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Responsible, Renewable, and Redesigned: How the Renewable Energy Movement Can Make Peace with the Endangered Species Act

Kalyani Robbins*

ABSTRACT

One of the most promising routes to a sustainable energy future, as well as climate change mitigation, is the development of renewable energy sources such as wind, solar energy, and hydropower. Indeed, scientists have proposed plans to move completely (100 percent!) to these energy sources within a couple of decades. Mark Z. Jacobson and M.A. Delucchi, scientists from Stanford and U.C. Davis, have outlined a plan to achieve this goal, thereby “eliminating all fossil fuels.” Hydroelectric power already provides almost one-fifth of the world’s electricity, and wind and solar development is rapidly picking up as well. However, before we leave our worries behind and celebrate, we must resolve one potentially difficult issue for renewable energy, especially these three favored brands. They conflict with another important goal, that of protecting biodiversity.

Wind, solar, and hydro energy all have one thing in common: they destroy habitat as well as directly kill wildlife, including listed endangered species and their habitat. Can these problems be reconciled with the movement toward renewable energy, allowing us to partake of its many benefits? At least for now, we regularly see renewable energy progress impeded by the need for Endangered Species Act compliance. The ESA has

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presented itself as a potentially catastrophic obstacle to renewable energy development. The time has come to think about how we might maximize our access to renewable energy while minimizing its impacts on vulnerable species.

This Essay will first review the existing conflicts between endangered species and these three sources of renewable energy. This will be followed by analysis of the potential for harmonizing each energy source with the dictates of the Endangered Species Act, concluding with specific proposals for redesigning our methods of harvesting these forms of renewable energy. As one example, innovators have designed impressive new wind-harvesting technologies that are less dangerous to birds and bats without sacrificing efficiency. I propose that the U.S. Fish & Wildlife Service incorporate a preference for wildlife-protective technologies into the regional incidental take permitting requirements, at least for certain higher-risk landscapes. The ultimate goal of the piece is to analyze the extent to which it is possible to use each form of renewable energy without significant ecosystem impacts, to generate somewhat of a ranking of preferred modes of development, and to seek the best path (in relation to wildlife) to a renewable energy future. Such a future is itself essential to biodiversity, so the interests must be harmonized.

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INTRODUCTION

We are about to embark on something we have never done before in this country. We are about to lay down, from scratch, a new nationwide infrastructure. Yes, we have done *that* before—creating a network of roads, train tracks, and the power grid, as examples.¹ We have had exciting periods of rapid infrastructure development before, but what is different this time is that we also have the Endangered Species Act (ESA) to contend with.² All previous major infrastructure developments have predated the ESA and went relatively unimpeded.³ While we are now accustomed to jumping through hoops and making compromises when developing land, as we have done for four decades, this will be the first time we attempt such grand-scale change—a whole new brand of infrastructure—since the ESA was passed. Yet here we find ourselves, in the 21st century, in a state of utter desperation. Not only have we nearly depleted our non-renewable resources, but worse, we have discovered that we need to stop using them even before depletion as they are destroying the earth’s atmosphere.⁴ We must, absolutely must, get large-scale renewable energy up and running as soon as possible. That, of course, requires a new nationwide infrastructure—the first since before the ESA.

Global climate change is rapidly becoming the greatest worldwide problem since the dawn of humanity.⁵ While there

1. See generally *Transportation Infrastructure*, AM. ON MOVE, http://amhistory.si.edu/onthemove/themes/story_47_1.html (last visited Oct. 20, 2013) (providing an outline of the history of American transportation infrastructure).

2. Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884 (codified as amended at 16 U.S.C. §§ 1531–1544 (2012)).

3. Cf. Barry Bosworth & Sveta Milusheva, Brookings Inst., *Innovation in U.S. Infrastructure Financing: An Evaluation*, BROOKINGS.EDU, 2–3, http://www.brookings.edu/~media/research/files/papers/2011/10/20%20infrastructure%20financing%20bosworth%20milusheva/1020_infrastructure_financing_bosworth_milusheva.pdf (last visited Oct. 20, 2013) (“Adjusted for inflation, investment spending peaked as a share of GDP in the 1960s and fell sharply during the 1970s The decline was largely the result of the completion of the interstate highway system and a cycle in the construction of educational buildings to meet the needs of the baby-boom generation.”).

4. See, e.g., *Natural Resources*, *Teacher Fact Sheet*, ENVTL. PROTECTION AGENCY, http://www.epa.gov/osw/education/quest/pdfs/unit1/chap1/u1_natresources.pdf (last visited Oct. 21, 2013).

5. See *Human Population Growth and Climate Change*, CENTER FOR BIOLOGICAL DIVERSITY, <http://www.biologicaldiversity.org/campaigns/overpopulation/climate/> (last visited Oct. 21, 2013) (“The largest single threat

would presently be some gradual warming of the atmosphere anyway, as part of a grand-scale climate cycle, human activity has accelerated this warming.⁶ We have dramatically increased, to an unnatural level, an otherwise natural occurrence known as greenhouse gases (GHGs).⁷ Under normal atmospheric conditions, energy from the sun enters the atmosphere, after which some of it is absorbed and some (quite a bit) is sent back into space.⁸ How the energy is divided between these two potential outcomes determines the atmospheric temperature.⁹ The more of it sent into space, of course, the cooler the atmosphere, and vice versa. GHGs absorb and re-emit infrared radiation, standing in the way of some of the energy-reflection from the earth.¹⁰ When the energy is re-emitted, it goes both into space and back toward the earth.¹¹ Because this creates a net increase in retained solar radiation, more GHGs in the atmosphere result in warmer average temperatures within the earth's atmosphere.¹² There are natural GHGs for which we cannot take the blame (and which are not blameworthy anyway, as without them the earth's atmosphere would be inhospitably cold), but when we emit

to the ecology and biodiversity of the planet in the decades to come will be global climate disruption due to the buildup of human-generated greenhouse gases in the atmosphere.”).

6. See, e.g., *Global Warming is Human Caused*, NAT'L WILDLIFE FED'N, <http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Global-Warming-is-Human-Caused.aspx> (last visited Oct. 20, 2013) (“Scientific data have since established that, for hundreds of thousands of years, changes in temperature have closely tracked with atmospheric CO₂ concentrations. Since the Industrial Revolution, the burning of coal, oil and natural gas has emitted roughly 500 billion tons of CO₂, about half of which remains in the atmosphere. This CO₂ is the biggest factor responsible for recent warming trends.”).

7. Nick Snow, *Humans Largely Causing Accelerated Climate Change, IPCC Reiterates*, OIL & GAS J. (Sept. 27, 2013) <http://www.ogj.com/articles/2013/09/humans-largely-causing-accelerated-climate-change-ipcc-reiterates.html> (“Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.” (internal quotation marks omitted)).

8. See generally *What is the Greenhouse Effect?*, AM. CHEM. SOC'Y, <http://www.acs.org/content/acs/en/climatescience/climatesciencenarratives/wh-at-is-the-greenhouse-effect.html> (last visited Oct. 27, 2013) (providing an overview of the greenhouse effect).

9. *Id.*

10. *Id.*

11. *Id.*

12. *Id.*

certain chemicals into the air, particularly carbon dioxide, methane, nitrous oxide, and sulphur hexafluoride, they collect in the atmosphere in unnatural quantities and contribute to the excessive greenhouse effect.¹³

Our GHG emissions are especially disastrous in that they represent a long-term commitment. This is because

the excess carbon dioxide we put in the atmosphere today is removed exceedingly slowly, meaning that the carbon dioxide we emit in the next half-century will alter the climate for millennia to come; even if we wholly ceased using fossil fuels after fifty years, the harm could not be undone.¹⁴

Climate change is impacting biodiversity across the board. Indeed, biodiversity may well be the catastrophe's greatest victim. We have already seen relatively dramatic changes in habitat and species behavior, and it is very clear that what has taken place so far is only the tip of the iceberg.¹⁵

Nearly all climate-related policy qualifies as "urgent," though some matters may need to be addressed more quickly than others, such as changes that put the brakes on the accelerating problem itself. For the purpose of this discussion, "climate mitigation" refers to policies that lead to a reduction in GHG emissions to slow the future progression of climate change, and "climate adaptation" refers to policies designed to

13. See *Other Gases*, GREENPEACE (Mar. 16, 2006), http://www.greenpeace.org/international/en/campaigns/climate-change/science/other_gases/; *Overview of Greenhouse Gases*, U.S. ENVTL. PROTECTION AGENCY, <http://www.epa.gov/climatechange/ghgemissions/gases.html> (last visited Oct. 20, 2013). For a frightening, in spite of being somewhat conservative, assessment of the state of anthropogenic climate change, see INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT (2007), available at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf. Not only was the report conservative in representing the predictions at the time, but in the few years since, we have already learned that the situation is worse than we thought. See, e.g., Richard A. Betts et al., *When Could Global Warming Reach 4°C?*, 369 PHIL. TRANSACTIONS ROYAL SOC'Y A 67 (2011); Julie Steenhuisen, *Global Warming Seen Worse than Predicted*, REUTERS (Feb. 14, 2009, 9:46 PM), <http://uk.reuters.com/article/2009/02/14/us-climate-idUKTRE51D29E20090214> (discussing the IPCC report's underestimation of climate change).

