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The Legal-Political Barriers to Ramping Up Hydro (symposium)

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THE LEGAL-POLITICAL BARRIERS TO RAMPING UP HYDRO

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INTRODUCTION

Hydroelectric energy is the oldest major source of non-carbon, renewable energy and is the only conventional renewable resource in the current energy mix. More importantly, hydroelectric energy is a *relatively* climate friendly, non-carbon source of energy. Thus, increased generation of blue-green energy would seem a logical component of any policy designed to help wean the United States from its growing dependence on politically unstable hydrocarbon sources[1] and to help mitigate global climate change. For example, increased hydroelectric generation has been identified as a source of emission credits for coal CO_2 emissions because hydro does not produce significant greenhouse gases.[2]

Conventional hydroelectric generation uses gravity or the energy of a river's flow to produce electricity by three methods. The most efficient way to generate power is to use falling water stored behind a dam in a high elevation canyon to turn a turbine which generates electricity.[3] Gravity does the job. The second method is a run-of-the-river facility which usesthe energy of a river's current to turn the blades of the turbine.[4] These facilities are generally smaller, although some, such as Lower Granite Dam on the

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1. *E.g.*, COUNCIL ON FOREIGN RELATIONS, NATIONAL SECURITY CONSEQUENCES OF U.S. DEPENDENCE ON OIL: REPORT OF A TASK FORCE 3 (2006). "The top five sources of US crude oil imports for June were Canada (2.197 million barrels per day), Saudi Arabia (1.348 million barrels per day), Mexico (1.066 million barrels per day), Nigeria (1.066 million barrels per day), and Venezuela (0.850 million barrels per day). The rest of the top ten sources, in order, were Iraq (0.630 million barrels per day), Russia (0.437 million barrels per day), Angola (0.425 million barrels per day), Colombia (0.287 million barrels per day), and Algeria (0.375 million barrels per day)." U.S. ENERGY INFO. ADMIN., CRUDE OIL AND TOTAL PETROLEUM IMPORTS TOP 15 COUNTRIES, http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/company_level_imports/current/import.html.

2. Reservoirs, however, are a source of methane, a greenhouse gas. *See infra* notes [12–13].

3. U.S. GEOLOGICAL SURVEY, HYDROELECTRIC POWER: HOW IT WORKS, http://ga.water.usgs.gov/edu/hyhowworks.html.

4. U.S. DEP'T OF ENERGY, ENERGY BASICS: LARGE-SCALE HYDROPOWER, available at http://www.eere.energy.gov/basics/renewable_energy/large_scale_hydropower.html.

Snake River in Washington State, are large.[5] The third method uses electricity generated elsewhere and gravity. Pumped storage plants consist of a storage reservoir built on an elevated site such as a river bluff or a cliff.[6] Off-peak electricity is used to pump water from the river or lake up to the reservoir; when peaking power is needed, the water is released to generate electricity.[7]

I. THE POTENTIAL ROLE OF HYDROELECTRIC ENERGY IN A LESS CARBON-DEPENDENT ENERGY FUTURE

The United States currently generates over 300 billion kW h of electricity from hydro plants.[8] The Department of Energy estimates that up to 30,000 MW of electricity could be generated from undeveloped sites.[9] The Electric Power Research Institute estimates that untapped hydro capacity could increase production by twenty-four to twenty-seven percent.[10] The Energy Information Administration puts that total potential increase in hydroelectricity for new and upgraded plants at forty terawatts.[11] Additional hydroelectric capacity could come from the construction of new dams and reservoirs, by increasing the generating capacity of existing facilities or placing hydrokinetic devices in a stream.[12] At existing dams, turbines could be upgraded, more water could be put through existing ones, or new pump storage facilities could be constructed.[13] For example, the Bonneville Power Authority has installed a new turbine at Chief Joseph Dam on the

5. WATER ENCYCLOPEDIA, http://www.waterencyclopedia.com/Ge-Hy/Hydroelectric-Power.html.

6. U.S. GEOLOGICAL SURVEY, *supra* note 3.

7. *Id.*

8. Water Encyclopedia, *supra* note 5.

9. Kim Murphy, *Boom in Hydropower Pits Fish Against Climate*, L.A. TIMES, July 27, 2009 *available at* http://www.latimes.com/sns-green-hydro-power-climate,0,745181.story.

