include only a single type of information (e.g. habitat type), while spatial models attempt to combine several layers of information into a single output map. These maps/models are often created by using weighted geostatistical processes; that is, mathematical processes that combine different layers of information on a cell-by-cell basis, with different variables holding different weights, to generate a single layer of data (generally, priority conservation or renewable energy locations).

GIS maps, however, are often created for different focal purposes, with different stakeholders in mind, and with different weights applied to the variables. Many maps will inherently leave off some areas considered important (ecologically, culturally, etc.) to other organizations and stakeholders, while prioritizing lands that others consider less valuable. This demonstrates the need to be expansive, broad, and diverse in the selection of information guiding renewable energy development, as models and datasets can only partially represent on-the-ground realities. While these models and datasets can inform renewable energy placement, they cannot alone decide or determine feasibility or desirability and thus should be used in conjunction with other forms of input, including community engagement and social values, as well as identification of lands that may be restorable and important to achievement of Sierra Club's 30 x 30 goals.

This list below is by no means exhaustive; many more spatial data layers exist and will be developed over time, however these are the datasets and tools that staff is currently aware of and have deemed them to be relevant, rigorous, and useful. Furthermore, GIS data layers are updated frequently and outdated quickly. While this list represents fairly up-to-date data, it can/will change over time as datasets are updated, improved, or subject to sunsetting. Appendix C also includes additional and standalone GIS datasets/tools that may be useful in conducting analyses.

1. Tips and Tricks for Interactive Map

Turning all layers on at once will result in an overwhelming and un-decipherable map, therefore it is suggested that users turn layers on and off as needed to gather relevant information. Entire groups of layers can be turned off (via the "eye" visibility button), therefore if the group is turned off, no layers within will be visible. Users can alternatively turn the group on, and toggle individual layers within the group on and off.

Layers are visible by clicking the “Layers” tool in the left-hand bar, and the legend can be visible only after clicking the Legend tool in the same bar.

2. Data Layers Included in the Sierra Club’s Interactive Map

I. Environmental Data

Ecosystem and Biodiversity: Data on local flora, fauna, and ecosystems is critical to understanding how renewable energy infrastructure (e.g., wind turbines, solar panels, hydropower plants) might impact local wildlife and habitats. This includes species distribution, migration patterns, and habitat sensitivity.

Water Resources: For projects like hydropower or geothermal energy, data on local water systems (rivers, lakes, groundwater) is needed. Understanding water availability, quality, and the potential for pollution or depletion helps assess impacts on local water resources.

Land Use, Landscape, and Soil: Information on land type (agricultural, forest, desert, etc.), soil quality, and erosion risk helps determine how the project might affect local landscapes and agricultural productivity. Landscape connectivity patterns are useful in determining if a proposed project could interrupt critical migration and connectivity corridors.

Climate Data: Understanding local climate patterns (wind speed, solar radiation, rainfall) ensures that the site is suitable for renewable energy technology.

II. Social and Cultural Data

Community Land Use: Data on how local communities use the land (e.g., for farming, grazing, or cultural practices) is important to avoid conflicts over land rights and ensure that the project does not displace people or disrupt livelihoods.

Cultural Heritage Sites: Identifying historical or culturally significant sites ensures that the project does not harm important cultural or archaeological resources.

III. Jurisdictional Layers Group

US Historic sites: Historic sites include areas where significant historical events of cultural interest occurred. These range from National Historic Parks, Sites, Trails, and Preserves to state, local, and areas held in trust.

Tribal Census Tracts: This feature layer, utilizing National Geospatial Data Asset (NGDA) data from the U.S. Census Bureau (USCB), depicts American Indian tribal census tracts. Per the USCB, "a tribal census tract is a relatively permanent statistical subdivision of a federally recognized American Indian reservation and/or off-reservation trust land, delineated by the American Indian tribal government and/or the Census Bureau for the purpose of presenting demographic data. For federally recognized American Indian Tribes with reservations and/or off-reservation trust lands with a population less than 2,400, a single tribal census tract is defined. Qualifying areas with a population greater than 2,400 could define additional tribal census tracts within their area".