14. R.T. Pierrehumbert, *Climate Change: A Catastrophe in Slow Motion*, 6 CHI. J. INT'L L. 573, 577 (2006).

15. See generally *Effects of Global Warming*, NAT'L. GEOGRAPHIC, <http://environment.nationalgeographic.com/environment/global-warming/gw-effects/> (last visited Oct. 21, 2013) (providing an overview of the repercussions stemming from global warming).

maintain the resilience of human populations and ecosystems in the face of a changing environment. The largest share of GHG emissions comes from power generation (electricity production and transformation were responsible for twenty-six percent of global emissions in 2004),¹⁶ so one of the most promising routes to climate mitigation is the development of renewable energy sources such as wind, solar energy, and hydropower. While renewable energy development is largely about mitigation, as it can begin to displace fossil-fuel energy sources, it must also take adaptation into account (as should all kinds of long-term planning at this point), which generally means minimizing the extent to which it adds pressure to species already at risk due to climate change.

Because climate change is so disastrous for biodiversity, advocates for climate mitigation and biodiversity advocates are natural allies. Unfortunately, there are substantial conflicts because the potential avenues for climate mitigation are numerous, and some can actually cause more immediate harm to endangered species. Renewable energy development, in particular, serves as both a highly valuable means of climate mitigation and a serious threat to certain habitats. In its programmatic environmental studies, the Bureau of Land Management has determined that solar and wind development are not as harmless as once believed, but can be quite harmful to ecosystems and wildlife, among other resources.¹⁷ The ESA is poorly designed to deal with this conflict—between the need for climate mitigation to save all species and the need for a single species to have enough habitat—just as it is poorly designed for climate adaptation.¹⁸ Climate change mitigation

16. See *Global Greenhouse Gas Emissions Data*, ENVTL. PROTECTION AGENCY, <http://www.epa.gov/climatechange/ghgemissions/global.html> (last updated Sept. 9, 2013).

17. See BUREAU OF LAND MGMT. & U.S. DEP'T OF ENERGY, FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (PEIS) FOR SOLAR ENERGY DEVELOPMENT IN SIX SOUTHWESTERN STATES (2012), *available at* <http://solareis.anl.gov/documents/fpeis/index.cfm>; BUREAU OF LAND MGMT., FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON WIND ENERGY DEVELOPMENT ON BLM-ADMINISTERED LANDS IN THE WESTERN UNITED STATES (2005), *available at* <http://windeis.anl.gov/documents/fpeis/index.cfm>.

18. In a 2010 research study, for which federal land managers were interviewed regarding the effectiveness (or existence) of strategies for climate adaptation, "a large majority (81%) of respondents believed that the Endangered Species Act (ESA) was a barrier to climate change adaptation,

and adaptation were not foremost in the minds of the legislators who drafted the statute.¹⁹

The purpose of this Essay is not to address this larger problem,²⁰ but to assist with a narrower but rather pressing one: how can we get renewable energy infrastructure on the ground as quickly as possible without the repeated ESA road blocks that tend to stand in the way of our renewable energy future? Which forms of renewable energy are more amenable to this relationship? This is not an essay about prioritizing every last fish, bat, or tortoise over the broader survival of life on earth, nor is it a defense of the ESA's inadvertent tendency to do so. Rather, it accepts that framework as the reality in which we find ourselves²¹ and seeks out the most navigable routes around the problem. Nor does this Essay comprehensively address the issue of reconciling renewable energy development with the ESA; rather, it focuses in on one specific area that has received less attention than others: making better use of technological advancements to do so. The more popular issue, which is siting of renewable energy projects to minimize conflicts with wildlife habitat, has been addressed by others,²² so I endeavor in this brief Essay to provide a supplement to that critical issue.

The ESA requires two agencies (which I refer to as the wildlife agencies) to list vulnerable species as either endangered or threatened, if applicable.²³ This power to list

while few (9%) believed this law to be an enabler." Lesley C. Jantarasami, Josh J. Lawler & Craig W. Thomas, *Institutional Barriers to Climate Change Adaptation in U.S. National Parks and Forests*, 15 *ECOLOGY & SOC'Y*, Dec. 2010, at 33, 41, available at <http://www.ecologyandsociety.org/vol15/iss4/art33/>.

19. This Author's research reveals that there is nothing in the legislative history of the ESA about climate change, nor any indication in the statute that it was considered.

20. I have endeavored to do so in a substantially larger work. Kalyani Robbins, *The Biodiversity Paradigm Shift: Adapting the Endangered Species Act to Climate Change* (unpublished manuscript) (on file with author).

21. See generally John Copeland Nagle, *Green Harms of Green Projects*, 27 *NOTRE DAME J.L. ETHICS & PUB. POL'Y* 59 (2013) (discussing harms of green energy and calling for a balance between green projects and other projects in the public interest).

22. See, e.g., Amy Wilson Morris & Jessica Owley, *Mitigating the Impacts of the Renewable Energy Gold Rush*, 15 *MINN. J. L. SCI. & TECH.* 293 (2014); Amy Morris, Jessica Owley & Emily Capello, *Green Siting for Green Energy*, 4 *J. ENERGY & ENVTL. L.* (forthcoming 2014).

23. 16 U.S.C. § 1533(a)(2)(A)(i) (2012).

endangered and threatened species belongs to the Secretary of the Interior and the Secretary of Commerce,²⁴ who have delegated that power to the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS), respectively.²⁵ “The majority of species—terrestrial species and freshwater fish—are the responsibility of FWS, whereas NMFS is generally charged with the protection of marine species and anadromous fish, such as salmonids.”²⁶ A species is endangered if it “is in danger of extinction throughout all or a significant portion of its range,”²⁷ and it is threatened if it “is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.”²⁸

While it is not often easy for a species to get onto these lists, because of the extensive protections offered listed species, the ESA has traditionally been called the “pit bull” of environmental legislation.²⁹ First, at the time a species is listed, the wildlife agency is required to designate its critical habitat, which is the area of habitat essential to conservation (i.e., recovery) of the species.³⁰ Listing should also trigger recovery planning, though this does not always take place.

Next,

section 7 requires all federal agencies to ensure that the actions they carry out, fund or authorize (such as by granting permits to private

24. *Id.* § 1533(c)(1).

25. 50 C.F.R. § 402.01(b) (2012).

26. See Kalyani Robbins, *Strength in Numbers: Setting Quantitative Criteria for Listing Species Under the Endangered Species Act*, 27 UCLA J. ENVTL. L. & POL’Y 1, 7 (2009).

27. *Id.* (citing 16 U.S.C. § 1532(6) (2006)).

28. *Id.* (citing 16 U.S.C. § 1532(20)).

29. *Id.* at 10 (citing George Cameron Coggins, *An Ivory Tower Perspective on Endangered Species Law*, 8 NAT. RESOURCES & ENV’T 3, 3 (1993); Oliver A. Houck, *The Endangered Species Act and Its Implementation by the U.S. Departments of Interior and Commerce*, 64 U. COLO. L. REV. 277, 279 (1993); Robert D. Thornton, *Searching for Consensus and Predictability: Habitat Conservation Planning Under the Endangered Species Act of 1973*, 21 ENVTL. L. 605, 605 (1991); Steven P. Quarles, *The Pit Bull Goes to School*, 15 ENVTL. F., Sept.–Oct. 1998, at 55; Timothy Egan, *Strongest U.S. Environment Law May Become Endangered Species*, N.Y. TIMES, May 26, 1992, at A11).