10. Daniel B. Botkin, Powering the Future: A Scientist's Guide to Energy Independence 83 (2010).

11. The National Academies, America's Energy Future: Technology and Transformation 36 (Summary ed. 2009).

12. Hydrokinetic devices float on or below the surface of the river and generate electricity from the current. BOTKIN, *supra* note 10, at 82.

13. The California Department of Water Resources news service reported that two irrigation districts in the Central Valley of California are proposing a billion dollar pumped storage project which will pump water from an existing reservoir to a new dam and reservoir to be construed on the hills above Don Pedro Dam located in the foothills of the Sierra Nevada Mountains. *MID, TID Explore Don Pedro Dam Project*, THE SONORA UNION DEMOCRAT, July 28, 2010, *available at* http://www.uniondemocrat.com/20100728100652/News/Local-News/MID-TID-explore-Don%E2%80%88Pedro-dam-project.

Columbia River, and the upgrade will generate enough power for 30,000 homes in the Pacific Northwest.[14]

No energy policy move is simple, and hydroelectric generation is no exception. Hydro is not completely clean and is an increasingly risky source of energy due to the projected impact of global climate change on river flows.[15] Storage reservoirs, especially those located in the tropics,[16] are a major source of methane emissions.[17] Hydroelectric generation causes other forms of more immediate, major environmental damage—primarily blocked fish runs, degraded downstream and upstream aquatic ecosystems due to temperature, flow changes, decreased downstream sediment transport, and the loss of access to scenic canyons.[18] For example, the chain of Missouri River dams constructed since the 1930s have decreased downstream sediment transport to the detriment of endangered species along the Missouri and contributed to the loss of wetlands in the Mississippi Delta.[19]

Unlike Africa, Asia, and Latin America, the United States has made only feeble and generally unsuccessful efforts to increase hydroelectric production.[20] Efforts to ramp up hydro to promote secure, renewable ener-

14. Shannon Dininny, *Upgrades Underway on Columbia River Dams*, BOSTON GLOBE, May 25, 2010, *available at* http://www.boston.com/business/articles/2010/05/25/upgrades_under_way_at_columbia_river_dams/.

15. In arid areas, the projections are for a net decrease in river run-off due to less snow pack, more rain and greater Spring and Summer evaporation rates. *E.g.*, STEPHEN SAUNDERS ET AL., HOTTER AND DRIER: THE WEST'S CHANGED CLIMATE V, 9, 10 (The Rocky Mountain Climate Organization and the Natural Resources Defense Council 2008); COMM. ON THE SCIENTIFIC BASES OF COLO. RIVER BASIN MGMT., NAT'L RESEARCH COUNCIL, COLORADO BASIN WATER MANAGEMENT: EVALUATING AND ADJUSTING TO HYDROCLIMATIC VARIABILITY 73–92 (2007); and Robert W. Adler, *Climate Change and the Hegemony of State Water Law*, 29 STAN. ENV'TL L. J. 1, 10–17 (2010).

16. Ivan B.T. Lima et al., *Methane Emissions from Large Dams as Renewable Energy Resources: A Developing Nation Perspective*, 13 MITIGATION AND ADAPTATION STRATEGIES FOR GLOBAL CHANGE 193 (2007), *available at* http://tinyurl.com/2bzawj.

17. United Nations Envtl Programme in Cooperation with The World Commission on Dams, Climate Change and Dams: An Analysis of the Linkages Between the UNFCCC Legal Regime and Dams (Nov. 2000) (call for further study because international climate change regime makes no provision for exploring the relationship between dams and climate change). Recent research, which confirms earlier concerns, is summarized in Kirsi Mäkinen and Shahbaz Kahn, *Policy Considerations for Greenhouse Gas Emissions from Freshwater Reservoirs*, 3 Water Alternatives at 91, 95 (2010).

18. *E.g.*, ELIOT PORTER, THE PLACE THAT NO ONE KNEW: GLEN CANYON ON THE COLORADO RIVER (1963) (documentation of the loss of access to the floor of Glen Canyon damned by Glen Canyon Dam at Page, Arizona); Murphy, *supra* note 9. Many developing nations are aggressively building dams, and these generally have substantial adverse social as well as environmental impacts. *See* THAYER SCUDDER, THE FUTURE OF LARGE DAMS: DEALING WITH SOCIAL, ENVIRONMENTAL, INSTITUTIONAL AND POLITICAL COSTS (2005).

19. Michael D. Blum and Harry H. Roberts, Drowning of the Mississippi Delta Due to Insufficient Sediment Supply and Global Sea-Level Rise, 2 NATURE GEOSCIENCE 447, 488 (2009).