USA Census Urban Areas: USA Census Urban Areas provides the boundaries, and 2020 U.S. Census names, codes, populations, and housing information for the urban areas of the United States. For the 2020 U.S. Census, an urban area comprises a densely settled core of census blocks that meet minimum housing unit density or population density requirements. This includes adjacent territory containing non-residential urban land uses. To qualify as an urban area, the

territory identified according to criteria must encompass at least 2,000 housing units or have a population of at least 5,000. Urban areas represent densely developed territory, and encompass residential, commercial, and other non-residential urban land uses. The sources for this layer are the U.S. Census Bureau's 2020 Census Urban Areas TIGER/Line data and the corresponding List of 2020 Census Population attribute fields.

a. Degraded Lands Group

Land Cover Vulnerability Change 2050 – Country: Predicted vulnerability to land cover change by year 2050, as generated by Clark Labs. Vulnerability to change was modeled at the country level and brought together into a single world map. A value of 1 means the pixel is among the most vulnerable to change, while a value of 0 means the pixel is among the least vulnerable. More information can be found here.

NPL Superfund Site Boundaries (EPA): This EPA content item depicts U.S. EPA superfund site (contaminated land) boundaries, which may be remediated and repurposed for renewable energy.

EPA Brownfields Hotspots: This EPA content item depicts location and facility identification information from EPA's Facility Registry Service (FRS) for the subset of brownfields sites, identified for cleanup and redevelopment. A Brownfield is previously-developed land that has been abandoned or underutilized, and which may carry pollution, or a risk of pollution, from industrial use. This data is displayed as "hotspots" (concentrated locations of multiple points). Zoom in on hotspots to see actual point locations.

EPA Brownfields Point Locations: Same as above, displayed as point/location data.

b. Energy Potential Group

Wind speed data for planning wind farm location is available at the U.S. Dept. of Energy's WINDExchange site: https://windexchange.energy.gov/maps-data?category=land-based&height=100m (accessed December 2, 2025). These DOE maps show very high average wind speeds at different heights suitable for small to large wind turbines in the central plains states and off the Pacific and Atlantic shores.

c. Landscape Connectivity Group

Intact Habitat Cores by Connectivity Importance: This layer was created as part of Esri's Green Infrastructure Initiative and is one of five newly generated companion datasets that can be used for Green Infrastructure (GI) planning at national, regional, and more local scales. These Esri derived data, and additional data central to GI planning from other authoritative sources, are also available as Map Packages for each U.S. State and can be downloaded from the Green Infrastructure Data Gallery.

This layer represents Intact Habitat Cores, symbolized based on their connectivity importance (Betweenness Centrality (BC). BC provides a metric depicting each core's importance in a connectivity network, thus illuminating each core's relative contribution to facilitating landscape connectivity and potential species movement. BC represents the number of paths that flow through a given habitat core. It is normalized by the total number of shortest paths between all

pairs of nodes, except those paths connecting immediate neighbors. High BC values reflect greater use of that core in traversing the network, thus elevating the core's importance in facilitating connectivity when compared to cores of lower value. Every time you change your viewing extent, the layer dynamically recalculates to depict the most important cores, based on its betweenness centrality value.

Resilient and Connected Networks: TNC's Resilient and Connected Network (RCN) is a proposed conservation network of representative climate-resilient sites designed to sustain biodiversity and ecological functions into the future under a changing climate. The network was identified and mapped over a 10-year period by Nature Conservancy scientists using public data available at the state and national scale, and an inclusive process that involved over 150 scientists from **agencies, academia and NGOs across the US.**

North American Priority Conservation Areas_Grasslands: This map shows the grasslands priority conservation areas (GPCAs) within North America's Central Grasslands, an ecosystem considered among the most threatened in the continent and the world. GPCAs are defined as areas of tri-national importance due to their ecological significance and threatened nature, which are in need of international cooperation for their successful conservation.