30. *Id.* (citing 16 U.S.C. § 1533(a)(3)(A)(i)). Although this is a requirement, it is only followed a fraction of the time, and when not followed only enforced (via citizen suits) a tiny fraction of the time. See, e.g., Robert J. Scarpello, Note, *Statutory Redundancy: Why Congress Should Overhaul the Endangered Species Act to Exclude Critical Habitat Designation*, 30 B.C. ENVTL. AFF. L. REV. 399, 416–17 (2003); see also 16 U.S.C. § 1533(f) (2012).

individuals) are not likely to jeopardize the continued existence of any listed species or adversely modify any designated critical habitat. [16 U.S.C. § 1536(a)(2) (2012).] The action agency accomplishes this via formal consultation with the wildlife agency responsible for the listed species at issue, which includes any species that may be affected by the agency action. [50 C.F.R. § 402.14(g)(4) (2012).] The Secretary must then issue a formal biological opinion determining whether the action is or is not likely to jeopardize the species or adversely modify the critical habitat. [16 U.S.C. § 1536(b)(3)(A) (2012).]³¹

This document includes an incidental take statement, which determines the extent of permissible harm to individual members of the species.³²

Finally,

[s]ection 9 prohibits any person, public or private, from “taking” a listed species of fish or wildlife. [16 U.S.C. § 1538(a)(1) (2012).] “Take” is a term of art—and a relatively broad one—encompassing both direct harm to the animals and indirect harm through habitat alterations that injure the animals. [16 U.S.C. § 1532(19) (2012).]³³

Both kinds of take are at issue in the context of renewable energy development, so section 10 habitat conservation planning³⁴ is an extremely important facet to such planning. Non-federal parties wishing to gain permission for any amount of take must submit a habitat conservation plan (HCP) for that species, containing mitigation planning that is directly tied to the species take that will occur.³⁵ The wildlife agencies are then able to approve the plan along with the expected take.³⁶ This is an important aspect of some of the suggestions in this Essay, as the agencies are able to tie specific requirements to this take permission, as well as group together parties in a region for a regional HCP, rendering it a source of substantial agency control over project development.³⁷ This process allows us to plan for the least harmful routes to a renewable energy future.

31. *Id.* at 11 (footnotes omitted).

32. 16 U.S.C. § 1536(b)(3)(A) (2012).

33. Robbins, *supra* note 26, at 11 (footnotes omitted).

34. 16 U.S.C. § 1539(a) (2012).

35. *Id.*

36. *Id.* § 1539(d).

37. See J.B. Ruhl, *Who Needs Congress? An Agenda for Administrative Reform of the Endangered Species Act*, 6 N.Y.U. ENVTL. L.J. 367, 382 (1998) (“One of the most sweeping movements in ESA administrative policy is FWS’s promotion of habitat conservation planning processes under section 10(a)(1) of the ESA, particularly at regional scales.”); see also 16 U.S.C. § 1540(a)(1) (2012) (illustrating civil penalties for otherwise prohibited acts).

The following sections focus on three major areas of renewable energy development—hydropower, wind, and solar—and consider the issues they have each had with the ESA, as well as the tech-based efforts to resolve these problems. What we see, when we review the potential for each type of renewable energy to minimize its harms to biodiversity, is that not all are created equally. Some are more capable of such essential advances than others. For this reason, we may want to favor these approaches going forward, and I propose administrative avenues to maximize the wildlife-saving innovations where they are possible. The problem of reconciling renewable energy development with the ESA is a substantial one, and I focus here on the idea of technology-forcing ESA implementation that will not only protect vulnerable species from the rapid development in this field, but might even create an avenue to a more substantial *increase* in renewable energy infrastructure (less harmful to wildlife means less hindered by the ESA).

I. HYDROPOWER

The twentieth century saw a love affair with the hydropower dam, resulting in the large percentage of energy we harvest from rivers today.³⁸ Approximately one-fifth of the world's power generation,³⁹ and nearly one-tenth of that in the United States, comes from hydropower dams.⁴⁰ It is the oldest and most heavily used source of renewable energy, and still accounts for about half of the total renewable energy in the United States, in spite of the fact that we have now developed less ecologically harmful sources.⁴¹ Depending upon how you look at it, this is either a renewable resource (in that the rivers

38. See, e.g., Sophie Namy, *Addressing the Social Impacts of Large Hydropower Dams*, J. INT'L POL'Y SOLUTIONS, Spring 2007, at 11, 11.

39. See Anne-Marie Corley, *The Future of Hydropower*, IEEE SPECTRUM (June 1, 2010, 5:07 PM), <http://spectrum.ieee.org/energy/renewables/future-of-hydropower>.

40. See *What Is the Role of Hydroelectric Power in the United States?*, U.S. ENERGY INFO. ADMIN. (last updated Aug. 29, 2012), http://www.eia.gov/energy_in_brief/article/hydropower.cfm.

41. The National Geographic website provides a concise and interesting background on hydropower, including some useful facts about how it works and how heavily people have come to rely on it. *Hydropower: Going with the Flow*, NAT'L GEOGRAPHIC, <http://environment.nationalgeographic.com/environment/global-warming/hydropower-profile/> (last visited Oct. 7, 2013).

keep flowing and are not consumed by the process) or the use of a limited resource (in that dams “consume” aquatic habitat) which thus needs to be curbed in favor of truly renewable/unlimited energy resources. Given the finite number of rivers and the many dwindling aquatic species that rely on them for habitat, hydropower must be at least relegated to a lower tier of renewable energy—one that is, in fact, quite limited.

A. THE TROUBLE WITH HYDROPOWER: ANADROMOUS FISH

Anadromous fish spend much of their lives in the ocean and migrate into fresh water to breed.⁴² Some well-known (and ESA-listed) examples are Pacific Salmonids and Steelhead Trout.⁴³ The young need the ability to swim downstream and the mature fish must get upstream to spawn.⁴⁴ Hydropower dams, which block the river to force the water through turbines, can interfere with essential migration and kill numerous fish.⁴⁵ Absent any efforts to aid the fish, dams would completely wipe out entire populations that use the river on which the dams are built.⁴⁶ Of course, such a state of affairs is not permitted to happen, but reality is only slightly better, as very few fish make it through the dam improvements described in the next Part. While migration is the biggest issue, dams also cause problems for a variety of non-migrating species, by restricting flow volume (as with the tulotoma snail)⁴⁷ or flooding habitat (as with the snail darter).⁴⁸

42. See *Species*, N. PAC. ANADROMOUS FISH COMM’N, http://www.npafc.org/new/science_species.html (last visited Oct. 27, 2013).

43. See EUGENE H. BUCK & HAROLD F. UPTON, CONG. RESEARCH SERV., PACIFIC SALMON AND STEELHEAD TROUT: MANAGING UNDER THE ENDANGERED SPECIES ACT (2010), available at <http://www.cnie.org/NLE/CRSreports/10Jul/98-666.pdf>.

44. See *Species*, *supra* note 42.

45. See John Harrison, *Fish Passage at Dams*, NW. POWER & CONSERVATION COUNCIL (Oct. 31, 2008), <http://www.nwcouncil.org/history/fishpassage> (“Congress long had recognized that dams kill fish.”).

46. See *id.*

47. See *Ala. Power Co. v. Fed. Energy Regulatory Comm’n*, 979 F.2d 1561 (D.C. Cir. 1992).

48. See *Tenn.Valley Auth. v. Hill*, 437 U.S. 153 (1978).

B. THE TECH-BASED SOLUTIONS FOR HYDROPOWER

The hydropower industry, unlike the sources of renewable energy whose booms have arrived more recently, has had every opportunity to develop technologies to minimize negative externalities for wildlife, and has made such efforts over the course of many years.⁴⁹ Unfortunately, what this effort has taught us is that hydropower is simply not compatible with anadromous fish, which evolved in free-flowing rivers. For downstream migration, the solution is to create spillovers and other diversions of downstream water to let some fish get past the dam.⁵⁰ The rest of the fish are sliced and diced in the turbines. With some narrow types of bypass, even the small percentage of fish that make it into the diversion are spit out in one spot—a spot that predators treat as a feeding dish to eat the helpless fish dumped there.⁵¹ For upstream migration, fish ladders are designed to allow fish to migrate past the dam.⁵² A fish ladder is a series of low, wide steps that wind their way around one side of a dam, to enable fish to pass by leaping up each step as they swim around it, eventually reaching the top so that they may continue up the river.⁵³ Unfortunately, these ladders create a funneling of fish migrating upstream, and thus lend themselves to the same predator field-day problem as downstream bypasses can.⁵⁴ And, of course, not all fish find their way to the ladder.

