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Green Siting for Green Energy

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Renewable energy development is critical to reducing greenhouse gas emissions. While solar energy projects can replace polluting fossil fuels, land-intensive solar projects have environmental costs of their own.[1] Current solar technologies require approximately 7 acres of land per megawatt of energy generated, whereas large gas-fired power plants require only 0.06 acres per megawatt.[2] Arrays of solar panels on commercial rooftops or landfills are attractive alternatives to putting solar on open land because they allow beneficial reuse of developed sites, but they are typically small-scale projects that produce less than 1 MW of power.[3] Large projects have the potential to provide hundreds of megawatts of electricity, but could also disrupt huge expanses of undeveloped land. The landscape changes resulting from increasing numbers of large renewable energy projects have been characterized by opponents as "energy sprawl."[4] This tension between renewable energy development and protection of precious landscapes creates a conundrum for environmentalists.

As a result of California's strong Renewable Portfolio Standard[5] ("RPS") and new funding from the American Recovery and Reinvestment Act,[6] in 2009 developers began proposing numerous large-scale solar projects in the California desert.[7] The unique ecosystems and biodiversity in the California desert have made the tradeoffs between various environmental costs and benefits of solar projects especially apparent.[8] The consequences of desert development are particularly troubling because of limited scientific understanding of these ecosystems.[9] For example, deserts are slow to recover from disturbances and damaging desert soils limits their ability to act as carbon sinks.[10]

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1. John D. Leshy, *Federal Lands in the Twenty-First Century*, 50 Nat. Resources J. 111, 117 (2010).
2. The Desert Renewable Energy Conservation Plan (DRECP) originally used 7.1 acres/MW for CSP and 9.1acres/MW for solar PV. Acreage Requirements for Central Station Renewable Technologies, *available at* http://www.drecp.org/meetings/2011-12-05_meeting/presentations/D-Vidaver_2040_and__DRECP_WG_Final_10-21-2011.pdf (last visited June 2, 2013). After additional discussion and review, the DRECP revised the acreage calculation to use 7.1 acres/MW for all solar technologies. Desert Renewable Energy Conservation Plan, Overview of DRECP Alternatives Briefing Materials, *available at* http://www.drecp.org/meetings/2012-07-25-26_workshop/background/Stakeholders_Briefing_Materials_08-07-2012.pdf (last visited June 2, 2013). CSP sites use more land than coal mines, oil and gas fields or traditional fossil fuel facilities. Leshy, *supra* note 1, at 117. One MW of electricity can power approximately 220 homes. *What's in a Megawatt?,* Solar Energy Industries Assoc'n, http://www.seia.org/policy/solar-technology/photovoltaic-solar-electric/whats-megawatt (last visited Jan. 26, 2013).
3. *Rooftop Solar Program Frequently Asked Questions*. S. Cal. Edison, https://www.sce.com/wps/portal/home/business/generating-your-own-power/solar-rooftop-program/faq/ (last visited June 2, 2013).
4. Sara C. Bronin, *Curbing Energy Sprawl with Microgrids*, 43 Conn. L. Rev. 547, 547 (2010).
5. In 2002, the California legislature passed a Renewable Portfolio Standard, requiring utilities to steadily increase the percentage of energy they obtain from renewable energy sources. S.B. 1078 (Cal. 2002). The RPS was strengthened in 2006 and 2011. Cal. Pub. Util. Comm'n, California Renewable Portfolio Standard, http://www.cpuc.ca.gov/PUC/energy/Renewables/ (last visited May 30, 2013).
6. American Recovery and Reinvestment Act of 2009, Pub. L. 111-5. (2009).
7. "Large-scale" here is a synonym of "utility-scale," meaning projects large enough to sell power to utilities (usually 20 MW or more). Large-scale project developers enter power purchase agreements with utilities. These agreements guarantee markets for the generated electricity. Since 2010, local, state, and federal agencies have approved nearly 9,000 MW of solar energy projects in the California desert, including more than 3,000 MW on public federal lands. Desert Renewable Energy Conservation Plan, Description and Comparative Evaluation of Draft DRECP Alternatives, EC Table (2012), *available at* http://www.drecp.org/documents/docs/alternatives_eval/index.php.
8. *See generally* Jeffrey E. Lovich & Joshua R. Ennen, *Wildlife Conservation and Solar Energy Development in the Desert Southwest, United States*, 61 Bioscience 12 (2011) (Lovich and Ennen note the potential effects of the construction and the eventual decommissioning of solar energy facilities include the direct mortality of wildlife; environmental impacts of fugitive dust and dust suppressants; destruction and modification of habitat, including the impacts of roads; and off-site impacts related to construction material acquisition, processing, and transportation. The potential effects of the operation and maintenance of the facilities include habitat fragmentation and barriers to gene flow, increased noise, electromagnetic field generation, microclimate alteration, pollution, water consumption, and fire. Facility design effects, the efficacy of site-selection criteria, and the cumulative effects of USSED on regional wildlife populations are unknown); *see also* Defenders of Wildlife, Making Renewable Energy Wildlife-Friendly, *available at* http://www.defenders.org/sites/default/files/publications/making_renewable_energy_wildlife_friendly.pdf (last visited Jan. 27, 2013).
9. *See generally* The DRECP Independent Science Panel, Final Report: Independent Science Review for the California Desert Renewable Energy Conservation Plan (DRECP) 28 (Nov. 2012), *available at* http://www.drecp.org/documents/docs/independent_science_2012/Independent_Science_Panel_2012_Final_Report.pdf; *see also* Leshy, *supra* note 1, at 126.
10. D. Richard Cameron, et al., *An Approach to Enhance the Conservation-Compatibility of Solar Energy Development*, 7 PLOS ONE 1, 2 (2012) (explaining "[d]isturbing desert soil may also limit the degree to which it acts as a carbon sink, an ecological process that is poorly studied and the magnitude of which has only recently been characterized"). Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses, and

This Article examines the environmental tradeoffs involved in siting solar projects with a particular focus on California. It examines the current hurdles for "greener" siting of projects in disturbed (i.e., graded, landscaped, or otherwise non-natural areas) and developed areas, including the obstacles to permitting distributed generation ("DG") projects, which are smaller-scale projects that can be built on places like parking lots or rooftops. Part I provides general context regarding the scale of solar energy. Part II sets forth the context of solar projects in California. Part III examines current proposals to address impacts and tradeoffs of siting solar on disturbed land and considers the types of disturbed land available for solar energy. Finally, Part IV concludes the Article with thoughts on where and how to site solar projects.

Although both large- and small-scale renewable energy sources are necessary to reduce greenhouse gas emissions, there are many opportunities for greener renewable energy siting. Greener siting must proceed on two fronts. First, as large utility-scale solar facilities become an increasingly important component of the U.S. sustainable energy portfolio, careful siting of such projects becomes increasingly important as well. Marginal agricultural land and abandoned mine lands can provide untapped opportunities. Second, DG with solar photovoltaics ("PV") located across California will be vital.[11] The key to greener siting of DG is fostering the expansion of renewable projects in disturbed areas, particularly on contaminated sites, rooftops, and parking lots.[12] A challenge significant challenge associated with using DG is the number of actors, permits, and environmental review processes required to implement it.[13] Facilitation and coordination of these processes will speed the journey to a solar energy future.

I. Solar Power Basics

Solar technologies generate electricity by harnessing energy from sunlight.[14] There are two primary solar technologies: PV and concentrated solar power ("CSP"). Semi-conductor cells in PV panels generate electricity directly when exposed to the sun.[15] Single panels may be used to generate small amounts of electricity for individual use, while millions of panels may be assembled in giant arrays for large-scale projects.[16] CSP systems use mirrors and collectors to convert solar energy indirectly by heating a fluid to between 300°F and 1,000°F. Heat from the fluid is used to boil water, creating steam that spins a turbine driving a generator to produce electricity.[17] Like PV panels, CSP systems may be used for small-scale projects or may cover thousands of acres.[18]

Although solar energy currently makes up less than 1% of the electric power generated in the United States, it has enormous potential to expand.[19] Solar power generation doubled in the United States between 2008 and 2011, and the market for solar energy generating equipment grew another 76% in 2012.[20] Solar energy development was previously limited by several factors including technological capability and the entrenchment of the fossil fuel industry, which is supported by subsidies.[21] Yet, solar technology is quickly becoming more cost-competitive with fossil fuels.[22] The price for PV panels in particular has dropped dramatically as a result of increasing Chinese production.[23] Improved technologies, increased fossil fuel costs, government subsidies of solar power, RPS requirements, and other government policies have been making solar power much more attractive. The push for solar is on.

II. The California Solar Power Scene

A. *Utility-Scale Power Facilities*

Renewable energy generation can be from large utility-scale facilities down to smaller DG installations. A utility-scale renewable energy facility is one that can generate large enough amounts of energy to have a power purchase agreement with

other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils, also known as a carbon sink. The sink of carbon sequestration in biomass and soils helps offset sources of carbon dioxide to the atmosphere. *Carbon Sequestration,* U.S. Dep't of Agric. Forest Serv., http://www.fs.fed.us/ecosystemservices/carbon.shtml (last visited Feb. 19, 2014); *see also generally* David A. Bainbridge, A Guide for Desert and Dryland Restoration (2007).