20. Africa, Asia, and Latin America are investing in new facilities while most of the North American investment (particularly investments in the United States) is in upgrades of existing ones. EDITORIAL STAFF, HYDRO REVIEW WORLDWIDE, *Hydro Business Report: Regional Overview*, 15

gy trace back to the country's first run at energy independence between 1973 and 1980. In 1978, Congress enacted legislation designed to bring new, smaller, low head plants on line.[21] The carrot was the requirement that public utilities purchase the electricity generated from qualifying facilities.[22] The Federal Energy Regulatory Commission (FERC) interpreted this to be the utility's avoided cost, and the Supreme Court upheld the standard.[23] However, the increased generation produced by the Act is well below the initial expectations.[24]

Global climate change (GCC) adaptation has spurred some calls for a second effort to increase hydro production and perhaps to subordinate environmental protection to power since environmental concerns are relatively easy to trade-off.[25] Increased run-off capture is on the adaptation agenda, and this includes the revival of building new carry-over storage. In May of 2007, Arnold Schwarzenegger, governor of California, called for the construction of two new hydroelectric dams to help meet the state's ambitious greenhouse gas emission targets,[26] although the dire fiscal condition of the state has postponed for the foreseeable future any effort to raise the capital to build new dams.[27] However, many new storage facilities may be small, off-stream dams and reservoirs intended for run-off capture instead of hydroelectric power generation. The capacity of these proposed projects for substantial increased hydroelectric generation is unknown.

This article makes the positive argument that increased hydroelectric generation is an unlikely component of the nation's energy future for four

HYDRO REV. WORLDWIDE (2007), *available at* http://www.hydroworld.com/index/display/article-display/353253/articles/hydro-review-worldwide/volume-15/issue-2/articles/cover-story/hydro-business-report-regionall-overview.html; *see also* Deborah Moore, John Dore & Dipak Gyawali, *The World Commission on Dams + 10: Revisiting the Large Dam Controversy*, 3 WATER ALTERNATIVES at 3, 5 (2010).

21. The Public Utility Regulatory Policies Act of 1978, 16 U.S.C. § 824a *et seq*. (2000).

22. *Id.* at § 824a-3(d).

23. American Paper Institute, Inc. v. American Electric Power Service Corp., 461 U.S. 402, 423 (1983).

24. Steven Ferrey, LAW OF INDEPENDENT POWER 3.4 (1989 with annual supplements).

25. To overcome public opposition to new high voltage power lines, many lines are being planned under rivers and bays. As a president of an offshore cable company noted, "The fish don't vote." Matthew L. Wald, *A Power Line Runs Through It: Underwater Cable an Alternative to Electrical Towers*, N.Y. TIMES, Mar. 17, 2010, at B1, col. 2.

26. Bonner R. Cohen, *Global Warming Creates Need for New Dams: Schwarzenegger*, ENV'T & CLIMATE NEWS, May, 2007, *available at* http://www.heartland.org/environmentandclimate-news.org/article/20949/Global_Warming_Creates_Need_for_New_Dams_Schwarzenegger.html.

27. Michael B. Marois, *California Lawmakers Vote to Postpone $11 Billion Bond Measure*, BUS. WK., Aug. 10, 2010, *available at* http://www.businessweek.com/news/2010-08-10/california-lawmakers-vote-to-postpone-11-billion-bond-measure.html.

related reasons.[28] First, hydro's glory days are past in the United States.[29] The best sites have been developed or protected from dams or smaller facilities. Second, the environmental movement was born from fights to prevent dams and hydroelectric facilities and thus any move would have to reverse the end of the "Big Dam Era."[30] Put differently, the roots of hydro's inability to expand substantially can be traced to the reaction to the water policies of the Progressive Conservation Era (1890–1920). Third, environmental law has moved beyond dam prevention to river restoration. One of the major water-related projects of environmental law is to conserve and restore the hydrographs of managed rivers and even to remove dysfunctional dams.[31] To ramp up hydro, we would have to undo or substantially modify much of environmental law including the Endangered Species and Clean Water Acts.[32] Fourth, we are slowly beginning to appreciate the potential adverse impacts of global climate change on biodiversity. Since these adverse impacts are likely to occur before any projected mitigation kicks in (if ever), we must adapt to climate change.[33] Many adaptation strategies contemplate aquatic ecosystem restoration and conservation.[34] As previously mentioned, the rub is that GCC may contribute to a decrease in river flows during times of high demand. Thus, both reliable flows for

28. A major National Academies of Science study recently reached a similar conclusion. THE NAT'L ACADS., ELECTRICITY FROM RENEWABLE SOURCES: STATUS, PROSPECTS AND IMPEDIMENTS 56 (2010). This conclusion does not hold globally; in Asia, Africa, and South America there is a renewed interest in hydropower and a high level of new dam and reservoir construction.