49. See ENVIRONMENTAL MITIGATION TECHNOLOGY FOR HYDROPOWER: SUMMARY REPORT ON THE 2010 SUMMIT MEETING CONVENED BY OAK RIDGE NATIONAL LABORATORY, THE NATIONAL HYDROPOWER ASSOCIATION, AND THE HYDROPOWER RESEARCH FOUNDATION 6 (2010), available at <http://www.esd.ornl.gov/WindWaterPower/EMTSSummit.pdf> (“In a survey conducted by the U.S. Department of Energy (DOE) in 1994, 9.5% of hydropower projects licensed by the Federal Energy Regulatory Commission had installed upstream fish passage mitigation measures (aka fishways). These include fish ladders, fish elevators, and trap-and-haul operations.”).

50. See Harrison, *supra* note 45.

51. *Id.*

52. *Id.*

53. See *Fish Ladders*, NAT’L OCEANIC & ATMOSPHERIC ADMIN., http://www.westcoast.fisheries.noaa.gov/fish_passage/about_dams_and_fish_h_ladders.html (last visited Oct. 7, 2013) (providing a useful illustration that will improve upon explanation).

54. See Matt Kaplan, *Fish Ladders of Doom*, NATURE (Jan. 17, 2008), <http://www.nature.com/news/2008/080117/full/news.2008.445.html> (“At the top of the ladders, the fish arrive in reservoirs, but because conditions in the reservoirs are not favourable (the waters are too clear and still to provide the cover the fish rely on to hide from predators, or the oxygen they enjoy in

In the end, only a small percentage of fish make it past the dams, especially where there are multiple dams on the same migration route (in which case you wind up with a small percent, multiplied by a small percent, multiplied by a small percent—no math degree needed to see where that leads).⁵⁵ Not surprisingly, this has been the source of substantial ESA conflict, as well as Federal Power Act issues.⁵⁶ Hydropower plants can also cause low dissolved oxygen levels in the water, which is harmful to river habitats, and not addressed by any of the industry tech-fixes.⁵⁷ There are numerous downsides for the aquatic and riparian ecosystems, and little opportunity for improvement. Indeed, many dams have already been torn down for their inability to get enough fish through.⁵⁸

C. THE BOTTOM LINE: REDUCE RELIANCE ON HYDROPOWER GRADUALLY OVER TIME

At this point, substantial innovation has already taken place long ago, with little remaining hope of meaningful improvement. The trend toward “run of the river” hydropower may reduce the flooding of land habitat, but offers little to no improvement for aquatic species. The greatest remaining issue is simply quantity and placement of dams. Because this form of renewable energy lacks the options available to the others for reducing and/or eliminating wildlife impacts, it should be phased out as the others become more developed, but not before substantial displacement of fossil fuel energy has occurred. Dam removal is ultimately the best solution.⁵⁹

ivers), the fish bolt for tributaries to spawn.”). Amazingly, fish ladders can be controversial from both sides, both because environmental advocates argue they are often ineffective, and hydropower developers and operators argue they are unnecessarily costly. Alexandra B. Klass, *Energy and Animals: A History of Conflict*, 3 SAN DIEGO J. CLIMATE & ENERGY L. 159, 177 (2011–12).

55. See, e.g., Kyle J. Mathews, *Who Controls the Fate of the Fish? Interagency Fighting over Section 10(J) of the Federal Power Act*, 74 S. CAL. L. REV. 1165, 1168–69 (2001).

56. For a survey of the fish/dam saga, as well as a general discussion of the environmental impact of dams, see *id.*

57. NAT'L. GEOGRAPHIC, *supra* note 41 (“Hydropower plants can also cause low dissolved oxygen levels in the water, which is harmful to river habitats.”).

58. See, e.g., Jess Bidgood, *Hopes for a Fish Revival as Dam Is Demolished*, N.Y. TIMES, July 26, 2013, at A11.

59. *But see* Nagle, *supra* note 21, at 60 (stating that even dam removal can cause ecological harm).

Although dam removal already takes place from time to time, and policies favoring renewable energy now tend to exclude hydropower,⁶⁰ the vast majority of hydropower dams constructed are still in operation today, blocking off migration paths for many vulnerable fish species.⁶¹ This practice will never be capable of peaceful coexistence with the ESA. Even so, it is important that we not shift from hydropower to increased burning of fossil fuels, so dams should be phased out gradually in tandem with development of other sources of renewable energy, and after the phasing out of existing fossil fuel sources. While it may take some time, these monstrous structures choking off the nation's rivers should eventually become relics of the past. Juxtaposed with images of windmills and solar panels, dams already seem archaic.

II. WIND ENERGY

While hydropower was the most popular form of renewable energy in the twentieth century, wind has taken that role in the twenty-first century, especially in the United States, which “represented roughly 29% of global installed capacity in 2012.”⁶² The U.S. wind industry is developing at a gold-rush pace, having added over thirty-five percent of all new generating capacity over the past four years, second only to natural gas, and greater than nuclear and coal combined.⁶³ Wind energy became the number one source of *new* U.S.

60. See, e.g., Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, 660 (2005) (codified as amended in scattered sections of 16 and 42 U.S.C.) (directing the U.S. Departments of Interior and Energy to place at least 10,000 megawatts of non-hydroelectric renewable energy on public lands by 2015).

61. See *Frequently Asked Questions*, NAT'L HYDROPOWER ASS'N, <http://www.hydro.org/tech-and-policy/faq/#882> (last visited Nov. 3, 2013) (discussing the number of operational hydroelectric facilities).

62. U.S. DEP'T OF ENERGY, 2012 WIND TECHNOLOGIES MARKET REPORT 6 (2012), available at http://www1.eere.energy.gov/wind/pdfs/2012_wind_technologies_market_report.pdf; see also Lauren Cox, *What Will It Take for U.S. Wind Energy to Take Off?*, POPULAR MECHANICS (July 5, 2013), <http://www.popularmechanics.com/science/energy/solar-wind/what-will-it-take-for-us-wind-energy-to-take-off-15657606> (“Windmills aren’t the solitary, squeaky sentinels spinning on the horizon anymore. They’ve evolved into sleek towers with blades hundreds of feet long, grouped together in massive wind farms.”).

63. See U.S. DEP'T OF ENERGY, U.S. DEPARTMENT OF ENERGY'S WIND PROGRAM—LASTING IMPRESSIONS (2012), available at http://www1.eere.energy.gov/wind/pdfs/wind_accomplishments.pdf.

electricity generating capacity for the first time in 2012, providing about forty-three percent of all new generating capacity.⁶⁴ Wind is both endlessly renewable and clean, in that it produces no pollution. Because wind is free, operational costs are negligible after the initial development investment.⁶⁵ In many ways, wind is the perfect energy source, limited only by the difficulties of transmission (because we cannot have turbines everywhere) and storage (because wind is not consistent but ebbs and flows). Because of its popularity and relative harmlessness, the ESA presents itself as one of very few hurdles for wind energy, but a substantial one nonetheless.

A. THE TROUBLE WITH WIND: BIRDS AND BATS

Bird collisions are the best-known problem with wind turbines.⁶⁶ Such collisions have caused struggles with both the Migratory Bird Treaty Act and the ESA.⁶⁷ Wind proponents correctly point out that far more birds are killed by other causes, such as housecats and collisions with glass, than by wind turbines.⁶⁸ But that is not relevant to the application of the ESA—indeed, the fact that listed birds have many other threats renders them even more vulnerable to the “takes” by

64. See Brian Scheid, *Wind Became Leading Source of New US Generating Capacity in 2012*: DOE, PLATTS: MCGRAW HILL FINANCIAL (Aug. 6, 2013, 11:35 AM), <http://www.platts.com/latest-news/electric-power/washington/wind-became-leading-source-of-new-us-generating-21381199>.

65. See, e.g., *Wind Energy FAQ*, NOOR POWER ENERGY DMCC, <http://www.noorpower.com/faq/windfaq.html#w10> (last visited Nov. 3, 2013) (“[A]nnual maintenance cost for wind turbines are in the range of approximately 2% of the installed cost.”).

66. See *Birds and Wind Development*, AM. BIRD CONSERVANCY, http://www.abcbirds.org/abcprograms/policy/collisions/wind_developments.html (last visited Oct 7, 2013) (“In 2009, the U.S. Fish & Wildlife Service estimated that 440,000 birds per year were killed by U.S. wind turbines and included this figure in the agency’s 2013 budget request to Congress. But in 2012, the agency changed how it describes the estimate and now says it maintains no official number. More recently, researcher K. Shawn Smallwood, well-known for his work at Altamont Pass, has estimated 573,000 bird fatalities/year (including 83,000 raptor fatalities) from wind turbines in the United States in 2012.”).