11. *See* State of Cal., Energy Action Plan 7–8 (2003), *available at* http://www.energy.ca.gov/energy_action_plan/2003-05-08_ACTION_PLAN.PDF.
12. *Id.* at 5, 6.
13. *Id.* at 1.
14. Cal. Energy Comm'n, Glossary of Energy Terms, http://www.energy.ca.gov/glossary/glossary-r.html (last visited May 30, 2013) [hereinafter CEC Glossary].
15. *See Solar Photovoltaic Technology Basics,* Nat'l Renewable Energy Labs., http://www.nrel.gov/learning/re_photovoltaics.html (last updated May 18, 2012).
16. *See id.*
17. *See Concentrating Solar Power,* Nat'l Renewable Energy Lab., http://www.nrel.gov/learning/re_csp.html (last visited May 30, 2013).
18. James Rawlings & Michael Ashcroft, Small-Scale Concentrated Solar Power: A Review of Current Activity and Potential to Accelerate Development, The Carbon Trust (Mar. 2013), *available at* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191058/small_scale_concentrated_solar_power_carbon_trust.pdf.
19. *What is U.S. Electricity by Energy Source?,* U.S. Energy Info. Admin., http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3 (last visited Nov. 3, 2013).
20. Lori Robertson, *Renewable Energy 'Doubled'?,* FactCheck.org (Sept. 14, 2012), http://factcheck.org/2012/09/renewable-energy-doubled-not-quite/; Ucilia Wang, *U.S. Solar Market Grew 76% in 2012,* Forbes (Mar. 14, 2013), *available at* http://www.forbes.com/sites/uciliawang/2013/03/14/u-s-solar-market-grew-76/.
21. *See* Int'l Monetary Fund, Energy Subsidy Reform: Lessons and Implications 1 (2013), *available at* http://www.imf.org/external/np/pp/eng/2013/012813.pdf.
22. *See Solar & Wind Power to be Cost-Competitive Without Subsidies by 2025 (NREL), While Fossil Fuels Still Subsidized Through Externalities,* CleanTechnica (Aug. 30, 2013), http://cleantechnica.com/2013/08/30/solar-and-wind-power-to-be-cost-competitive-without-subsidies-by-2025-according-to-new-study-from-the-national-renewable-energy-laboratory/.
23. *See* Brad Plummer, *China May Soon Stop Flooding The World With Cheap Solar Panels,* Wash. Post WonkBlog (Mar. 23, 2013), http://www.washingtonpost.com/blogs/wonkblog/wp/2013/03/23/china-might-stop-providing-the-world-with-cheap-solar-panels/. For general information about the finances of the PV industry, see Shyam Mehta, *PV Technology, Production and Cost Outlook: 2010–2015,* GreenTech Media Research, (Oct. 26, 2010), http://www.greentechmedia.com/research/report/pv-technology-production-and-cost-outlook-2010-2015; *see also* Stefan Reichelstein & Michael Yorston, *The Prospects For Cost Competitive Solar PV Power,* 55 Energy Policy 117 (2013), *available at* http://dx.doi.org/10.1016/j.enpol.2012.11.003. As PV prices have dropped, many project developers are moving away from CSP. Reuters, *Solar Thermal Plants Scrap Steam For Photovoltaic,* CNet News, (July 2011), http://news.cnet.com/8301-11128_3-20076065-54/solar-thermal-plants-scrap-steam-for-photovoltaic/.

an electric utility and to feed into the electricity transmission grid.[24] Utility-scale solar power projects are those larger than 20 MW; however, recent utility-scale projects are primarily 100 MW or greater.[25] California's push for utility-scale solar is tied to its ambitious RPS, which was first enacted in 2002 and strengthened in 2010.[26] The RPS requires utilities to procure 33% of their energy from renewable sources by 2020 and 80% by 2050.[27]

Utility-scale PV projects are located throughout California with a concentration of the larger projects in Imperial, Riverside, Kern, and San Luis Obispo counties.[28] Starting in roughly 2007, a large number of utility-scale solar projects were proposed on relatively pristine federal lands, managed by the Bureau of Land Management ("BLM"), in California's Mojave, Sonoran, and Colorado Desert eco-regions.[29]

The first wave of utility-scale projects proposed in the California desert in the late 2000s was primarily composed CSP projects. By the fall of 2009, the California Energy Commission was reviewing applications for twelve CSP projects ranging from 50–1,000 MW, seven of which were located on land administered by the BLM.[30] Except for the projects withdrawn by the applicants during the review process, the California Energy Commission approved all eleven of the CSP projects proposed.[31] However, the majority of these have not been built.[32] There are currently three large CSP projects under construction in California.[33] One additional solar power tower project was approved and recently procured a power purchase agreement.[34] The remaining CSP projects were delayed, redesigned to use other technologies like solar PV, or withdrawn.[35]

During the late 2000s, several solar PV projects were proposed on BLM-administered land and private land. By 2010, Kern County had approved three utility-scale solar PV projects[36] and San Luis Obispo County followed in 2011 approving two utility-scale solar PV projects.[37] Utility-scale solar PV projects continue to be proposed with frequency. The California Public Utility Commission's ("CPUC") RPS Status Table indicates that over thirty utility-scale solar PV projects are expected to be completed between 2012 and 2016, located throughout California, ranging from Imperial County in the south to Tulare and Mendota Counties in the Central Valley.[38]

As noted above, land-intensive solar projects can also have significant environmental impacts.[39] All utility-scale solar project developers fence off large areas of land and cover them with industrial facilities.[40] Some projects require exten-

24. Utility-scale renewable generation was originally considered by the California Energy Commission to be on the scale of 10 MW or larger. *Utility Scale Renewable Energy*, Cal. Energy Comm'n, http://www.energy.ca.gov/research/renewable/utility.html (last visited Nov. 4, 2013). More recently, utility-scale renewable generation has been considered projects that are larger than 20 MW. Cal. Energy Comm'n, Renewable Power in California: Status and Issues 37 (2011), *available at* http://www.energy.ca.gov/2011publications/CEC-150-2011-002/CEC-150-2011-002.pdf.

25.

26. *California Renewable Portfolio Standard*, Cal. Pub. Utils. Comm'n, http://www.cpuc.ca.gov/PUC/energy/Renewables/ (last visited May 30, 2013). The California Legislature passed the first version of the statutory RPS in 2002 (codified in Cal. Pub. Utils, Code § 399.11, *et seq.*). Initially, the RPS encouraged (but did not require) publicly owned utilities to procure 20% of their electricity from renewable sources by 2017. To qualify as eligible for California's RPS, a generation facility must use a designated renewable resource or fuel, as in the Overall Renewable Energy Program Guidebook. Cal. Energy Comm'n, Overall Renewable Energy Program (2d ed. 2008), CEC Publication # CEC-300-2007-003-ED2-CMF, *available at* http://www.energy.ca.gov/2007publications/CEC-300-2007-003/CEC-300-2007-003-ED2-CMF.PDF. State energy agencies recommended accelerating the RPS in the 2003 Energy Action Plan. State of Cal., Energy Action Plan (2003), *available at* http://www.energy.ca.gov/energy_action_plan/2003-05-08_ACTION_PLAN.PDF. Senate Bill 107 (2006, Simitian and Perata) modified the RPS to require that "investor-owned utilities" procure 20% of their retail electricity from renewable sources by 2010. California League of Conservation Voters, *SB 107: More Renewable Energy for California* (2006), http://www.ecovote.org/page/sb-107-2006 (last visited May 30, 2013). Also in 2006, the California legislature passed AB 32 (Nuñez, Chapter 488) — the Global Warming Solutions Act. AB 32 charges California Air Resources Board (CARB) with reducing California's greenhouse gas emissions to 1990 levels by 2020. Legislative Analysts Office, *Implementation of "AB 32"—Global Warming Solutions Act of 2006*, http://www.lao.ca.gov/analysis_2007/resources/res_04_anl07.aspx (last visited May 30, 2013). The RPS is a central policy for CARB in achieving these emission reductions. Office of the Governor Edmund G. Brown, Memo Re: California Needs Large Central Station Power Projects In The California Desert Resources Areas In Order To Meet State Policy Requirements And To Reduce Greenhouse Gas Emissions (Oct. 12, 2011), *available at* http://www.drecp.org/meetings/2011-10-12_meeting/presentations/Governor_Brown_Renewable_Energy_Statement_10-12-2011.pdf.

27. Cal. Exec. Order No. S-14-08 (Nov. 17, 2008). Cal. Energy Comm'n, *Renewables Portfolio Standards (RPS) Proceeding - Docket # 03-RPS-1078,* at 21 (Oct. 2010). In 2011, the California Renewable Energy Resources Act (SB X1-2) was enacted. SB X1-2 specifically applies the new 33 percent RPS to all retail sellers of electricity by December 31, 2020. The California Public Utilities Commission is responsible for implementing the RPS, and the California Energy Commission certifies that renewable energy sources meet the RPS requirements.

28. *RPS Project Status Table 2013*, Cal. Energy Comm'n, http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm (last visited May 30, 2013).

29. *Id.*; Bureau of Land Mgmt., BLM California Solar Applications (May 2013), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/pa/energy/solar.Par.84447.File.dat/BLM%20Solar%20Apps%20and%20Auths.pdf.

30. Cal. Energy Comm'n, 2010 Integrated Energy Policy Report Update 55 (2010), *available at* http://www.energy.ca.gov/2010publications/CEC-100-2010-001/CEC-100-2010-001-CMF.PDF.

31. Cal. Energy Comm'n, Solar Thermal Projects under Review 1–2 (Sept. 14, 2012) [hereinafter Projects Under Review], *available at* http://www.energy.ca.gov/siting/solar/.

32. *Id.*; Cal. Energy Comm'n, Tracking Progress — Renewable Energy 12 (Oct. 22, 2013) [hereinafter Tracking Progress], *available at* http://www.energy.ca.gov/renewables/tracking_progress/documents/renewable.pdf. (listing four CSP projects under construction or "pre-construction") [hereinafter Tracking Progress].

33. Tracking Progress, *supra* note 32.

34. PennEnergy Editorial Staff, *Solarreserve's Rice Solar Energy Project First to Include Energy Storage in California*, PennEnergy (Jan. 29, 2013), http://www.pennenergy.com/articles/pennenergy/2013/january/-solarreserves-rice-solar-energy-project-first-to-include-energy.html.

35. Tracking Progress, *supra* note 32, at 13–14.

36. Kern Cnty., Kern County Solar Projects (Mar. 13, 2013), *available at* http://www.co.kern.ca.us/planning/pdfs/renewable/solar_projects.pdf (last visited May 30, 2013).

37. *See* San Luis Obispo Cnty., SunPower California Valley Solar Ranch Monitoring/Construction: Ongoing Status Report, 1 (Oct. 30, 2013), *available at* http://www.slocounty.ca.gov/Assets/PL/SunPower+-+High+Plains+Solar+Ranch/SunPower-OngoingStatusReport.pdf; David Baker, *Big Solar Plant Opens in San Luis Obispo County*, SF Gate, (Oct. 31, 2013), http://blog.sfgate.com/energy/2013/10/31/big-solar-power-plant-opens-in-san-lois-obispo-county/.

38. Cal. Pub. Utils. Comm'n, Cal. Renewable Portfolio Standard (Feb. 2013) (on file with author).

39. Patrick Donnelly-Shores & Dustin Mulvaney, *Solar Energy Development on Public Lands: Policy-making Processes in California's New Gold Rush*, Land Use Pol'y (forthcoming) (manuscript at 19) (on file with authors).