PADUS: The Protected Areas Database of the United States (PAD-US) is the official inventory of public parks and other protected open space. PAD-US is published by the U.S. Geological Survey (USGS) Science Analytics and Synthesis (SAS), Gap Analysis Project (GAP). GAP produces data and tools that help meet critical national challenges such as biodiversity conservation, recreation, public health, climate change adaptation, and infrastructure investment. See the GAP webpage for more information about GAP and other GAP data including species and land cover. Accurate as of May 2024.

d. Endangered Species/Biodiversity Group

Critical Habitat for Threatened and Endangered Species

Imperiled Vertebrates Species Richness

Imperiled Pollinators: Species Richness

Richness of Imperiled Species in the United States

Imperiled Vascular Plants: Species Richness[1] [2]

Areas of Unprotected Biodiversity Importance of Imperiled Species in the United States:

e. Carbon Group

Irrecoverable Carbon in biomass (MgC ha−1) refers to the vast stores of carbon in nature that are vulnerable to release from human activity and, if lost, could not be restored by 2050 — when the world must reach net-zero emissions to avoid the worst impacts of climate change. [Conservation International]

Irrecoverable Carbon in soils (MgC ha−1) refers to the vast stores of carbon in nature that are vulnerable to release from human activity and, if lost, could not be restored by 2050 — when the world must reach net-zero emissions to avoid the worst impacts of climate change. [Conservation International]

IV. Limitations on the Use of GIS and Spatial Data

Not all types of data and information can be made spatial, available, or quantifiable, but are important for assessing local impact. This may include qualitative and/or values-based perspectives, such as scenic value, significant cultural value, unmarked historical sites, and sites of significant tribal value outside of reservation boundaries. This makes community engagement critical to the process of renewable energy siting. While Sierra Club volunteers, staff, and members are not responsible for community engagement processes, it may be prudent to ensure local governments and energy developers are doing so in a meaningful way.

3. Additional Data Bases and Layers

a. Clean Energy Potential

These layers represent geospatial datasets/tools that assess the potential for clean energy infrastructure (that is, built energy production facilities such as wind, solar, hydroelectric, etc).

Geospatial Energy Mapper (GEM) (anl.gov)

- Source: US Department of Energy
- Type: Interactive map
- Methods: Report for full tool details
- Summary/Notes: Geospatial Energy Mapper provides renewable energy infrastructure potential for the continental United States. Users can choose from the different renewable energy sources available, including electrical infrastructure, hydropower, solar, and wind. The mapper also includes information on wildfire risk and electric vehicle feasibility.

Princeton Net-Zero America 100% Renewable Scenario

- Source: Princeton
- Type: Shapefile
- Methods: See the NZA Report for details
- Summary/Notes: This dataset shows the wind and solar development in the contiguous United States that will be required by 2050 under a net-zero-emissions scenario with 100% renewable energy generation and more permissive land-use assumptions. The main purpose of this website is for raw shapefile download (for use with desktop GIS applications) however the map data is viewable on this page.

2035 Report

- Source: GridLab, Energy Innovation, and UC Berkeley modeling
- Type: Summary CSV
- Methods: Most methods included in the appendices and 2035 1.0 report.
- Summary/Notes: We have detailed data by balancing area from the 2035 2.0 report. Doesn't include exact siting locations, just a summary over wider areas.

b. TNC Renewables Siting Tool

Site Renewables Right

- Source: The Nature Conservancy
- Type: Interactive map
- Methods: Published methods paper

- Summary: While this tool and the data model it was built upon are relevant and scientifically appropriate, it is important to note the limitations of this tool. This model was built upon renewable energy potential, climate corridor landscapes, federally endangered species habitat, and select other non-endangered wildlife species of interest (e.g. big game and eagles), making it a fairly robust model for renewables siting. This model, however, cannot inherently/accurately model all site-level nuances or smaller-scale ecological considerations. For instance, this tool does not include habitat for state-endangered species, tribal culturally relevant species/landscapes, endemic species (those found in a small/single area and nowhere else on Earth), or qualitative values such as scenery that may be locally important.