67. See generally John Arnold McKinsey, *Regulating Avian Impacts Under the Migratory Bird Treaty Act and Other Laws: The Wind Industry Collides with One of Its Own, the Environmental Protection Movement*, 28 ENERGY L.J. 71 (2007) (discussing avian impacts under various laws).

68. See Marc Lallanilla, *How Do Wind Turbines Kill Birds?* LIVE SCI. (May 14, 2013, 12:39 PM), <http://www.livescience.com/31995-how-do-wind-turbines-kill-birds.html>.

the wind industry. There is no free pass to take listed species, neither where work is environmentally valuable nor because there are many more takes by activities that are tougher to regulate.⁶⁹

Bats have been at least as problematic as birds—it was hoped that their echolocation ability would enable them to avoid wind turbines, but tragically they are instead attracted to the sites.⁷⁰ Of particular concern is the endangered Indiana bat, which has had substantial conflicts with wind energy development, serving as a meaningful source of delay in progress.⁷¹ For bats, the problem goes beyond just collisions:

Research shows, and the parties agree, that wind energy facilities cause bat mortality and injuries through both turbine collisions and barotrauma . . . Barotrauma is damage caused to enclosed air-containing cavities (e.g., the lungs, eardrums, etc.) as a result of a rapid change in external pressure, usually from high to low.⁷²

Moreover, there have been more frequent issues with habitat destruction, such as when wind developers wish to place turbines near a bat roosting area. “For example, the cutting of trees may kill or injure roosting bats and destroy potential roosting sites.”⁷³ In the *Beech Ridge* case, the court enjoined a wind project because the developer had not obtained an incidental take permit (ITP) from the FWS, which would have required it to create an HCP.⁷⁴ This case is more than just an example, as it may well have served to lower the bar for plaintiffs in such cases,⁷⁵ creating the likelihood of more litigation in the future. Do not be fooled by the Indiana bat’s

69. See J.B. Ruhl, *Harmonizing Commercial Wind Power and the Endangered Species Act Through Administrative Reform*, 65 VAND. L. REV. 1769, 1770 (2012) (“[W]ind power has no ‘green pass’ to get out of the ESA.”).

70. See Brian Handwerk, *Wind Turbines Give Bats the “Bends,” Study Finds*, NAT’L GEOGRAPHIC NEWS (Apr. 25, 2008), <http://news.nationalgeographic.com/news/2008/08/080825-bat-bends.html>; see also *Animal Welfare Inst. v. Beech Ridge Energy LLC*, 675 F. Supp. 2d 540, 569, 576 (D. Md. 2009) (finding that a wind turbine project site created “habitat ‘sinks’ that attract Indiana bats” by creating more edge forest, which increases insect prey for bats, as well as by funneling the bats toward the turbines via transmission corridors).

71. Nathan Hurst, *Battered Down*, OUTSIDE MAG. (Nov. 15, 2011), <http://www.outsideonline.com/outdoor-adventure/the-gist/Battered-Down.html>.

72. *Beech Ridge Energy*, 675 F. Supp. 2d at 547.

73. *Id.* at 548.

74. *Id.* at 580.

75. See Ruhl, *supra* note 69, at 1786.

name, as its current range includes at least twenty mid-western and eastern states,⁷⁶ and so the impediment to wind development is substantial. Of course, habitat destruction poses problems for land-based wildlife as well, as happened with a population of black bears placed at risk by a proposed wind farm in Vermont.⁷⁷ Indeed, wind power requires around 100 times (or more) the amount of land area per megawatt developed as coal or nuclear energy.⁷⁸

Wind energy development has been significantly slowed, as well as rendered more costly, by the numerous environmental lawsuits against developers.⁷⁹ It only stands to reason that the effort to expand the use of wind energy would benefit from some adjustments in approach that render it more wildlife-friendly.

B. THE TECH-BASED SOLUTIONS FOR WIND DEVELOPMENT

Although a set of windmills on rolling hills can be a bucolic scene, the manner in which they confuse and then assault birds is actually quite violent. “Turbine blades appear to be moving slowly, but they reach speeds of nearly 170 miles per hour at the tip of the blade,” so birds are caught by surprise and often sliced into pieces.⁸⁰ The FWS estimated that collisions with wind turbines were killing nearly half a million birds per year when it published its 2012 Land-Based Wind Energy Guidelines.⁸¹ These guidelines suggest best practices in order to avoid collisions and habitat loss or fragmentation, among other issues for wildlife.⁸² A major focus of the guidelines, as with most policy efforts relating to wind development thus far,

76. *Indiana Bat (Myotis Sodalis), Endangered Species*, U.S. FISH & WILDLIFE SERVICE, <http://www.fws.gov/midwest/endangered/mammals/inba/inbafactsht.html> (last updated Feb. 25, 2013).

77. See Reed Elizabeth Loder, *Breath of Life: Ethical Wind Power and Wildlife*, 10 VT. J. ENVTL. L. 507, 509–10 (2009).

78. See Klass, *supra* note 54, at 184.

79. For a review of such litigation, see Nagle, *supra* note 21.

80. *Id.* at 63.

81. See *Wildlife Concerns Associated with Wind Energy Development*, U.S. FISH & WILDLIFE SERVICE, <http://www.fws.gov/midwest/wind/wildlifeconcerns.html> (last updated Oct. 29, 2012).

82. U.S. FISH & WILDLIFE SERV., U.S. FISH AND WILDLIFE SERVICE LAND-BASED WIND ENERGY GUIDELINES 49–52 (2012), available at http://www.fws.gov/windenergy/docs/WEG_final.pdf.

is on siting to avoid major migratory pathways.⁸³ Location is one extremely important issue that is getting a great deal of attention already, so this Essay remains focused on the construction, operation, and design issues, which also make a significant difference for birds.

Unlike hydropower, wind has yet to run out of ideas that would allow it to live in harmony with the listed species it would otherwise harm. The last decade has seen substantial research and development for wind technology, both in terms of efficiency (a twice-as-efficient turbine causes half the harm per megawatt provided) and more directly protective measures for birds and bats.⁸⁴ Some of the newest designs even create the possibility of zero collisions, and others hold potential for very few.⁸⁵ The designs discussed here have been prototype tested, but are just now coming into the market, and thus not yet in widespread use. While this is certainly a caveat, it should be noted that we are laying down a widespread and long-term new infrastructure, and it is preferable to address as many issues as possible at the start rather than be forced to upgrade later. It may be advisable to slow down just enough to determine whether any of the newly-emerging technologies hold the potential to be scaled-up from prototypes to wind farms.

Not surprisingly, many innovators are focusing on efficient collection of wind energy, in order to maximize the value of each turbine. One promising development in this area is the “wind lens,” which has an inward curving ring surrounding the turbine’s blades as they rotate, creating a pocket of low pressure in front of the turbine.⁸⁶ “This has the effect of directing and accelerating the airflow as it enters the blade zone, effectively doubling or even tripling a wind turbine’s power output.”⁸⁷ It also, albeit to a lesser extent than with the next two examples, may reduce the likelihood of collisions due to the stillness and visibility of the surrounding ring. The efficiency itself, however, reduces the burden on habitat, given

83. *See id.* at vi.

84. *See infra* note 93 and accompanying text.

85. *See infra* notes 89–90, 100–01 and accompanying text.

86. *Is the ‘Wind Lens’ a Green Energy Breakthrough?*, EARTHEASY.COM (Mar. 23, 2012), <http://eartheasy.com/blog/2012/03/is-the-wind-lens-a-green-energy-breakthrough/>.

87. *Id.*

that less space is needed to provide the same amount of energy.⁸⁸

In the area of collision-avoidance technology, there are two especially notable approaches emerging. The first is to enclose the blades in a cone or drum.⁸⁹ The wind that flows through the device spins the blades, but the blades are virtually inaccessible to birds.⁹⁰ This approach has been picked up by secondary innovators since its original design, resulting in several variations on the theme. Although this design is sometimes referred to as “bladeless,” because the blades are hidden, another design that has tested well in prototype is truly bladeless.⁹¹ Drawing from the concept of sails to capture wind and deliver ships across oceans, the bladeless wind energy collector is a giant round sail (it looks almost like a satellite dish, but flexible and not as dense) that oscillates in the wind and “drives small pistons connected to a hydraulic system. The kinetic energy captured can be stored or converted directly into electricity with a generator.”⁹² Saphon Energy touts the device as costing about half as much as traditional turbines to manufacture while operating twice as efficiently,⁹³ a claim that, if true (or even slightly exaggerated) would make this approach highly desirable, especially in less optimal siting areas. In any event, it would certainly make sense, before embarking on the most rapid and widespread development of our generation, to consider these new technologies in the process.