40. *See* Cal. Energy Comm'n, Renewable Power in California: Status and Issues 60 (2011) [hereinafter CEC Renewable Power Report], *available at*

sive grading and scraping of sites, which essentially eliminates plant and wildlife habitat and dramatically changes site hydrology.[41] Project construction may generate huge amounts of dust and large quantities of water are typically required both for dust suppression and for washing mirrors and panels.[42] In addition, wildlife may be killed by construction vehicles or by collisions with solar facilities and transmission lines.[43] CSP power tower facilities in particular may pose major risks to migrating birds due to the cone of heat created between the mirrors and the power tower that burns birds when they fly through.[44] In addition to these ecological impacts, projects that are sited in culturally sensitive areas may disturb prehistoric archaeological resources and contemporary Native American sacred sites.[45]

Utility-scale solar facilities face a host of environmental requirements at federal, state, and sometimes local levels.[46] Soft costs associated with permitting and grid interconnection may make up to 40% of the cost of developing solar projects.[47] Environmental review requirements from the National Environmental Policy Act and California's Environmental Quality Act are accompanied by constraints from both the federal and state Endangered Species Acts.[48] Projects on federal land also have permitting requirements under the Federal Land Policy and Management Act of 1978.[49] Large CSP projects in California go through state licensing and permitting processes with the California Energy Commission.[50]

Two desert projects highlight the environmental concerns with recent utility-scale solar projects are the Ivanpah Solar Energy Generation System and the Genesis Solar Energy Project. Almost as soon as construction began, the Ivanpah Solar Energy Generation System ran into Endangered Species Act problems.[51] Section 9 of the federal Endangered Species Act prohibits "tak[ings]" of listed endangered species.[52] The Endangered Species Act defines "tak[ings]" to include actions that "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" a protected species.[53] Section 10 of the Endangered Species Act creates a mechanism to enable projects to proceed even where a take may occur if the project applicant puts together a Habitat Conservation Plan demonstrating, *inter alia*, that minimization and mitigation measures will not jeopardize the species as a whole.[54] The Ivanpah facility obtained a section 10 permit that allowed incidental take of desert tortoise, but during construction, much larger numbers of tortoises were discovered than anticipated. As a result, the project developer had to halt construction and get an amended biological opinion from the U.S. Fish and Wildlife Service to increase the level of allowable take and revise the project's strategies for relocating affected tortoises.[55]

Construction of the Genesis Solar Energy Project CSP facility in Riverside County did not proceed smoothly either. After construction of the Genesis Project began, widely dispersed buried prehistoric cultural resources, including human remains, were discovered and that also resulted in the temporary halting of construction.[56] Both the Genesis and Ivanpah projects had construction challenges despite review

http://www.energy.ca.gov/2011publications/CEC-150-2011-002/CEC-150-2011-002.pdf; John Copeland Nagle, *See the Mojave!*, 89 Or. L. Rev. 1357, 1382–83 (2011) (arguing that green industry isn't necessarily more palatable to those opposing conversion of the desert landscape).

41. The utility-scale solar projects under construction in the California Valley in San Luis Obispo have been designed specifically to retain the habitat value of the sites wherever possible. The alternatives approved by the county avoided the habitat, supporting the largest amount of special status species habitat, and a standard 4-barbed-wire ranch-style fence was used for perimeter fencing to permit maximum wildlife across and through the sites. It is unclear to what extent wildlife will use the project site or designed movement pathways during and after construction. Monitoring for up to 10 years was included in the Conditions of Approval to quantify the number and distribution of certain special status species and included a contingency plan for mitigation elements that did not meet performance or final success criteria (COA #59, 60, and 61). Aspen Envtl. Group, California Valley Solar Ranch Conditional Use Permit Final Environmental Impact Report § C.6.5.2 at C.6-89 (2011), *available at* http://www.sloplanning.org/EIRs/CaliforniaValleySolarRanch/index.htm; Aspen Envtl. Group, Topaz Solar Farm Conditional Use Permit Final Environmental Impact Report § C.6.4 at C.6-93 (2011), *available at* http://www.sloplanning.org/EIRs/topaz/FEIR/topaz_VolumeI.htm; Louis Sahagun, *Environmental Concerns Delay Solar Projects in California Desert*, L.A. Times (Oct. 19, 2009), http://articles.latimes.com/2009/oct/19/local/me-solar19.
42. CEC Renewable Power Report, *supra* note 40, at 58.
43. *Id.* at 57–58.
44. *Id.* at 57.
45. *Id.* at 60.
46. *See* Amy Wilson Morris & Jessica Owley, *Mitigating the Impacts of the Renewable Energy Gold Rush*, 15 Minn. J. L. Sci. & Tech. 193 (2014).
47. U.S. Dep't of Energy, *Rooftop Solar Challenge,* http://www.eere.energy.gov/solarchallenge/ (last visited June 7, 2013).
48. *See Renewable Energy Development in Region 8,* U.S. Fish and Wildlife Serv., http://www.fws.gov/cno/energy.html (last visited Nov. 3, 2013).
49. 43 U.S.C. § 1712. Regulations governing rights-of-ways (ROW) are found at 43 C.F.R. § 2800 (2013). ROW policies and procedures are governed by Title V of FLPMA, agency regulations and agency guidance in the form of a BLM Instruction Memoranda (IM-2011-003). U.S. Dep't of Interior, Bureau of Land Mgmt., EMS Transmission 10/13/2010, Instruction Memorandum No. 20121-003, Solar Energy Policy (Oct. 7, 2010), *available at* http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2011/IM_2011-003.html (last visited Mar. 17, 2013). ROWs are granted for a maximum of a 30-year term. FLPMA section 501(a)(4) explains that ROWs can be used for "systems for generation, transmission, and distribution of electric energy." Although this seemed to originally contemplate transmission lines, ROWs are now used to develop solar and wind projects on public lands as well as many other related energy and electricity uses. ROW authorization is subject to environmental review under the National Environmental Policy Act. *Id.*
50. Cal. Pub. Res. Code §§ 25120, 25500 (West 2014). In 2011, Senate Bill 226 amended the law to allow the CEC to continue to review some projects that began as CSP but would like to switch to PV. § 25500.1(a).
51. *January 14, 2011 — Ivanpah Solar Electric Generating System Updates*, Basin & Range Watch.Org, http://www.basinandrangewatch.org/IvanpahUpdate.html (last visited Oct. 30, 2013).
52. 16 U.S.C. § 1538(a)(1)(B).
53. 16 U.S.C. § 1532(19). Harm has been further defined in agency regulations as including "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. §17.3; Babbitt v. Sweet Home Chapter of Communities for a Great Oregon, 515 U.S. 687, 699 n.12 (1995).
54. 16 U.S.C. § 1539(a).
55. *January 14, 2011 — Ivanpah Solar Electric Generating System Updates*, Basin & Range Watch Org., http://www.basinandrangewatch.org/IvanpahUpdate.html (last visited Oct. 30, 2013); U.S. Fish & Wildlife Serv., Biological Opinion on BrightSource Energy's Ivanpah Solar Electric Generating System Project, San Bernardino County, CA [CACA-48668, 49502, 49503, 49504] (8-8-10-F-24R) 3, 14, 23 (2011), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/needles/lands_solar.Par.71302.File.dat/ISEGS_Reinitiation,%20Final%20BO.pdf (last visited Feb. 19, 2014).
56. Bureau of Land Mgmt., Notice to Proceed in Implementing the "Genesis Solar Energy Project Unit 1 Buried Resource Phase I and Phase II Mitigation Plan, Riverside County, California (2012), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/palmsprings/genesis.Par.72047.File.dat/Genesis%20NTP%205-11-12.pdf (last visited May 30, 2013).

by the California Energy Commission and BLM and having received permits from the California Department of Fish and Wildlife and the U.S. Fish and Wildlife Service.[57] These agencies were criticized as proceeding too quickly with the environmental review, resulting in unanticipated impacts.[58]

B. *Distributed Generation*

DG uses smaller-scale power generation technologies that typically generate between 3 kW and 20 MW. These projects are typically located close to where the electricity is used.[59] Although large-scale solar projects are still being proposed and developed,[60] DG solar projects have increased in number and importance for achieving California's RPS and greenhouse gas emission reduction goals.[61] A 2012 study commissioned by CPUC found that California could potentially develop 15,000 MW of electrical capacity through local DG solar by 2020.[62] Another report states that distributed PV is and will continue to be the fastest growing part of the solar market.[63]

Local DG can meet local, substation-level peak loads[64] and can eliminate the need to build additional local distribution lines.[65] DG facilities may be located directly within the low-voltage distribution grid or may supply power directly to the consumer.[66] Advocates of small-scale solar power generation argue that local DG projects have the potential to provide enormous amounts of electricity with far less environmental damage than large utility-scale projects.[67]

Homeowners and businesses with solar installations can also defray the cost of installing rooftop solar panels by taking advantage of net metering programs.[68] Under net metering programs, residential customers with solar panels are credited at the retail rate for the solar energy they feed back into the electricity grid.[69] There are forty states with net metering laws.[70] If customers produce as much energy as they consume, they do not need to pay the utility for electricity, which means that the customer does not contribute funds to the utility's fixed costs, including grid infrastructure operations and maintenance costs. The grid continues to act essentially as a battery for these customers as their excess electricity is fed into the grid when it is sunny and the homes draw from the grid at night and on cloudy days.[71]

California has also promoted DG through the development of new methods for utilities to purchase DG power. California's Renewable Auction Mechanism streamlines utility procurement of energy from RPS-eligible DG facilities.[72] The Renewable Auction Mechanism is a market-based procurement system for DG projects ranging from 3–20 MW.[73] The program authorizes the three large investor-owned utilities to procure 1,299 MW of DG through four auctions over 2 years.[74]