  While this tool can help to identify potential sites, it should not be used as a standalone source for deciding whether to support/reject a renewables project. As such, despite its fairly comprehensive nature, we recommend also utilizing several of the other data sources listed below, as well as developing a protocol/best practice for engaging with local realities. We also emphasize the utility of considering other landscape uses, values, and climate mitigation efforts in the suite of climate change approaches and tools, such as the use of nature-based solutions, utilization of Brownfield sites for renewables (where possible/appropriate), and environmental justice concerns.

c. Climate Mitigation Potential (Nature-Based Solutions)

Reforestation Hub

- Source: The Nature Conservancy
- Type: Interactive map
- Methods: In Cook-Patton et al. (2020) Lower cost and more feasible options to restore forest cover in the contiguous United States for climate mitigation
- Summary: Forest restoration is an integral part of both climate adaptation and mitigation. Re-establishing forests can help prevent soil erosion/landslides during large rain events, slow the flow of surface waters, improve water quality, and enhance habitat. The Nature Conservancy launched a study to assess the most feasible (biologically and socially), cost-effective locations for reforestation across the US.

Geospatial Data for Nature-Based Solutions

- Source: Land & Carbon Lab (partners include Univ of Maryland, Google, USGS, etc)
- Type: Web page with embedded maps
- Methods: Methods are detailed within the website
- Summary: Land & Carbon Lab (LCL) is the World Resources Institute's premier hub for geospatial data, analysis, and monitoring of the world's land and its natural ecosystems. Its data and monitoring solutions, which include the Global Forest Watch platform, exist to help accelerate implementation and financing of nature-based solutions to climate change worldwide. Website summarizes internal and partner spatial data on climate change and nature-based solutions. Interactive maps are embedded throughout.

d. Land Cover / Land Use

Protected Areas Database (PADUS)

- Source: US Geological Survey

- Type: Interactive map/data viewer
- Methods: See USGS website
- Summary: PAD-US is America's official national inventory of U.S. terrestrial and marine protected areas that are dedicated to the preservation of biological diversity and to other natural, recreation and cultural uses, managed for these purposes through legal or other effective means. PAD-US also includes the best available aggregation of federal land and marine areas provided directly by managing agencies, coordinated through the Federal Geographic Data Committee Federal Lands Working Group.

GAP Status Code:

Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management. Examples of Status 1: Wilderness Areas, Several National Parks

Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance. Examples of Status 2: National Wildlife Refuges, Conservation Areas, The Nature Conservancy Preserves

Status 3: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging, Off Highway Vehicle recreation) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area. Examples of Status 3: National Forests, BLM Lands, State Forests, some State Parks

Status 4: Generally public ownership, however there are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic land uses. The area generally allows conversion to unnatural land cover throughout or management intent is unknown. Examples of Status 4: City parks and sports complexes, tribal lands, agricultural research units, etc.

LANDFIRE

- Source: US Geological Survey
- Type: Interactive map/data viewer
- Methods: See here
- Summary: LANDFIRE is a nationally consistent collection of more than 25 geospatial layers, databases, and ecological models at a 30-meter resolution that describe disturbance, vegetation, fire, and fuel characteristics. Within LANDFIRE, national datasets on land cover/land use are available.

RE-Powering Mapper (Contaminated Sites for renewables development)

- Source: US EPA
- Type: Interactive map/data viewer
- Methods: See here
- Summary: The RE-Powering Mapper provides federal and state data for over 190,000 brownfields, Superfund, landfill, mine sites and other contaminated lands to help users

identify sites for renewable energy development. Sites have been pre-screened for renewable energy potential using criteria from the National Renewable Energy Lab.

e. Critical and Rare Habitats

Mature and Old Growth Data Viewer

- Source: US Forest Service
- Type: Interactive Map
- Methods: Information related to the process and analysis can be found on the US Forest Service Mature and Old Growth "Climate Risk Viewer".
- Summary: Climate exposure and vulnerability information in the Climate Risk Viewer can help illustrate climate trends and their effects on forest and other ecosystem resources, the current condition of these resources, and future projected climate changes and their effects.