C. THE BOTTOM LINE: NUDGE INDUSTRY TO NEW TECHNOLOGIES VIA REGIONAL HCPS

As a matter of policy, it is important to approach the encouragement of bird-saving technology carefully. On the one hand, mere guidelines or suggestions provide no teeth and no

88. *See id.*

89. *See, e.g.,* Alyssa Danigelis, ‘Bladeless’ Wind Turbine Spares Birds, DISCOVERY NEWS (Sept. 4, 2012, 7:47 PM), <http://news.discovery.com/tech/bladeless-wind-turbine-spare-birds-120904.htm>.

90. *Id.*

91. *See* DNEWS Editors, *Bladeless Wind Turbine Inspired by Sails*, DISCOVERY NEWS (Nov. 12, 2012, 12:41 PM), <http://news.discovery.com/tech/alternative-power-sources/bladeless-wind-turbine-saphon-energy-121112.htm>.

92. *Id.*

93. *Breakthrough in Wind Energy Technology*, CHOOSE NATURALLY (Nov. 7, 2012), <http://choosenaturally.com/breakthrough-in-wind-energy-technology/>.

guarantee they will be followed. On the other hand, being too rigid, such as requiring the use of these new technologies across the board, could slow progress in a desperately needed area of development. After all, the single greatest danger to wildlife is climate change.⁹⁴ This is why I recommend layering the technology fixes into the regional HCP (RHCP) and ITPs along with the siting preferences already being placed there.

There is a broad movement toward creating RHCPs to reduce both risk and delay (thus encouraging more rapid development of renewable energy), and it is becoming especially prevalent in the wind context, albeit mostly in early stages as of this writing.⁹⁵ The Great Plains Wind Energy HCP, for example (which is now in the crafting stage in consultation with the FWS), covers a 200-mile wide corridor across nine states: North Dakota, South Dakota, Montana, Colorado, Nebraska, Kansas, New Mexico, Oklahoma, and Texas.⁹⁶ This is the country's most ideal area for wind development based on wind conditions, but within it are areas of varying popularity for bird migration.⁹⁷ This RHCP will apply to all companies that wish to develop wind energy in the region,⁹⁸ so what goes into it is extremely important.

The ITP development process already enables the FWS to assist the developer in identifying siting options less likely to destroy essential habitat or interfere with migration (using landscape assessment tools now available online through the

94. See *Threats, Overview*, WORLD WILDLIFE FED'N, <http://worldwildlife.org/threats/climate-change> (last visited Oct. 10, 2013). See generally Robbins, *supra* note 20.

95. See, e.g., *Midwest Wind Habitat Conservation Plan*, U.S. FISH & WILDLIFE SERVICE, <http://www.fws.gov/midwest/endangered/permits/hcp/r3wind/index.html> (last visited Oct. 20, 2013) ("To meet the growing demand for rapid approval of wind energy plants, yet ensure conservation of federally-listed species, the Service and a coalition of eight states, The Conservation Fund, and representatives of the wind energy industry are preparing a Multi-Species Habitat Conservation Plan.").

96. See GREAT PLAINS WIND ENERGY HABITAT CONSERVATION PLAN, <http://www.greatplainswindhcp.org/index-2.html> (last visited Oct. 24, 2013).

97. See *The Importance of the Great Plains Wind HCP*, GREAT PLAINS WIND ENERGY HABITAT CONSERVATION PLAN, <http://www.greatplainswindhcp.org/aboutthehcp.html> (last visited Nov. 3, 2013).

98. *Id.*

American Wind Wildlife Institute and other sources).⁹⁹ Why stop there? Siting is not a black-and-white, “it’s good or it’s bad,” sort of issue, but rather exists on a spectrum of risk-level to wildlife. In addition to limiting siting options and requiring mitigation (already in these budding RHCPs), the FWS is in a position to establish preferences that push us toward the technological advances that render wind turbines far less hazardous to wildlife. This does not have to be a draconian measure that slows progress, but rather can result in an *expansion* of the siting areas available. I propose a ranking of landscapes within the RHCP, rather than a mere thumbs up or thumbs down approach. There would still be some high value habitat defined as hands-off, as well as some areas of least concern in which there are no tech-based restrictions, but there can also be areas with moderate migratory use in which developers may place bladeless turbines, or more broadly, turbines that meet a certain standard of wildlife protection. It is neither necessary nor advisable to mandate a specific technology, but simply to set higher standards for such areas that might be met with developing technologies. Such an approach may well increase the total land area available for wind development. It could also lead to greater technological innovation in an effort to make full use of the wind development potential.

In addition to the construction solutions suggested in the bird context, bats can also benefit from operational mitigation techniques such as raising the turbine’s “cut-in speed” (the wind speed at which the spinning blades of a turbine start to produce electricity into the power grid) during periods of high bat activity.¹⁰⁰ This has been shown to yield significant reductions in bat fatalities.¹⁰¹ Such requirements are likewise

99. See *Seeing the Big Picture*, AM. WIND WILDLIFE INST., <http://www.awwi.org/initiatives/landscape.aspx> (last visited Oct. 7, 2013).

100. See *Animal Welfare Inst. v. Beech Ridge Energy*, 675 F. Supp. 2d 540, 554 n.15 (2009) (“In the context of wind turbines, adaptive management techniques may include, for example, changing the cut-in speed and feathering the blades to prevent the turbines from operating when Indiana bats are most likely to be present.”).

101. See Edward B. Arnett et al., *Altering Turbine Speed Reduces Bat Mortality at Wind-Energy Facilities*, FRONTIERS ECOLOGY & ENV’T, May, 2011, at 209, 209; *Slight Change in Wind Turbine Speed Significantly Reduces Bat Mortality*, SCI. NEWS (Nov. 3, 2010), <http://www.sciencedaily.com/releases/2010/11/101101115619.htm>.

appropriate for inclusion in RHCPs. Numerous other best management practices have been identified for protecting wildlife from the perils of wind development,¹⁰² providing yet more tools for reducing conflicts with the ESA going forward.

III. SOLAR POWER

Albeit not as rapidly-expanding as wind (something that may change as the solar cell technology gets less expensive), solar power is quite possibly the most promising source of renewable energy, given how quickly and relatively cleanly it could provide all our energy needs.¹⁰³ The planet receives more energy from the sun in an hour than it takes to power the entire world for a year.¹⁰⁴ The cost of photovoltaic (PV) solar technology has been plummeting, giving it the potential to become the most cost-effective route to escaping fossil fuels.¹⁰⁵ Several companies provide financing for small-scale

102. See Hadassah M. Reimer & Sandra A. Snodgrass, *Tortoises, Bats, and Birds, Oh My: Protected-Species Implications for Renewable Energy Projects*, 46 IDAHO L. REV. 545, 567–69 (2010) (listing best management practices developed by government impact studies). Of course, FWS draws from its own 2012 Wind Energy Guidelines (which were otherwise voluntary) in designing ITPs as well.

103. See, e.g., Ramez Naam, *The Limits of the Earth, Part 2: Expanding the Limits*, SCI. AM. BLOGS (Apr. 18, 2013), <http://blogs.scientificamerican.com/guest-blog/2013/04/18/the-limits-of-the-earth-part-2-expanding-the-limits/> (“[The] energy [from the sun] is so vast that solar panels on less than 0.3% of the Earth’s land area would supply many times more energy than humanity needs for the next few decades.”).

104. *Solar Energy*, NAT’L GEOGRAPHIC, <http://environment.nationalgeographic.com/environment/global-warming/solar-power-profile/#> (last visited Oct. 24, 2013).

105. See Klass, *supra* note 54, at 191–92. As Klass explains, Solar energy is harnessed commercially primarily through the use of two main technologies: concentrating solar power (“CSP”) and photovoltaic (“PV”). As of 2011, the total CSP and PV electric power capacity installed in the United States was approximately 3,650 MW. CSP converts solar power into thermal energy by using mirrors or lenses to concentrate radiation onto a receiver. Because the most cost-efficient CSP plants are often large, they are typically associated with energy suppliers to utilities or with utilities themselves. By contrast, a PV system, the most common method of using solar power, converts sunlight into energy when solar radiation hits a semiconductor, releasing electrons. PV systems, which allow for solar energy production on a smaller level, generally consist of ground mounted or roof mounted panels, which contain several individual solar cells or a single thin layer.