57. *See* Ken Wells, *Where Tortoises and Solar Power Don't Mix*, Bloomberg Businessweek (Oct. 10, 2012), http://www.businessweek.com/articles/2012-10-04/where-tortoises-and-solar-power-dont-mix; The Desert Tortoise Council, Newsletter (Fall 2010), *available at* http://www.desert-tortoise.org/newsletter/2010fall.pdf.
58. Ken Wells, *Where Tortoises and Solar Power Don't Mix*, Bloomberg Businessweek (Oct. 10, 2012), http://www.businessweek.com/articles/2012-10-04/where-tortoises-and-solar-power-dont-mix; *Genesis Solar Energy Project*, Colo. River Indian Tribes (Mar. 19, 2012), http://www.crit-nsn.gov/crit_contents/news/03192012.shtml (last visited May 30, 2013); Louis Sahagun, *Discovery of Indian Artifacts Complicated Genesis Solar Project*, L.A. Times (Apr. 24, 2012), http://articles.latimes.com/2012/apr/24/local/la-me-solar-bones-20120424.
59. CEC Glossary, *supra* note 14.
60. *See, e.g., Hidden Hills Solar Electric Generating System Power Plant Licensing Case*, Cal. Energy Comm'n, http://www.energy.ca.gov/sitingcases/hiddenhills/ (last visited May 30, 2013) (describing a 500 MW solar power tower); Bureau of Land Mgmt., McCoy Solar Energy Project (CACA 48728), http://www.blm.gov/ca/st/en/fo/palmsprings/Solar_Projects/McCoy.html (last visited May 30, 2013) (describing a 750 MW solar PV project); Kern Cnty., Notice of Preparation A Draft Environmental Impact Report For The Kern County Solar Ranch Project (Jan. 25, 2013), *available at* http://www.co.kern.ca.us/planning/pdfs/notices/kern_solar_nop.pdf (last visited May 30, 2013) (describing a 1,000 MW solar PV project).
61. *See* Julie Cart, *Small-Scale Solar's Big Potential Goes Untapped*, L.A. Times (Dec. 29, 2012), http://articles.latimes.com/2012/dec/29/local/la-me-solar-future-20121229.
62. Energy + Environmental Economics, Technical Potential for Local Distribution Photovoltaics in California 6 (Mar. 2012), *available at* http://www.cpuc.ca.gov/NR/rdonlyres/8A822C08-A56C-4674-A5D2-099E48B41160/0/LDPVPotentialReportMarch2012.pdf.
63. *Distributed Solar PV to Increase 18% p.a. to 2015, Growing Pains Notwithstanding*, CleanTechnica (Apr. 13, 2012), http://cleantechnica.com/2012/04/13/distributed-solar-pv-to-increase-18-p-a-to-2015-growing-pains-notwithstanding/.
64. Peak load is the highest electrical demand within a particular period of time; daily peak usually occurs in late afternoon and early evening on weekdays and annual peak demand occurs on hot summer days. *Id.*
65. *Id.*
66. Cal. Energy Comm'n, 2011 Integrated Envtl. Pol'y Rep. 11 (2011) [hereinafter 2011 IEPR], *available at* http://www.energy.ca.gov/2011publications/CEC-100-2011-001/CEC-100-2011-001-CMF.pdf..
67. Julie Cart, *Small-Scale Solar's Big Potential Goes Untapped*, L.A. Times (Dec. 29, 2012), http://articles.latimes.com/2012/dec/29/local/la-me-solar-future-20121229.
68. *Net Energy Metering in California*, Go Solar Cal., http://www.gosolarcalifornia.ca.gov/solar_basics/net_metering.php (last visited May 30, 2013);
    > "In California, the contest has been building since last May, when the CPUC revised the formula utilities use to limit the number of customers eligible for net metering. That ceiling would be hit when the amount of power generated by houses and businesses with solar hits 5 percent of 'aggregated customer peak demand.' The CPUC changed the definition of 'peak demand' in a way that's expected to allow potentially twice as much rooftop solar to qualify for net metering. (May 25, 2012). Utilities have been contesting that ruling." Anne C. Mulkern, *Utilities Challenge Net Metering as Solar Power Expands in California*, E & E Publishing (Apr. 12, 2013), http://www.eenews.net/stories/1059978731/print.
69. Go Solar Cal., *supra* note 68.
70. David Roberts, *Utilities vs. Rooftop Solar: What the fight is About*, Grist (May 15, 2013), http://grist.org/climate-energy/utilities-vs-rooftop-solar-what-the-fight-is-about/.
71. Susan Kraemer, *California Utilities Balk as Home Solar Producers Near 5 Percent Limit*, CleanTechnica (May 2, 2012), http://cleantechnica.com/2012/05/02/california-utilities-balk-as-home-solar-producers-near-5-percent-limit/#WfsmQwekG8XL82bG.99.
72. Interstate Renewable Energy Council, Blueprint for the Development of Distributed Generation in California 2 (2013), *available at* http://www.irecusa.org/wp-content/uploads/DGBlueprint_2.21.13_final.pdf.
73. *Renewable Auction Mechanism*, Cal. Pub. Utils. Comm'n, http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/Renewable+Auction+Mechanism.htm (last visited June 6, 2013); DSIRE (Database of State Incentives for Renewables & Efficiency), *Renewable Auction Mechanism (RAM)*, DSIRE, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA244F (last visited June 6, 2013); *Renewable Auction Mechanism*, Cal. Pub. Utils. Comm'n, http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/Renewable+Auction+Mechanism.htm (last visited June 6, 2013). CPUC final decision here: http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/128432.htm.
74. *Renewable Auction Mechanism*, Cal. Pub. Utils. Comm'n, http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/Renewable+Auction+Mechanism.htm (last visited June 6, 2013).

One of the major obstacles to the expansion of DG is utility opposition to competition from DG sources.[75] Investor-owned utilities serve approximately 60% of U.S. customers.[76] They are regulated monopolies with geographically designated customer bases and legally guaranteed profits.[77] Retail rates at which electricity is sold to consumers are approved by state public utility commissions.[78] Utilities are concerned about the implications of rooftop solar facilities because of impacts to the grid due to the intermittent nature of solar PV power and impacts to their profits.[79] Utilities argue that net metering will require rate increases for non-solar-rooftop customers and that the solar customers not only still make use of the grid, but also make managing it more complicated by requiring utilities to deal with many distributed, intermittent electricity generators.[80] As a result of utilities' concerns about economic and technical issues, the total amount of electricity allowed for net metering was originally limited to 5% of peak customer demand in California.[81] That limit has subsequently been raised and is scheduled to be raised again in 2015, but the future of these limits remains uncertain and could shift with the political winds.[82]

Permitting requirements can be an obstacle to expansion of DG in California. For larger DG facilities that require conditional use permits from counties, permits from regulatory agencies, and California Environmental Quality Act review, lack of coordinated approval processes may be a major hurdle for project developers.[83] As early as 2000, the California Energy Commission published recommendations for streamlining permitting and environmental review for distributed generation projects.[84] Subsequently, legislatures and local, state, and federal agencies have made many attempts to streamline permitting for DG renewables, including the programs and incentives described below.

75. Lauren Sommer, *Could Rooftop Solar Kill Utilities? California Grapples with Solar's Success*, KQED Science (May 17, 2013), http://blogs.kqed.org/science/audio/could-rooftop-solar-kill-utilities-california-grapples-with-solars-success-2/.
76. California's three large IOUs are Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas and Electric Company. *California Renewable Portfolio Standard*, Cal. Pub. Utils. Comm'n, http://www.cpuc.ca.gov/PUC/energy/Renewables/ (last visited May 30, 2013).
77. Roberts, *supra* note 70, at 2.
78. *Id.*
79. David Roberts, *Solar Panels Could Destroy U.S. Utilities, according to U.S. Utilities,* Grist (Apr. 10, 2013), http://grist.org/climate-energy/solar-panels-could-destroy-u-s-utilities-according-to-u-s-utilities/.
80. Roberts, *supra* note 70, at 2; David R. Baker, *Solar Customers' 'Net Metering' Challenged*, S.F. Chron. (March 30, 2013), http://www.sfchronicle.com/business/article/Solar-customers-net-metering-challenged-4396058.php.
81. David R. Baker, *Solar Customers' 'Net Metering' Challenged,* S.F. Chron. (Mar. 30, 2013), http://www.sfchronicle.com/business/article/Solar-customers-net-metering-challenged-4396058.php; *see also California: Incentives/Policies for Renewables & Efficiency*, DSIRE http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA02R (last visited June 6, 2013) (describing the net metering policies and rules).
82. Asemb. Bill 327, 2013–2014 Reg. Sess., Ch. 611 (Cal. 2013), *available at* https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB327
83. *See* Cal. Energy Comm'n, Renewable Power In California 8–9 (2011), *available at* http://www.energy.ca.gov/2011publications/CEC-150-2011-002/CEC-150-2011-002.pdf.
84. *See* Cal. Energy Comm'n, Distributed Generation: CEQA Review and Permit Streamlining (2000), *available at* http://www.abcsolar.com/pdf/permitstreamlining.pdf.

II. Siting on Disturbed Lands

A. *Disturbed Lands Policy*

Pressure to develop renewable energy in California and elsewhere has energy companies and public officials looking for viable sites. Current projects in the California desert threaten to convert thousands of acres of natural habitat to graded land and industrial facilities and trigger widespread disruption of desert ecosystems.[85] Opposition to these projects is leading developers to explore the possibility of using sites that are already developed and disturbed.[86] Indeed, the Environmental Protection Agency ("EPA") has created its RE-Powering America program specifically to encourage renewable energy development on brownfields[87] and other developed and impaired areas.[88] In addition, the BLM has declared support for using disturbed lands and has created a program in Arizona targeting former agricultural areas for solar development.[89] Other local, state, and federal agencies have also expressed support for greener siting of renewable energy.[90]

B. *Types of Disturbed Land*

Since BLM announced its intention to encourage the use of disturbed lands, developers have been trying to figure out which lands qualify as disturbed. There are potential issues with defining disturbed lands and different interest groups are likely to have widely variable definitions. For example, some worry that developers will label anything with "a few tire tracks and some trash" as disturbed.[91] Such definitions could lead to valuable habitat and popular recreation areas being labeled as disturbed. Wildlife groups may seek to define active agricultural lands, including prime farmland as disturbed, while farming groups strongly oppose using prime farmland for solar development.[92] For the purposes of this analysis, we examine three major types of disturbed land:

85. Todd Woody, *It's Green Against Green in Mojave Desert Solar Battle*, Yale Env't 360 (Feb. 1, 2010), http://e360.yale.edu/feature/its_green_against_green_in_majove_desert_solar_battle/2236/.
86. *See* Tom Kenworthy, *Brown to Green: Renewable Energy on Disturbed Lands*, Ctr. for Am. Progress (Dec. 9, 2010), http://www.americanprogress.org/issues/green/news/2010/12/09/8826/brown-to-green/.
87. Brownfields are property where the expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substances, pollutant, or contaminant. *Brownfields and Land Revitalization*, U.S. Envtl. Prot. Agency, http://www.epa.gov/brownfields/ (last visited February 19, 2014).
88. *Siting Renewable Energy on Potentially Contaminated Lands, Landfills, and Mine Sites*, U.S. Envtl. Prot. Agency, http://www.epa.gov/oswercpa/ (last visited May 30, 2013).
89. *Secretary Salazar Finalizes Plan to Establish Renewable Energy Zone on Public Lands in Arizona*, U.S. Dep't of the Interior, http://www.doi.gov/news/pressreleases/secretary-salazar-finalizes-plan-to-establish-renewable-energy-zone-on-public-lands-in-arizona.cfm (last visited Nov. 4, 2013).
90. *See, e.g.*, *New Energy for America*, Bureau of Land Mgmt., http://www.blm.gov/wo/st/en/prog/energy/renewable_energy.html (last visited Nov. 4, 2013).
91. *Defining Disturbed Land: Siting Renewable Energy Responsibly*, Basin and Range Watch (Apr. 30, 2011), http://www.basinandrangewatch.org/DisturbedLand.html.
92. *See "Converting crops to solar panels" in California's Disappearing Farmland*, CalWatchDog (Dec. 3, 2013), http://calwatchdog.com/2013/12/03/californias-disappearing-farmland/.

(1) contaminated sites, (2) rooftops and parking lots, and (3) agricultural land.