Resilient and Connected Landscapes

- Source: The Nature Conservancy
- Type: Interactive Tool
- Methods: Information related to the process and analysis can be found in TNC's
- Conservation Gateway.
- Summary: This tool maps lands and corridors considered "resilient" to climate change impacts, based on a number of landscape metrics. These lands are highly critical to biodiversity, particularly those considered especially at risk for climate change. These lands also help to support the continuation of ecosystem services in the face of climate change, which are highly important to humans and communities.

f. Biodiversity

Map of Biodiversity Importance

- Source: NatureServe
- Type: Story Map with interactive biodiversity map
- Methods: Combination of independently created habitat suitability models.
- Summary: Interactive map tool for identifying critical areas for species conservation. Includes habitat suitability models for 2,216 of the nation's most imperiled species, coupled with information on range size and degree of protection derived from those models. The tool provides 15 total map layers for the Lower 48 states.

Key Biodiversity Areas

- Source: KBA Partnership
- Type: Website with interactive map
- Methods: See KeyBiodiversityAreas.org
- Summary: Map of areas of greatest biodiversity importance, as consolidated by 13 partnering conservation organizations.

Biodiversitymapping.org

- Source: Jenkins lab, Florida International University
- Type: Website with embedded maps and raw GIS data downloads

- Methods: See Jenkins et al. (2013)
- Summary: Detailed maps summarizing all the terrestrial vertebrates, freshwater fish, amphibians, and trees, as well as an overall biodiversity map.

g. Indigenous Lands

ArcOnline USA Native Lands

- Source: Bureau of Indian Affairs, hosted by ArcGIS Online
- Type: Interactive Map
- Methods: N/A
- Summary/Note: This data depicts the external boundaries of federally recognized tribal reservation lands. This is not a comprehensive dataset of all tribally-important areas and does not communicate tribally-held ceded-territory rights (i.e. off-reservation rights) which exist throughout the country. This tool is also in sunsetting phase; use this data with caution, and for general information purposes only.

h. Environmental Justice

EJ Screen (Environmental Justice Screening and Mapping Tool)

- Source: US EPA
- Type: Interactive Map
- Methods: How was EJScreen Developed? | US EPA
- Summary: This is an environmental justice (EJ) mapping and screening tool called EJScreen. It is based on nationally consistent data and an approach that combines environmental and demographic indicators in maps and reports.

i. Other Useful Tools/Resources:

EnviroAtlas (USEPA)

FEMA Flood Risk Map

EPA Watershed Health/Stress Data

The US Environmental Protection Agency (EPA) has developed the Watershed Index Online (WSIO) tool as a national watershed indicator data library that users can download within specified geographic areas. The EPA data uses a compilation of ecological information that is measurable, comparable, and consistent across the area of the assessment, and relevant to assessing a watershed's condition. This data was combined to create a watershed ecological health index and a watershed stress index. Data within the ecological index include percent forest in the watershed, percent wetlands, mean aquatic condition score, habitat condition index and more. Data within the stressor index include measures of soil erosion, percent cultivated crop in the riparian zone, stream-road crossing density, percent ag on slopes, percent non-buffered agriculture, percent imperviousness (impervious surfaces), and more.

Appendix D: Agrivoltaic Resources

Agrivoltaic Resources

August 2024

Links to references, resources, videos, and media articles (not in any particular order or ranking)

General Sources of Information on Agrivoltaics

Inspire: Innovative Solar Practices Integrated with Rural Economies and Ecosystems

Funded by the U.S. Department of Energy and managed by NREL.

https://openei.org/wiki/InSPIRE

This is a comprehensive site including many resources such as:

- Agrivoltaics Primer
- Financial Calculator
- Data Portal (technical research papers)
- Map of Agrivoltaic sites in the U.S.
- The 5Cs: Agrivoltaic Success Factors
- Research Sites

NREL: Capital Costs for Dual-Use Photovoltaic Installations:
2020 Benchmark for Ground-Mounted PV Systems with Pollinator-Friendly Vegetation, Grazing, and Crops

https://docs.nlr.gov/docs/fy21osti/77811.pdf

A report by the National Renewable Energy Laboratory investigating the capital cost premium of various approaches to agrivoltaics installations.