Id. (footnotes omitted).

installations, rendering it initially cost-free to set up, with payments replacing traditional utility bills thereafter.¹⁰⁶ We see distributed energy development increasing with both wind and solar, but these recent developments render solar far more attractive than wind on this smaller scale (especially when considering the quality of life issues with traditional wind turbines, which have placed wind squarely in NIMBY territory). Distributed sources of solar power are becoming popular both in the context of adding panels to existing rooftops as well as planning entire new residential or commercial complexes with solar-paneled rooftops throughout. However, the majority of new solar energy development planning is in the commercial context, and concentrated utility-scale solar power is a relatively land-intensive energy source per megawatt of power.¹⁰⁷

A. THE TROUBLE WITH SOLAR: DESERT HABITAT

If you are going to invest in a massive solar panel farm, it is only reasonable to want to place it in the sunniest place you can find. Thus, naturally, the desert southwest is highly desirable for this enterprise. Unfortunately it is also an already-dwindling ecosystem type, thanks to prior human development activity. Many species depend on this desert habitat, but the face of the problem has been provided by the desert tortoise. This oddly charismatic creature has experienced a ninety percent decline in the last half-century,

106. See, e.g., Shamsiah Ali-Oettinger, *US: SolarWorld Extends Financing Program*, PV MAG. (Aug. 1, 2013), http://www.pv-magazine.com/news/details/beitrag/us—solarworld-extends-financing-program-_100012226/#axzz2jd0qx51l.

107. Cf. *Solar Energy*, U.S. DEPT INTERIOR, BUREAU LAND MGMT., http://www.blm.gov/wo/st/en/prog/energy/solar_energy.html (last visited Oct. 20, 2013) (“The Western Solar Plan provides a blueprint for utility-scale solar energy permitting in Arizona, California, Colorado, Nevada, New Mexico and Utah by establishing solar energy zones with access to existing or planned transmission, incentives for development within those zones, and a process through which to consider additional zones and solar projects. The Western Solar Plan established an initial set of 17 Solar Energy Zones, totaling about 285,000 acres of public lands, that serve as priority areas for commercial-scale solar development, with the potential for additional zones through ongoing and future regional planning processes.”).

and is now listed as threatened under the ESA.¹⁰⁸ Because of their long life cycle (with a trajectory similar to ours both in life-span and reproductive timing), it is difficult for populations to bounce back quickly from disturbances.¹⁰⁹ This means that once the population is small, even ideal conditions for growth can only work if maintained for many years. This may render the desert tortoise a lost cause, but the ESA as presently drafted does not take this into account.

Desert tortoise habitat is the most desirable area for utility-scale solar energy siting.¹¹⁰ Some have argued that filling the desert with solar panels is the only way to attain a fully solar-powered America.¹¹¹ Studies in which populations of the tortoise were translocated and tracked (for solar power development in their former habitat) found that assisted migration of desert tortoise populations led to overwhelmingly poor outcomes.¹¹² Thus, siting becomes the key issue, as the tortoise will need to stay in its existing habitat. On the other hand, this also further suggests that, in the face of climate change pressuring many species migrations, the desert tortoise may well be lost. With regard to the issue of siting utility-scale solar panel fields, as mentioned above, other scholars have focused on issues relating to such siting choices. It is beyond the scope of this technology-policy-focused Essay. One thing is

108. 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>.

109. See *Lifecycle of the Desert Tortoise*, DESERT TORTOISE PRESERVE COMM., INC., <http://www.tortoise-tracks.org/wptortoisetracks/about-the-desert-tortoise/lifecycle-of-the-desert-tortoise/> (last visited Nov. 3, 2013).

110. Wells, *supra* note 108.

111. See, e.g., Dave Levitan, *Is Anything Stopping a Truly Massive Build-Out of Desert Solar Power?*, SCI. AM. (July 1, 2013), <http://www.scientificamerican.com/article.cfm?id=challenges-for-desert-solar-power> ("The appeal of building solar power plants in deserts like Ivanpah's Mojave is obvious, especially when the mind-blowing statistics get thrown around, such as: The world's deserts receive more energy beamed down from the sun in six hours than humankind uses in a year.").

112. See, e.g., KRISTIN H. BERRY, ASHLEY EMERSON & TIMOTHY GOWAN, THE STATUS OF 158 DESERT TORTOISES 33 MONTHS AFTER TRANSLOCATION FROM FT. IRWIN 7 (2011), available at <http://www.deserttortoise.org/abstracts/2011DTCSymposiumAbstracts.pdf>; U.S. FISH & WILDLIFE SERV., HEALTH ASSESSMENT PROCEDURES FOR THE MOJAVE DESERT TORTOISE (*GOPHERUS AGASSIZII*): A HANDBOOK PERTINENT TO TRANSLOCATION (2013), available at http://www.fws.gov/nevada/desert_tortoise/documents/reports/2013/assess/Ma y2013-Desert-tortoise-health-eval-handbook.pdf.

clear, however: focusing on the desert has not benefitted the solar power industry, but rather has been a source of great delay and expense.¹¹³

B. THE TECH-BASED SOLUTIONS FOR SOLAR POWER

Because the only wildlife issue with solar power is habitat destruction for the space taken up by the panels, there is little wildlife benefit to technological changes to those panels, apart from increasing efficiency and thereby generating more energy in a smaller area. That said, the best solution is somewhat of a siting and technological hybrid: distributed energy development (typically referred to as DG for distributed generation).¹¹⁴ DG involves the scattering of rooftop panels (or turbines, in the wind context) on different parcels of private property rather than concentrating the panels in one large field.¹¹⁵ It is generally associated with individualized power generation for private consumption rather than commercial use, but the latter is a growing use.¹¹⁶ It is especially workable to move distributed energy into the commercial energy context in more populated regions.

The primary ESA-related value to DG for solar development is that it gets the industry out of the desert and out of other undisturbed or only partially disturbed lands.¹¹⁷ Rather than placing the panels on desert tortoise habitat,

113. See Julie Cart, *Saving Desert Tortoises Is a Costly Hurdle for Solar Projects*, L.A. TIMES, Mar. 4, 2012, <http://articles.latimes.com/2012/mar/04/local/la-me-solar-tortoise-20120304>.

114. See, e.g., *Introduction to Distributed Generation*, NAT'L GRID, http://www.nationalgridus.com/masselectric/business/energyeff/4_introduction.asp (last visited Oct. 20, 2013).

115. See *id.* ("In general, DG systems produce power for the buildings which the systems are connected to (e.g., solar panels on a home or business). Renewable DG systems are able to provide power with minimal impact on the environment.")

116. See Kiera Bulter, *Big Solar's Death Panels*, MOTHER JONES, <http://www.motherjones.com/environment/2011/03/solar-panels-desert-tortoise-mojave> (last visited Oct. 20, 2013).

117. The Department of Interior's 2013 plan to utilize disturbed lands is a step in the right direction, but insufficient, as they are still proposing areas of desert tortoise habitat and will still need a substantial transmission infrastructure. See Press Release, Dep't of the Interior, Secretary Salazar Finalizes Plan to Establish Renewable Energy Zone on Public Lands in Arizona (Jan. 18, 2013), available at <http://www.doi.gov/news/pressreleases/secretary-salazar-finalizes-plan-to-establish-renewable-energy-zone-on-public-lands-in-arizona.cfm>.

creating time-consuming conflicts with the ESA, panels are placed on rooftops. Even if it weren't for the desert tortoise habitat, nationwide transmission lines are still an issue, as they disrupt and fragment habitat in a variety of ecosystems.¹¹⁸ This is another advantage to distributed energy, which typically places the energy generation close to the demand for that energy. Although even DG will raise some issues for wildlife requiring compliance with the ESA, the extent of this conflict pales in comparison to concentrated renewable energy development.¹¹⁹

C. THE BOTTOM LINE: DISTRIBUTED ENERGY PREFERENCE FOR SOLAR DEVELOPMENT

If every suitable rooftop had solar panels, it would create enough power for much of the country.¹²⁰ Combined with wind energy designed with care, it may be possible to shift to a fully renewable energy infrastructure with minimal impact on wildlife. Sungevity, one of many companies that provide solar panels for homeowners, heads its website with the phrase, "Going solar—it's a cinch."¹²¹ Solar panels can be leased with zero money down.¹²² With the addition of stronger government-sponsored incentives (including feed-in tariffs, described below), solar power would become the obvious choice for homeowners nationwide. Saying no to blanketing the desert southwest with solar panels need not mean saying no to solar

118. See J.B. Ruhl, *Harmonizing Distributed Energy and the Endangered Species Act*, 4 SAN DIEGO J. CLIMATE & ENERGY L. 121, 122 (2012–13) ("Expansive solar panel arrays could potentially displace endangered species habitat, the dozens of turbines concentrated in commercial wind farms present obvious concerns for endangered birds and bats, and the new transmission lines needed to move power from these distant generation sources to consumers will consume habitat and pose risks to a broad range of species.").