1. Contaminated Sites

EPA is promoting the reuse of potentially contaminated properties including landfills, mining sites, and brownfields.[93] EPA has screened more than 11,000 potential sites and has put together a map showing the potential feasibility of renewable energy technologies at each site.[94]

a. Landfill Basics

Before the 1960s, landfills were open pits used to dispose of all types of waste.[95] There were few engineering design or siting criteria and little regulatory control.[96] In this context, there were a host of environmental concerns regarding leaching of toxic materials.[97] Under the Solid Waste Disposal Act, EPA established standards for hazardous waste disposal and minimum standards for non-hazardous waste disposal facilities.[98] A Municipal Solid Waste landfill is a discrete area of land or excavation that receives household waste.[99] Municipal Solid Waste landfills are subject to federal regulation under the Resource Conservation and Recovery Act.[100] Once a landfill is full, it goes through a closure process that must adhere to federal and state laws.[101] Generally, landfill operators must install a final cover on the landfill, ensure that there will be no leakage, and make plans for gases that will be released while the contained waste decomposes.[102] Owners and operators are responsible for the landfill for 30 years after closure of the facility.[103] Use of the land afterward may not "disturb the integrity of the waste containment systems or the functioning of the monitoring systems."[104]

Former landfills are often not well suited to many other uses, as few desire to build homes or businesses on former landfill sites because of clean-up costs, stigma, or liability concerns. These issues also generally mean that the land is cheaper than other potential solar sites.[105] Landfill sites are also likely to be relatively flat, facilitating placement of PV arrays.[106] Thus, solar facilities can provide an economically viable reuse for sites that no one else wants. Landfills are already connected to road networks and other infrastructure and are likely to be relatively near populated areas where there is demand for electricity, reducing costs associated with transporting the electricity over long distances.[107] There also tend to be fewer zoning complications on these sites.[108]

There have already been successful solar projects on capped landfills, like on the closed municipal Box Canyon Landfill at Camp Pendleton in California.[109] The 1.48 MW project there was completed in 2011 and is expected to supply 10% of the military base's energy needs.[110] However, some parties, including Pentagon auditors, question the economic feasibility of the landfill project.[111] Specifically, the auditors noted that the cost of the project did not justify the small amount of energy produced. To avoid similar economic concerns, EPA and the National Renewable Energy Laboratories recommend a feasibility assessment and an investment-grade technology and economic feasibility study for each proposed site.[112] The most important component of this assessment is determining how much sunlight the site receives and thinking about the project as an integrated system, not as a landfill and a solar facility separately.[113]

There are some obstacles to using capped landfills for solar arrays. Any solar projects on landfills must take into account the owner's obligations during the post-closure period and must ensure that the projects will not disturb the integrity of the landfill's encapsulated wastes.[114] This requires close coordination with various authorities responsible for ensuring that post-closure requirements are met.[115] The chief concern with using capped landfills for a solar facility is potential liability. The Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA" or "Superfund")

93. *RE-Powering America's Land*, U.S. Envtl. Prot. Agency, http://www.epa.gov/oswercpa/ (last visited May 30, 2013).
94. U.S. Envtl. Prot. Agency & Nat'l Renewable Energy Lab., Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills 1 (2013) [hereinafter MSW Landfills Report], *available at* http://www.epa.gov/oswercpa/docs/best_practices_siting_solar_photovoltaic_final.pdf.
95. Jon Roberts, *Garbage: The Black Sheep of the Family: A Brief History of Waste Regulation In The United States And Oklahoma*, Okla. Dep't of Envtl. Quality (Nov. 3, 2013, 8:11 PM), http://www.deq.state.ok.us/lpdnew/wastehistory/wastehistory.htm; *see also* S.C. Office of Solid Waste Reduction and Recycling, DHEC's Office of Solid Waste Reduction And Recycling FYI: Landfills (Nov. 3, 2013, 9:46 PM), *available at* http://www.scdhec.gov/environment/lwm/recycle/pubs/landfill_101.pdf.
96. Roberts, *supra* note 95.
97. *Id.*
98. The Solid Waste Disposal Act, 42 U.S.C. 6901–6992k (2002); *see also Solid Waste Management on Tribal Lands*, U.S. Envtl. Prot. Agency (Nov. 3, 2013, 9:13 PM), http://www.epa.gov/region9/waste/tribal/reg.html; Nat'l Solid Wastes Mgmt. Assoc., Modern Landfills: A Far Cry From The Past 3 (Nov. 3, 2013, 7:23 PM), *available at* http://www.environmentalistseveryday.org/docs/research-bulletin/Research-Bulletin-Modern-Landfill.pdf.
99. EPA Protection of Environment, 40 C.F.R. § 258.2 (2011).
100. § 258.1.
101. §§ 258.16, 258.60, 258.61; *see also*, U.S. Envtl. Prot. Agency, The Quest for Less: Landfills, *available at* http://www.epa.gov/osw/education/quest/pdfs/unit2/chap4/u2-4_landfills.pdf (last visited May 30, 2013).
102. The Quest for Less: Landfills, *supra* note 101.
103. *Closure and Post-Closure Care Requirements for Municipal Solid Waste Landfills (MSWLFs)*, U.S. Envtl. Prot. Agency,http://www.epa.gov/osw/nonhaz/municipal/landfill/financial/mswclose.htm (last visited May 30, 2013).
104. MSW Landfills Report, *supra* note 94, at 8.
105. *Id.* at 1.
106. *Id.* at 21.
107. *Id.*
108. *Id.*
109. Energy and Environmental Readiness Division, Chief of Naval Operations, *Two Award Programs Recognize Navy & Marine Corps Energy & Water Saving Achievements*, Currents, 50–51 (Winter2013), *available at* http://greenfleet.dodlive.mil/files/2013/01/Currents_Winter_2013_SMALL.pdf.
110. *Id.* at 50; Andrew Ferri, *Massive Clean Energy System Unveiled at Camp Pendleton*, San Clemente Patch (Feb. 4, 2011, 3:37 PM), http://sanclemente.patch.com/groups/politics-and-elections/p/massive-clean-energy-system-unveiled-at-camp-pendleton.
111. Gretel C. Kovach, *Camp Pendleton Goes Solar*, U-T San Diego: Military (Apr. 18, 2013, 5:47 PM), http://www.utsandiego.com/news/2013/Apr/18/camp-pendleton-solar/; Matt Potter, *Navy Loses Shirt on Solar Project at Camp Pendleton*, San Diego Reader (Dec. 21, 2011), http://www.sandiegoreader.com/news/2011/dec/21/radar1-camp-pendleton-solar-navy/.
112. MSW Landfills Report, *supra* note 94, at 17.
113. *Id.* at 18, 20.
114. *Id.* at 7.
115. *Closure and Post-Closure Care Requirements for Municipal Solid Waste Landfills (MSWLFs)*, U.S. Envtl. Prot. Agency, http://www.epa.gov/osw/nonhaz/municipal/landfill/financial/mswclose.htm (last visited May 30, 2013).

authorizes the federal government to assess and clean-up properties contaminated with hazardous substances.[116] Investors are likely to shy away from such land because of contamination and liability concerns.[117] CERCLA's philosophy is that the polluter pays, meaning that the parties responsible for the contamination are the ones who should be cleaning it up.[118] Usually this includes owners, operators, arrangers, and transporters.[119] The picture becomes more complicated with changing landownership. Although it is hard to envision new owners as responsible for any contamination, landowners always have some responsibility regarding their land as part of the risk of investing in land.[120] Solar power project operators can avoid some of these problems by leasing the land instead of purchasing it.[121] Additionally, there are special programs to protect parties who acquire contaminated property but did not cause or contribute to the contamination and solar developers may be able to take advantage of them.[122]

Solar developers also need to be careful about disrupting the surface or penetrating too deeply into the landfill cap because they must not cause any movement of waste.[123] If waste is moved on their watch, a solar developer could qualify as an operator, arranger, or transporter depending on the exact nature of the problem.[124] To mitigate risks associated with this issue, PV developers have developed products that largely remain on the surface and are unlikely to cause any release or movement of hazardous waste.[125] Special construction considerations for building on landfills include avoiding compaction or settlement that may damage the landfill-cap components below the surface level and working with the existing landfill monitoring and piping equipment.[126] Liability issues generally only arise when the federal government designates a site as needing clean-up, which does not occur frequently.[127]

b. *Abandoned Mine Lands*

Another potential type of disturbed land available for solar energy projects are abandoned mine lands. These lands consist of former mines and associated lands where extraction or processing of ores and minerals has occurred in the past.[128] The number of available mining lands and their total acreage remains uncertain. The U.S. General Accounting Office estimates that there is somewhere between 80,000 and 250,000 abandoned mine lands across the country.[129] Mines are not simply underground facilities with miners trudging deep below the earth. Many mines are surface mines, including open pit mines and mines using mountain top removal techniques.[130] These sites are usually considered eyesores with significant negative environmental consequences.[131] There are often large piles of tailing or mine waste contributing to surface and groundwater contamination.[132]

Although mines exist throughout the United States, there are many large mines in the southwest, where solar resources are most valued.[133] Additionally, former mines and associated lands are often large, with sufficient acreage to house even utility-scale solar arrays.[134] Previous mining operations are also likely to provide preexisting roads and other helpful infrastructure.

Because of safety and environmental concerns, most abandoned mine sites have not been reused.[135] Safety concerns include weakened structural integrity inside the mine openings, steep vertical shafts, falling hazards, abandoned blasting caps or dynamite, pockets of oxygen-depleted air or lethal gas, and chemical and environmental hazards.[136] Even more so than landfills, there are nearly no alternative land uses for these sites.[137] Additionally, areas covered in waste rock and tailings are not likely to provide valuable wildlife habitat.[138] In fact, installing renewable facilities not only offers a way to