AgriSolar Clearinghouse

https://www.agrisolarclearinghouse.org/

The AgriSolar Clearinghouse is a nationwide hub developed by the National Center for Appropriate Technology to connect businesses, landowners, and researchers with trusted resources to support the growth of co-located solar and sustainable agriculture, also known as agrivoltaic development. Primarily an information-sharing, relationship-building, public communications hub for agrivoltaics.

Includes an extensive Information Library and Media Hub.

Farmland Information Center - a project of the American Farmland Trust

https://farmlandinfo.org/?search=agrivoltaics

https://farmlandinfo.org/?search=solar

https://farmlandinfo.org/?search=solar%20policy

A searchable information source (links above are for keywords agrivoltaics, solar, and solar policy).

Agrivoltaics: Coming Soon to a Farm Near You?

U.S. Department of Agriculture - Northeast Climate Hub

https://www.climatehubs.usda.gov/hubs/northeast/topic/agrivoltaics-coming-soon-farm-near-you

Includes a great graphic showing the maximum land required for solar in 2050 compared with solar-suitable disturbed and contaminated land area in the U.S.

Foundational Agrivoltaic Research for Megawatt Scale (FARMS) Funding Program

U.S. Department of Energy - Office of Energy Efficiency and Renewable Energy

https://www.energy.gov/eere/solar/foundational-agrivoltaic-research-megawatt-scale-farms-funding-program

Listing of research programs funded by D.O.E in 2022.

Solar and Agriculture Co-Location

U.S. Department of Energy - Office of Energy Efficiency and Renewable Energy

https://www.energy.gov/eere/solar/solar-and-agriculture-co-location

A good introduction to agrivoltaics and a sidebar with a listing of upcoming webinars, meetings, and news.

Growing Power - Transforming production through agrivoltaics

https://scapes.illinois.edu/

https://sustainability.illinois.edu/usda-funds-agrivoltaics-project/

U.S.D.A funded research at the University of Illinois.

Farmland Owner's Guide to Solar Leasing - National Agricultural Law Center

https://farmoffice.osu.edu/our-library/farm-leasing-law

Scroll down the page to SOLAR LEASES. Published in 2019, this is a good link for large scale solar PV on farmland but does not specifically address leases for dual-use agrivoltaic installations.

Incentivizing Agrivoltaics to Improve Farmland Resiliency and Meet Renewable Energy Demands in Indiana

https://www.sciencepolicyjournal.org/article_1038126_jspg210108.html

A policy memo - University of Notre Dame, October 2022.

Corn Ethanol vs Solar - Land Use Comparison

https://drive.google.com/file/d/1EQUO0-PY5SUyInnlBfz9LIIW-r8hHVAF/view?usp=sharing

An analysis published by Clean Wisconsin - January 19, 2023.

Techno–ecological synergies of solar energy for global sustainability

8.-Hernandez-et-al.-2019-TES-of-Solar-Energy.pdf (wildenergy.org)

A technical paper exploring the synergistic outcomes of solar energy technology across industrial and ecological boundaries.

AgriSolar Clearinghouse media hub

https://www.agrisolarclearinghouse.org/media-hub/

The AgriSolar Clearinghouse is a nationwide hub developed by the National Center for Appropriate Technology to connect businesses, landowners, and researchers with trusted resources to support the growth of co-located solar and sustainable agriculture, also known as agrivoltaic development. Primarily an information-sharing, relationship-building, public communications hub for agrivoltaics. Includes a collection of AgriSolar videos, podcasts, factsheets, and other media.

Board of Directors, updated March 7, 2026