119. See *id.* at 124 ("The utility-scale renewable energy industry, particularly the wind power industry, has been working feverishly over the past few years to forge ESA compliance solutions to fulfill the nation's policy of getting facilities sited and generating green electrons.").

120. See, e.g., Nick Brass, *If Every House Had Solar . . .*, CLIMATE SPECTATOR (Apr. 11, 2013, 12:03 PM), <http://www.businessspectator.com.au/article/2013/4/11/solar-energy/if-every-house-had-solar> ("[A]pproximately 134 percent of the country's residential electricity needs could be met if every suitable rooftop was converted into a solar power station.").

121. *Sungevity Experience*, SUNGEVITY, <http://www.sungevity.com/sungevity-experience> (last visited Oct. 24, 2013).

122. *Id.*

energy. The choice between giving up solar power or desert tortoises is a straw man, as we are not limited to these options.

In addition to encouraging privatized distributed energy development, we should consider a program in which regional utilities obtain rooftop easements for commercial-scale rooftop panel development, utilizing both a streamlined leasing structure and a feed-in tariff approach.¹²³ This method of utility-scale development is a bit more expensive than concentrated desert solar fields, but drastically better for wildlife.¹²⁴ Because there is little financial incentive to favor this approach, policies are needed to encourage it. A feed-in tariff is a government subsidy to cover the difference between the cost of generating renewable energy (especially the initial costs, which are highest, then it ratchets down) and what fossil-fuel energy would have cost, in order to encourage renewable energy development.¹²⁵ It is especially popular in the DG context, and most programs allow homeowners to actually profit, or at least save money compared to what they were spending on energy prior to installing solar panels.¹²⁶

Because the ESA requires all federal agencies to “utilize their authorities in furtherance of the purposes of this [Act] by carrying out programs for the conservation of endangered species and threatened species,”¹²⁷ an argument could be made that the Department of Energy (DOE) is required to direct its subsidy resources toward such programs and away from fossil fuels. Not only are the ESA listed species imperiled by climate change, but subsidizing solar DG would take the pressure off desert habitat. Although the DOE does provide subsidies for renewable energy development, it has not made adequate effort to prioritize DG, for which feed-in tariffs have become the standard.¹²⁸ Unfortunately, the Departments of Energy and

123. See *Feed-in Tariff: A Policy Tool Encouraging Deployment of Renewable Electricity Technologies*, U.S. ENERGY INFO. ADMIN. (May 30, 2013), <http://www.eia.gov/todayinenergy/detail.cfm?id=11471>.

124. Naturally, many small development projects will cost more than a single large one adding up to the same total coverage area.

125. See *Feed-in Tariff: A Policy Tool Encouraging Deployment of Renewable Electricity Technologies*, *supra* note 123.

126. *Id.*

127. 16 U.S.C. § 1536(a)(1) (2012).

128. That said, the DOE does have one interesting DG program underway at the time of this writing, called the “Solar Decathlon,” in which collegiate teams compete to design the best solar-powered house. See *The Solar*

Interior remain largely focused on approving large-scale centralized projects.¹²⁹

The U.S. Energy Information Administration describes feed-in tariffs as an excellent approach, modeled after Germany's pioneering program forcing utilities to purchase the power generated by private individuals, rare around the United States (just localized programs) but quite common in other countries.¹³⁰ Nevertheless, the Obama administration continues to invest its resources in planning for land-intensive projects. On July 24, 2012, the U.S. Department of the Interior issued a press release regarding its environmental impact statement for solar energy development, which made no mention of the wildlife issues raised in the study of their permitting plans for hundreds of thousands of acres to be utilized for solar development.¹³¹ The public gets excited about the benefits without being made aware of the harms or the alternative means of reaching the same benefits.

A DG-favoring feed-in tariff system does not result in a move away from utility-scale development, it simply forces the industry to take a more scattered approach to its commercial solar energy development. When rooftops become more valuable to development, rather than wide open ranges of wildlife habitat, business comes to the rooftops, leasing them from homeowners to take advantage of feed-in tariff programs on a larger commercial scale. A perfect example of this can be seen in Gainesville, Florida, where a municipality has created one of the most successful feed-in tariff programs in the

Decathlon Competition, U.S. DEPT ENERGY SOLAR DECATHLON, <http://www.solardecathlon.gov/competition.html> (last visited Oct. 13, 2013).

129. Most recently, in mid-June 2013, huge solar developments were approved. See Press Release, Dep't of the Interior, Secretary Jewell Announces Approval of Three Renewable Energy Projects in Arizona and Nevada (June 3, 2013), available at <http://www.doi.gov/news/pressreleases/secretary-jewell-announces-approval-of-three-renewable-energy-projects-in-arizona-and-nevada.cfm>; U.S. DEPT OF ENERGY, *DOI Approves Three Renewable Energy Projects in Arizona and Nevada*, EERE NEWS (June 12, 2013), http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=19358.

130. See U.S. DEPT OF ENERGY, *supra* note 129.

131. See *Obama Administration Releases Roadmap for Solar Energy Development on Public Lands*, U.S. DEPT INTERIOR (July 24, 2012), http://solareis.anl.gov/documents/docs/PressRelease_Final_Solar_PEIS.pdf.

world.¹³² Utility companies have been clamoring for rooftop leases, each submitting dozens of projects simultaneously for the program, creating jobs, successful businesses, increased solar energy output, and benefitting both homeowners and commercial property owners who profit from leasing their rooftops to this new brand of energy companies.¹³³

In addition to the DOE better incentivizing DG, it will also be necessary for the FWS to stand more firmly with regard to protecting desert tortoise habitat. Audience members at this symposium presentation argued that doing so will put a halt to solar energy progress,¹³⁴ but the success of feed-in tariffs in other countries suggests otherwise. More likely, it will direct solar development into more wildlife-friendly channels. It is only due to the lack of viable options that the pressure is so high to compromise on this already-dwindling habitat. Instead of pitting green against green, the climate greens and wildlife greens (who have a lot in common and substantial overlap in membership) should be working together to accelerate rooftop solar development.

CONCLUSION

There remain many impediments to renewable energy development, including the inadequacy of federal support for progress in the area.¹³⁵ Reducing conflict with the ESA will not serve as a panacea for this much-needed shift, but at least it can remove a substantial obstacle. Renewable energy development benefits wildlife by reducing our reliance on fossil fuels and thereby mitigating climate change, which is catastrophic for biodiversity. For this reason, once we render

132. See John Farrell, *Gainesville, Florida, Becomes a World Leader in Solar*, CLEAN TECHNICA (Jan. 6, 2012), <http://cleantechnica.com/2012/01/06/gainesville-florida-becomes-a-world-leader-in-solar/>.

133. See Christopher Curry, *50 Projects Picked for Feed-in Tariff; Residential Capacity Still Available*, GAINSEVILLE SUN (Feb. 20, 2013), <http://www.gainesville.com/article/20130220/ARTICLES/130229930>.

134. This observation is based on the Author's participation in the Consortium on Law and Values in Health, Environment & the Life Sciences 2013 Annual Conference: Legal & Policy Pathways for Energy Innovation, at the University of Minnesota School of Law.

135. See generally Uma Outka, *Environmental Law and Fossil Fuels: Barriers to Renewable Energy*, 65 VAND. L. REV. 1679 (2012) (discussing the existence of subsidies and regulatory support for fossil fuel production but not renewable energy development).

renewable energy development less directly harmful to wildlife, it arguably falls within the ESA's affirmative mandate to all federal agencies to conserve listed species. In this way, the ESA ceases to be the enemy to renewable energy that it is now accused of being, and can actually become one more reason to accelerate such development.