116. U.S. Envtl. Prot. Agency, RE-Powering America's Land: Siting Renewable Energy on Potentially Contaminated Properties: Liability Considerations 1 (Dec. 2012), *available at* http://www.epa.gov/enforcement/cleanup/documents/superfund/re-liab-2012-fs.pdf.
117. EPA has released guidance documents and articulated policies addressing liability and contamination issues specifically to encourage the productive use of Superfund sites sitting idle. *Id.*
118. *Id.*
119. *Id.*
120. Even if a landowner did not cause or contribute to contamination, to remain protected from CERCLA liability they must meet and maintain compliance with certain statutory requirements (*e.g.*, taking reasonable steps to handle contamination at the site after acquisition of the property). *Id.* at 2.
121. First, leasing a contaminated property does not automatically trigger CERCLA liability for the tenant, meaning that some tenants will avoid liability altogether. Second, even if a tenant may incur CERCLA liability, EPA has explicitly stated its intent to provide certain tenants with the protections afforded "bona fide prospective purchasers" and therefore still allow them to avoid CERCLA liability provided they follow certain statutory obligations to prevent further harm and deal with contaminated properties properly. *Id.*
122. *Id.*
123. Nat'l Renewable Energy Lab., Best Practices for Siting Solar Photovoltiaics on Municipal Solid Waste Landfills 51 (2012).
124. *See* 42 U.S.C. § 9607 (a)(c) (2006).
125. *See* U.S. Envtl. Prot. Agency, Clean Energy: Land Use (2013), www.epa.gov/cleanenergy/energy-and-you/affect/land-resource.html.
126. Nat'l Renewable Energy Lab., Best Practices for Siting Solar Photovoltiaics on Municipal Solid Waste Landfills 50–51 (2013).
127. Dean M. Gloster, Gary M. Kaplan & Matthew J. Lewis, *Creative Use of Receiverships to Solve Environmental, Construction and Other Problems in Distressed Projects*, Farella Braun + Matel (Jan. 21, 2011), http://www.fbm.com/media/uniEntity.aspx?xpST=PubDetail&pub=5403. (Using receiverships can avoid some environmental liability. California Civil Procedure Code § 564(c) authorizes a receiver to inspect the property to assess the existence and magnitude of hazardous substance release. Receivers get quasi-judicial immunity as officers of the Court so he is not subject to liability as an owner or operator. This could help with sales of distress properties.).
128. U.S. Envtl. Prot. Agency, Shining Light on a Bright Opportunity: Developing Solar Energy on Abandoned Mine Lands 1 (Dec. 2011), *available at* http://www.epa.gov/aml/revital/amlsolarfact.pdf.
129. U.S. Envtl. Prot. Agency, Shining Light on a Bright Opportunity: Developing Solar Energy on Abandoned Mine Lands 1 (Dec. 2011), *available at* http://www.epa.gov/aml/revital/amlsolarfact.pdf
130. *Open Pit Mining*, ThinkQuest (Nov. 3, 2013), http://library.thinkquest.org/05aug/00461/openprint.htm; *Mid-Atlantic Mountaintop Mining*, U.S. Envtl. Prot. Agency (2013), http://www.epa.gov/region03/mtntop/index.htm#what.
131. *Open Pit Mines Are Ugly?*, Mining Focus (Nov. 3, 2013), http://miningfocus.org/open-pit-mines-are-ugly.
132. *Water Resources Engineering: Mine Tailings Management*, HydroQual (Nov. 3, 2013). http://www.hydroqual.com/wr_tailings_mgmt.html.
133. U.S. Envtl. Prot. Agnecy, *supra* note 129, at 1.
134. *Id.*
135. *Id.*
136. Cal. Dep't of Conservation, The Abandoned Mine Lands Unit (AMLU) Frequently Asked Questions (FAQs) (March 2009), *available at* http://www.consrv.ca.gov/omr/abandoned_mine_lands/Documents/AMLU%20FAQs_2012-01.pdf.
137. *Id.*
138. *Id.* at 9.

reuse the land, but may also facilitate site cleanup by providing energy for remediation efforts.[139]

Former mining sites are already providing space for solar power facilities. Chevron Technology Ventures converted two former mines and their tailing ponds into solar energy facilities in Questa, New Mexico.[140] In 2010, Chevron built a 1 MW PV facility on 20 acres at the Chevron Questa Mine Superfund site and it now sells its energy to a local energy cooperative.[141] Future sites are planned throughout the American West including atop a former uranium mill tailings dump in Colorado[142] and a potential utility-scale project on tribal land in Arizona.[143]

c. *Brownfields*

In what it calls the Brightfields Initiative, EPA is also encouraging the use of brownfields for solar energy facilities.[144] Federal law defines brownfield sites as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."[145] Brownfields dot the country and can be found in urban, suburban, and rural communities. Many brownfields are former industrial sites, but they can also be locations that previously housed more innocuous businesses like drycleaners, paint shops, and gas stations.[146] Urban brownfields are often eyesores that hamper redevelopment.

The analysis for the suitability for brownfields to support solar power facilities echoes the benefits and concerns discussed above for landfills. These are stigmatized properties that may involve disrupting contaminated land, creating liability concerns.[147] Brownfields are attractive locations for solar facilities because few people want to live or work on them. Such sites are likely to be close to power grids and other infrastructure. Because solar panels do not need to penetrate deeply into the soil, they may be well-suited for construction on brownfields. Solar developers work with brownfield development companies to manage liability concerns.[148] For example, a solar company called Brightfields Development LLC specializes in using brownfields as solar sites, touting the benefit of these available cheap sites over previously undeveloped locations.[149]

2. Rooftops and Parking Lots

Areas such as rooftops and parking lots have already been paved and developed, and are often described as the greenest locations for solar energy development.[150] Since 2000, rooftop solar projects have dramatically expanded in California.[151] As of spring 2013, "California has broken another record in its continued expansion of clean energy generation, having reached 150,000 rooftop solar installations."[152] Although rooftop solar facilities exist in many different sizes, the vast majority are facilities that produce less than 10 kW.[153] Over 95% of solar installations that are part of the California Solar Initiative are located on residential, 2.6% are on commercial facilities and 2% are on government or non-profit facilities.[154]

California has consistently encouraged rooftop solar projects through various policies and laws. In June 2010, Governor Brown announced a Clean Energy Jobs Plan that included development of 12,000 MW of DG capacity.[155] The plan envisioned solar arrays of up to 2 MW installed on roofs of warehouses, parking lot structures, schools and other commercial buildings as well as solar projects of up to 20 MW on public and private property such as along the California highway systems.[156] Senate Bill No. 226, a law which was passed in 2011, exempts rooftop solar facilities from state environmental review.[157] Multiple county and city programs provide guidance to homeowners, companies, schools, and other building owners to help establish community solar programs and other means of financing renewable energy systems.[158]

139. *Id.* at 1.
140. U.S. Envtl. Prot. Agency, Celebrating Success: Molycorp, Inc. Questa, New Mexico (Apr. 2011), *available at* http://epa.gov/superfund/programs/recycle/pdf/molycorp-success.pdf (last visited June 6, 2013).
141. U.S. Envtl. Prot. Agency, Renewable Energy Projects at Mine Sites: Highlighting Progress Across the Regions (March 2012), *available at* http://www.epa.gov/aml/revital/amlrenew0312.pdf.
142. U.S. Envtl. Prot. Agency, *supra* note 129, at 7.
143. U.S. Envtl. Prot. Agency, *supra* note 141.
144. *Energy Department Announces National Initiative to Redevelop Brownfields with Renewable Energy*, U.S. Envtl. Prot. Agency, http://www.epa.gov/swerosps/bf/partners/brightfd.htm (last visited May 29, 2013).
145. Small Business Liability Relief and Brownfield Revitalization Act Pub. L. No. 107-118, § 39, 115 Stat. 2356 (2002) (amending CERCLE).
146. *What Is a "Brownfield"*, Brownfield Action, http://brownfieldaction.org/brownfieldaction/brownfield_basics
147. U.S. Envtl. Prot. Agency, *supra* note 116, at 1.
148. *Cost Advantages of Solar on Brownfields*, BrightFields Dev. LLC, http://www.solarbrownfields.com/solar_brownfields_cost_advantages/ (last visited May 30, 2013).
149. *Id.*
150. Christof Demont-Heinrich, *Five Reasons Rooftop & Parking Lot Solar Rock*, SolarChargedDriving.Com (June 23, 2011, 9:35pm), http://www.solarchargeddriving.com/editors-blog/on-going-solar/743-five-reasons-rooftop-a-parking-lot-solar-rock.html.
151. Mari Hernandez, *Solar Power to the People: The Rise of Rooftop Solar Among the Middle Class*, Center for Am. Progress (Oct. 21, 2013), http://www.americanprogress.org/issues/green/report/2013/10/21/76013/solar-power-to-the-people-the-rise-of-rooftop-solar-among-the-middle-class/.
152. Barbara Vergetis Lundin, *CA rooftop solar success comes with warning*, Fierce Energy (May 20, 2013), http://www.fierceenergy.com/story/ca-rooftop-solar-success-comes-warning/2013-05-20. *See also Welcome to California Solar Statistics*, Go Solar Cal., http://www.californiasolarstatistics.ca.gov/ (last visited May 30, 2013).
153. *See* Solar Statistics: Cost By System Size, Go Solar Cal. (Oct. 30, 2013), http://www.californiasolarstatistics.ca.gov/reports/cost_vs_system_size/ (last visited Nov. 1, 2013).
154. *Solar Statistics: Applications by Sector,* Go Solar Cal. (May 22, 2013), http://www.californiasolarstatistics.ca.gov/reports/agency_detail/ (last visited May 29, 2013).
155. Jerry Brown, Clean Energy Jobs Plan (2010), *available at* http://digital.library.ucla.edu/websites/2010_995_002/sites/default/files/6-15%20Clean_Energy%20Plan.pdf. Localized energy is defined by Governor Brown's plan as "onsite or small energy systems located close to where energy is consumed that can be constructed quickly (without new transmission lines) and typically without any environmental impact." *Id.*
156. *Id.*
157. Cal. Nat. Res. Agency, Streamlined CEQA Review for Infill Projects (SB 226), http://ceres.ca.gov/ceqa/guidelines-sb226/ (last visited May 30, 2013).
158. The Governor's Office of Planning and Research provides a list of renewable energy resources for local capacity including programs for installing solar systems on buildings and parking lots and other renewable energy system financ-

The expansion of rooftop DG capacity in California has been incentivized by significant public funding. The California Solar Initiative overseen by CPUC is intended to provide over $2 billion in subsidies between 2007 and 2016 with the goal of installing nearly 2,000 MW of new solar power generation.[159] Under the Initiative, the California Energy Commission also has a New Solar Homes Partnership that provides funding for construction of new, energy efficient solar homes.[160] In 2011, California installed 1,061 MW of customer-generated solar facilities.[161] Of the $2 billion in subsidies originally available, nearly all of it has been used.[162] Although future subsidies could incentivize additional rooftop solar, some proponents say that these incentives are no longer necessary and that rooftop solar will continue to expand quickly without the subsidies.[163]

In addition to subsidies, solar panel leasing programs have also contributed to the rapid growth of rooftop solar. Solar leasing allows homeowners to sign a long-term lease with a company that installs solar panels on the homeowners' residences and pay the company for the electricity generated. At the end of the lease homeowners may renew the contract, purchase the system, or have the equipment removed. Solar leasing accounts for 70% of residential solar installations in California.[164]

California's principle energy agencies, the California Energy Commission and CPUC, have made renewable energy and DG development priorities.[165] In addition to state policies promoting the construction of rooftop solar facilities, each investor-owned utility has a rooftop solar program that has led to the installation of larger, commercial rooftop ventures. In 2008, Southern California Edison launched the first utility-owned generation installation plan for 250 MW to be built on 65,000,000 square feet of unused Southern California commercial rooftops, which has been heralded as a "revolutionary approach."[166] Since that time, Southern California Edison has requested that CPUC allow it to reduce the utility-owned portion of the program twice from 250 to 91 MW, stating that the rooftop market has changed since 2008 and it can purchase renewable energy from PV technology at a lower cost through other programs, such as the Renewable Auction Mechanism.[167]

Parking lots are also emerging as key sites for solar development, so some solar firms are specializing in solar parking installations.[168] There are many benefits to siting solar on rooftops and parking lots and technical breakthroughs and diverse funding strategies have led to extremely fast expansion of built environment solar. However, rooftop solar installations have limitations too. Rooftop solar is generally dependent on the actions of many different consumers installing very small systems, which means that dramatically scaling up the amount of rooftop solar generated can be complicated. In addition, the cost of the power generated may be much higher per kW hour than larger facilities that take advantage of many economies of scale.[169]

3. Agricultural Land

Agricultural land is one of the most attractive disturbed land types for solar energy development. Agricultural land is close to transportation networks and energy users.[170] Although agricultural land is often categorized as disturbed,[171] there are a number of drawbacks and challenges to using farmland and grazing land for renewable energy projects. One major challenge is that farmers and farmland advocates object to converting land from agricultural use and bristle at any characterization of productive farmland as disturbed.[172] Although agricultural land is not typically considered wildlife habitat, agricultural land is used by some special-status species that are protected under state or federal law.[173] In California,

ing. Local examples include the City of San Jose SunShares Model, California School Boards Association Solar Schools Program, or the Santa Monica Open Neighborhoods Solar Program. The Governor's Office of Planning & Research, *Renewable Energy in California*, CA.Gov, http://opr.ca.gov/s_renewableenergy.php#D (last visited May 29, 2013).

159. *About the California Solar Initiative (CSI),* Go Solar Cal., http://www.gosolarcalifornia.org/about/csi.php (last visited May 30, 2013).

160. *Id.*

161. Cal. Pub. Utils. Comm'n, California Solar Initiative Annual Program Assessment (June 2012), *available at* http://www.cpuc.ca.gov/NR/rdonlyres/0C43123F-5924-4DBE-9AD2- 8F07710E3850/0/CASolarInitiativeCSIAnnualProgAssessmtJune2012FINAL.pdf.

162. *Id.* at 34.

163. Barry Cinnamon, *Solar Incentives Are Dead, Long Live Solar*, GreenTech Media (May 8, 2013), http://www.greentechmedia.com/articles/read/Solar-Incentives-are-Dead-Long-Live-Solar.

164. Ucilia Wang, *Solar Leases Will Drive Solar Home Growth to $5.7B*, Forbes (Feb. 11, 2013), http://www.forbes.com/sites/uciliawang/2013/02/11/solar-leases-will-propel-solar-home-growth-to-5-7b/.

165. California's Clean Energy Future: An Overview on Meeting California's Energy and Environmental Goals in the Electric Power Sector in 2020 and Beyond, *available at* http://www.cacleanenergyfuture.org/documents/CACleanEnergyFutureOverview.pdf (last visited May 29, 2013). California's loading order policy was first adopted by the energy agencies (*i.e.*, the Energy Commission, CPUC, and the California Consumer Power and Conservation Financing Authority) in the *2003 Energy Action Plan* and reiterated in the *2005 Energy Action Plan. Id.*

166. *Rooftop Solar Program Frequently Asked Questions*, S. Cal. Edison, https://www.sce.com/wps/portal/home/business/generating-your-own-power/solar-rooftop-program/faq/ (last visited June 2, 2013).

167. S. Cal. Edison Co., Southern California Edison Company's (U 338-E) Petition for Modification of Decision No. 12-02-035 (July 27, 2012), *available at* http://docs.cpuc.ca.gov/efile/PM/171666.pdf (last visited May 29, 2013).

168. Jeffrey Spivak, *Solar Parking Lots Arriving in Greater Numbers,* UrbanLands (Oct. 19, 2011), http://urbanland.uli.org/Articles/2011/October/SpivakParking (last visited May 29, 2013).

169. CPUC report says that relying heavily on rooftop solar would double the cost of meeting RPS standards. *33% Renewables Portfolio Standard Implementation Analysis Preliminary Results*, Cal. Pub. Util. Comm'n, *available at* http://www.cpuc.ca.gov/NR/rdonlyres/1865C207-FEB5-43CF-99EB-A212B78467F6/0/33PercentRPSImplementationAnalysisInterimReport.pdf.

170. Press Release, Secretary Salazar Finalizes Plan to Establish Renewable Energy Zone on Public Lands in Arizona (Jan. 18, 2013) (describing former agricultural areas as previously disturbed sites), *available at* http://www.doi.gov/news/pressreleases/secretary-salazar-finalizes-plan-to-establish-renewable-energy-zone-on-public-lands-in-arizona.cfm.

171. *Id.*

172. David Castellon, *Tulare County Changes Solar Farm Policy*, Visalia Times-Delta (Feb. 27, 2013), http://sequoiariverlands.wordpress.com/2013/02/28/tulare-county-changes-solar-farm-policy/.

173. Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service, Giant Garter Snake (*Thammophis gigas)* 5-Year Review: Summary and Evaluation 3 (Sept. 2006), *available at a*http://www.fws.gov/cno/es/giant%20garter%20snake%205-year%20review.FINAL.pdf; Kathlyn Jean McVey, Trophic Ecology Of Burrowing Owls In Natural And Agricultural Habitats And An Analysis Of Predator Communities Using Stable Isotopes Of Carbon And Nitrogen 28, 70 (May 2011), *available at* http://scholarworks.boisestate.edu/cgi/viewcontent.cgi?article=1200&context=td.

these include Swainson's hawk, the burrowing owl, and the giant garter snake.[174] In many areas, including the California desert, farmland that is converted to grazing land or left fallow may be recolonized by native plants and wildlife.[175] Rare Mojave ground squirrels, desert tortoises, and giant kangaroo rats are found in areas previously used for agriculture.[176]

Many farmers are reluctant to see farmland converted to other uses. The largest statewide farmland conservation program in California was created by the Land Conservation Act of 1965, known as the Williamson Act.[177] The Williamson Act allows landowners in nearly all California counties to enroll in 10-year rolling term contracts that provide reduced property tax assessments in exchange for not allowing development of their land, which precludes the development of solar facilities on such land.[178] The California Farm Bureau Federation is worried that such farmland protection laws could "be sacrificed in a rush to expedite the development of large-scale renewable energy projects."[179]

In 2011, California passed Senate Bill No. 618 ("SB 618") to encourage the construction solar projects on impaired farmland enrolled in the Williamson Act.[180] SB 618 created solar use easements, which allow landowners to develop solar projects on Williamson Act-enrolled farmland under certain conditions including a demonstration of reduced agricultural productivity.[181] Solar use easement terms are 10–20 years, and landowners must pay 6.25% of the fair market value of the enrolled property to move from a Williamson Act contract to a solar use easement.[182] California's solar use easement law attempts to balance the goals of agricultural preservation and solar energy generation.[183] However, since it was enacted, no solar use easements have actually been created, although two may be in progress.[184]

Focusing projects on truly marginal agricultural lands has the potential to benefit everyone involved. Not all agricultural land is created equal. For instance, some properties in the San Joaquin valley that are designated as agricultural land are struggling with salt contamination due to over-irrigation.[185] The California Farm Bureau Federation urges a focus on "marginally productive or physically impaired land" while preserving prime agricultural lands.[186] In areas where farming is becoming increasingly difficult, or at least less cost competitive with other land uses, the farmers may be happy to lease or sell their land to a solar developer. In the wake of climate change, more agricultural areas in California may face droughts and poor growing conditions.[187]

Two specific impaired agricultural areas are frequently mentioned as good sites for solar development are Owens Lake and Westlands.[188] Owens Lake has essentially become a dust bowl because its water supply has been siphoned out of the area to feed the water needs of the Greater Los Angeles Area.[189] Some commentators have argued that solar panels could improve ecological conditions in this area by reducing soil erosion and dust storms.[190] The Los Angeles Department of Water and Power has proposed a 5,000 MW solar array for Owens Lake.[191] The Department regularly pays millions of dollars to control the dust storms in the area and is using a pilot project to study possible methods for dust control and mitigation if a solar project is sited there.[192]

Farmers and officials at the Westlands Water District have already agreed to provide 24,000 acres of land for Westlands Solar Park, which could become the world's largest solar energy complex.[193] Area farmers like this project because they want the extra water that they believe will come from a reduced number of farms competing over available water resources.[194] Environmentalists support this project too. According to the Sierra Club, "it's about as perfect a place as you're going to find in the state of California for a solar project like this."[195] Such properties are also closer to users of

174. Sacramento Fish and Wildlife Office, *supra* note 173, at 3; Kathlyn Jean McVey, *supra* note 173, at 28, 70.
175. *See* San Luis Obispo Cnty., California Valley Solar Ranch Conditional Use Permit, and Twisselman Reclamation Plan and Condition Use Permit, at C.6-1 (Jan. 2011) (providing details regarding giant kangaroo rat in previously cultivated area), *available at* http://www.sloplanning.org/EIRs/CaliforniaValleySolarRanch/feir/c06_biology.pdf.
176. *Defining Disturbed Land: Siting Renewable Energy Responsibly*, Basin & Range Watch (Apr. 30, 2011), http://www.basinandrangewatch.org/DisturbedLand.html; Cal. State Univ., Stanislaus Endangered Species Recover Program, J. Tipton Kangaroo Rat (Dipodomys nitratoides nitratoides), *available at* http://esrp.csustan.edu/publications/pubhtml.php?doc=sjvrp&file=chapter02J00.html (last visited June 6, 2013).
177. Cal. Gov't Code § 51200 (West 2014).
178. Cal. Dep't of Conservation, The California Land Conservation (Williamson) Act 1 (2010), *available at* http://www.conservation.ca.gov/dlrp/lca/stats_reports/Documents/2010%20Williamson%20Act%20Status%20Report.pdf.
179. Testimony of John Gamper, Assembly Select Committee On Renewable Energy Economy In Rural California (Oct. 24, 2011), *available at* http://www.cfbf.com/issues/pdf/REERCtestimony.pdf.
180. S.B. No. 618 (Cal. 2011), *available at* http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0601-0650/sb_618_bill_20111008_chaptered.html.
181. *See Replacing a Williamson Act Contract with a Solar-Use Easement*, Cal. Farm Bureau Comm'n, http://www.cfbf.com/issues/landuse/solar/ (last visited May 30, 2013).
182. *Id.*
183. *Id.*.
184. Personal communication of Meri Meraz from the California Department of Conservation with Amy Morris. Email April 2, 2013 (on file with authors).
185. Todd Woody, *Recycling Land for Green Energy Ideas*, N.Y. Times, Aug.10, 2010, at B1.
186. *Id.* In 2011, the Farm Bureau unsuccessfully sued Fresno County for approving a solar project on agricultural land that required the cancellation of a farmland conservation contract. *Farm Bureau Sues Fresno County over Farmland Conversion*, Cal. Farm Bureau Fed'n (Oct. 31, 2011), http://www.cfbf.com/news/showPR.cfm?rec=D709F38EF758B5066EF31B18039B8CE5&PRID=370; Envtl. Law Alert: Fresno Court Denies Farm Bureau Challenge — Holds County Cancellation of Williamson Act Contract for Solar Project is OK (Dec. 19, 2012), *available at* http://www.stoel.com/showalert.aspx?Show=9978.
187. *See, e.g.*, *Agriculture and Climate Change Adaptation*, Climate Change, CA.gov (Mar. 3, 2010), http://www.climatechange.ca.gov/adaptation/ (last visited Nov. 4, 2013).
188. Reginald Norris, Disturbed Land Becomes Destination for Solar Farms § 2013 (2010).
189. *Id.*
190. *Id.*
191. Woody, *supra* note 185.
192. *Owens Lake Dust Mitigation*, L.A. Dep't of Water & Power (May 30, 2013), http://wsoweb.ladwp.com/Aqueduct/EnvironmentalProjects/owenslakedustmitigation/owenslakeindex.htm.
193. Woody, *supra* note 185. Westlands Water District Notice of Preparation (Mar. 13, 2013), *available at* https://cs.westlandswater.org/resources/resources_files/misc/environmental_docs/WWD-WSP-NOP-Final_3-13-2013.pdf.
194. Woody, *supra* note 185.
195. *Id.* (quoting Carl Zichella, former Western Renewable Programs Director for the Sierra Club).

electricity and electricity infrastructure than the desert solar projects are.[196]

III. Conclusion: Seeking a Balance

Solar energy projects at all levels are necessary to reduce greenhouse gas emissions. Utility-scale projects are unquestionably necessary to meet RPS goals. The challenge is determining how both utility-scale projects and increase DG projects can be sited greenly. We can also improve the efficiency and minimize environmental impacts by more comprehensive energy planning.

On the siting front, focus should be on disturbed lands for both scales. Marginal agricultural lands and abandoned mines may provide the best option at the utility-scale because of the sheer number of acres potentially available. In some cases, large landfills may offer opportunities as well. The clearest way to avoid conflicts with Native American sites and valuable wildlife habitat, however, is to site projects in heavily degraded and hardscape areas such as landfills, mines, rooftops, and parking lots.[197] Because most of these sites are not as large as the expanses of desert and agricultural land contemplated by utility-scale projects, developing these degraded sites typically requires smaller-scale DG projects. DG siting is even more flexible with opportunities on contaminated sites and hardscapes throughout the state.

Utility-scale projects still have a lot to offer. Per unit of energy generated, installing rooftop solar is more expensive than installing arrays of ground-mounted panels.[198] Because of the economies of scale in developing large projects, which utilities are better positioned to take advantage of,[199] utility-scale projects can be greener than some of the recent projects in California have been. Some projects, like the Carrizo Valley Solar Ranch are already moving in the right direction.[200] The Carrizo Valley Solar Ranch has been configured and constructed in ways that will allow continued use of portions of the project area by endangered wildlife such as the San Joaquin kit fox and giant kangaroo rat.[201]

Many site developers are concerned with cumbersome permitting requirements.[202] Whether on public or private land, solar projects are subject to federal and state laws protecting endangered species.[203] Under federal law, project proponents are required to develop habitat conservation plans to minimize and mitigate harm to species.[204] Under California's Natural Community Conservation Planning Act,[205] public and private partners regularly work together to develop ecosystem based planning approaches.[206] As was seen in East Contra Costa County, the federal habitat conservation plan and the state natural community conservation plan can be set forth in one document as the product of a cooperative effort.[207] Endangered species permitting in conjunction with these planning processes could aim at balancing endangered species protection and renewable energy development. The Desert Renewable Energy Conservation Plan, which covers counties in California's desert regions and is coordinated by a joint state and federal Renewable Energy Action Team, provides an example of this effort already underway. However, the Desert Renewable Energy Conservation Plan process has been controversial and beset with major delays, so it has not yet realized significant renewable energy development benefits.[208]

Compared to these struggles and potential environmental impacts, local DG solar has many potential advantages. Electricity generated on local DG systems is used on the same feeder or substation where it is generated. That means that it avoids the complicated interconnect process required for electricity that uses transmission systems for moving electricity longer distances.[209] Local DG also reduces line losses from transporting electricity through the transmission system and avoids impacts from the expansion of transmission infrastructure.[210] "[R]ooftops have more accessible capacity, and more community benefits, and investments of both money and intention are starting to flow that way."[211] Lancaster, California now requires all new homes to have their own solar panels or be part of subdivisions that produce 1 kW of solar power.[212]

196. Woody, *supra* note 185.
197. *See* Spivak, *supra* note 168.
198. Energy & Envtl. Econ., Technical Potential for Local Distributed Photovoltaics in California (2012), *available at* http://www.cpuc.ca.gov/NR/rdonlyres/8A822C08-A56C-4674-A5D2-099E48B41160/0/LDPVPotentialReportMarch2012.pdf.
199. U.S. Envtl. Prot. Agency, Re-Powering America's Land: Renewable Energy on Potentially Contaminated Land and Mine Sites (n.d.), *available at* http://www.epa.gov/renewableenergyland/docs/repower_contaminated_land_factsheet.pdf.
200. Chris Clarke, *Carrizo Plain Solar Ranch Starts Pumping Power Into Grid*, Rewire (Oct. 25, 2012), http://www.kcet.org/news/rewire/solar/photovoltaic-pv/carrizo-plain-solar-ranch-starts-pumping-power-into-grid.html; *Fact Sheet*, Cal. Valley Solar Ranch, http://us.sunpowercorp.com/cs/Satellite?blobcol=urldata&blobheadername1=Content-Type&blobheadername2=Content-Disposition&blobheadervalue1=application%2Fpdf&blobheadervalue2=inline%3B+filename%3D12_613_sp_cvsr_fact_sheet_p.pdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1300281579698&ssbinary=true (last visited May 30, 2013).
201. Clarke, *supra* note 200.
202. *See, e.g.*, U.S. Envtl. Prot. Agency, Shining Light on a Bright Opportunity: Developing Solar Energy on Abandoned Mine Lands 11–12 (Dec. 2011), *available at* http://www.epa.gov/aml/revital/amlsolarfact.pdf.
203. 16 U.S.C. § 1531 *et seq.*; Cal. Fish & Game Code §§ c2050 *et seq.*
204. 16 U.S.C. § 1539(a)(1)(B).
205. Cal. Fish & Game Code §§ 2800–2835.
206. *See Natural Community Conservation Planning (NCCP)*, Cal. Dep't of Fish & Wildlife, http://www.dfg.ca.gov/habcon/nccp/ (last visited Nov. 3, 2013).
207. *See, e.g.*, E. Contra Costa Cnty. Habitat Conservation Plan Ass'n, Conserving Natural Lands and Sustaining Economic Development: the Final East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan (Oct. 2006), *available at* http://www.co.contra-costa.ca.us/depart/cd/water/hcp/documents/HCP_NCCP/ECCC_HCP-NCCP_Informational_Booklet.pdf (created by a association comprised of Contra Costa County, some cities within the county, the Contra Costa Water District, and the East Bay Regional Park District).
208. *See* Amy Wilson Morris & Jessica Owley, *Mitigating the Impacts of the Renewable Energy Gold Rush*, Minn. J. L. Sci. & Tech. (forthcoming 2014).
209. Keyes, Fox & Wiedman LLP, Unlocking DG Value: A PURPA-based Approach to Promoting DG Growth 5, 6 (May 2013), *available at* http://www.irecusa.org/wp-content/uploads/2013/05/Unlocking-DG-Value.pdf.
210. *Id.*
211. Dean Kuipers, *California's New Era of Rooftop Solar*, Huffington Post (Jan. 24, 2013), http://www.huffingtonpost.com/dean-kuipers/californias-new-era-of-ro_b_2449237.html.
212. Felicity Barringer, *With Help From Nature, a Town Aims to Be a Solar Capital*, N.Y. Times, Apr. 9, 2013, at A12, *available at* http://www.nytimes.com/2013/04/09/us/lancaster-calif-focuses-on-becoming-solar-capital-of-universe.html?pagewanted=all

Again, coordination and careful configuration of sites can play an important role. One of the challenges of deploying enough DG to meet RPS targets and substantially reduce greenhouse gas emissions is that smaller scale projects require many more residents, commercial building owners, and developers of smaller scale projects to take action. Subsidies encourage more individuals and businesses to become involved, but may not facilitate the most efficient solar development. For example, many subsidies from the California Solar Initiative have gone to residents in foggy San Francisco, when much more energy could have been generated if those rooftop panels had been installed in sunny inland southern California.[213] Incentivizing larger DG community-based solar in sunny communities may be a more effective way to target solar subsidies.[214] For example, DG procurement programs could adjust to prioritize development in areas close to consumers and areas with low interconnection costs where DG may defer the need for transmission upgrades and reduce environmental impacts.[215]

Environmental review requirements under state and federal law may slow the development of renewable energy. There are several ways to address this concern. First, the California Energy Commission and CPUC should assign staff to provide technical assistance to local jurisdictions conducting environmental review for DG projects. Such staff could also work with local government planning departments to develop appropriate thresholds of significance and standard mitigation measures for DG projects.[216] Second, programmatic environmental review could be used to identify areas appropriate for DG or utility-scale solar generation facilities.[217] Subsequent projects proposed in areas previously assessed would then face less comprehensive environmental review requirements.[218]

At the local level, counties and cities could develop general plans and solar ordinances that designate areas for DG solar development and remove zoning restrictions that would otherwise prohibit DG solar facilities in low-environmental-impact areas. These zoning changes could expedite the process of granting conditional use permits for green DG and facilitate siting of solar on appropriate marginal agricultural land.

The likely and potential impacts of global climate change mean that development of renewable energy is vital to our future. Solar power has an important role to play at multiple scales. Utility-scale facilities will be important and the time is ripe for improving the environmental sustainability of those facilities and thinking more strategically about where we site such projects. Even more important, though, is development of DG projects. The availability of DG sites is nearly limitless. Although all DG development faces challenges, coordination of environmental review and permitting processes along with targeted subsidies and governmental support can accelerate the move toward sustainability.

213. Steve Sexton, *Why California's Push for Rooftop Solar is a Foggy Idea*, Freakonomics (Aug. 11, 2011, 10:23 AM), http://www.freakonomics.com/2011/08/11/the-inefficiency-of-californias-push-for-rooftop-solar/.
214. *Id.*
215. *Id.*
216. *See* Cal. Energy Comm'n, *supra* note 84, at 28.
217. *Id.* at 29–30.
218. *Id.* at 30–31..