29. *E.g.*, Christopher G. Pernin et al., Rand Science and Technology, Generating Electric Power in the Pacific Northwest: Implications of Alternative Technologies 8 (2002) ("Current projects show that, in the future, the majority of all new electricity generation in the Northwest—in fact, the entire West—will come from natural-gas-fired plants."). The possibility of the development of large new supplies of shale gas supports this prediction. Amy Myers Jaffe, *How Shale Gas Is Going to Rock the World*, Wall St. J., May 10, 2010, at R1.

30. Environmental law began with the Second Circuit's opinion in *Scenic Hudson Preservation Conference v. Federal Power Commission*, 354 F.2d 608 (2d Cir. 1965), which remanded an FPC license for a pump storage plant because it failed to consider the aesthetic and fishery impacts of a proposed pumped storage plant at Storm King Mountain on the Hudson River, id. at 611, 624.

31. *See* Thomas V. Cech, Principles of Water Resources: History. Development, Management, and Policy 170 (2003).

32. Endangered Species Act of 1973, Pub.L. No. 93-205, 87 Stat. 884 (codified as amended at 16 U.S.C. §§ 1531–1544 (2006)); Federal Water Pollution Control Act (Clean Water Act), ch. 758, 62 Stat. 1155 (1948) (codified as amended at 33 U.S.C. §§ 1251–1387 (2006)).

33. The current thinking is that it will be at least one thousand years before any serious mitigation, which is not now in place, will begin to produce benefits. NAT'L RESEARCH COUNCIL, CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENNIA 46–48 (2010) *available at* http://www.nap.edu/openbook.php?record_id=12877.

34. *See generally id.* at 128–73; *see also, e.g.*, Mass. Dep't of Fish and Game, *Climate Change and Aquatic Ecosystems*, DIVISION OF ECOLOGICAL RESOURCES, *available at* http://www.mass.gov/dfwele/der/climatechange.htm.

power generation[35] and aquatic biodiversity, including recent restoration efforts, will be imperiled.

II. THE RISE AND FALL OF THE BIG DAM ERA

A. From Mills to Large Dams

Water power has been used to turn wheels to divert water for irrigation and to grind grain and other commodities for millennia.[36] The industrial revolution expanded mill power from grinding and sawing to the manufacture of textiles and to other uses such as lumber processing.[37] The use of water to generate electricity, hydroelectric power, developed in the 1880s after Thomas Edison applied the work of Michael Faraday to invent the electric generator.[38] Visionaries immediately saw that water power could be a source of energy. In 1882, after a group of progressive business leaders saw Edison's steam generator in New York City, a small 12.5 KW electric system powered by the current of the Fox River was developed in Appleton, Wisconsin.[39] It was a short step to the use of stored, falling water to generate more power. The technology for the large dam was already in place[40] and the large multiple dam and reservoir with hydroelectric generating capacity soon became a central feature of the Progressive Conservation Movement.

In the last decades of the Nineteenth Century, our understanding of the nation's resource endowments increased, and this information helped to provide a case for the more efficient use of these resources. Efficiency was the center piece of the Progressive Conservation Movement.[41] Proponents

35. Carl J. Bauer, Dams and Markets: Rivers and Electric Power in Chile, 49 NAT. RES. J. 583, 589 (2009).

36. *See* Cech, *supra* note 31, at 17–18.

37. Mills used wheels to power Richard Arkwright's water frame but the steam power soon replaced water wheels. *See* 4 A HISTORY OF TECHNOLOGY: THE INDUSTRIAL REVOLUTION 1750–1850 at 282–85 (Charles Singer et al. eds., 1958).

38. *See id.* at 18–19; Rutgers, *Electric Generator*, The Thomas Edison Papers, http://http://edison.rutgers.edu/generator.htm (last updated Mar. 31, 2010).

39. *Cech, supra* note 31, at 18. The Vulcan Street Plant was named a National Historical Engineering Landmark in 1977. Fiftieth Anniversary Historical Brochure, http://files.asme.org/ASMEORG/Communities/History/Landmarks/5657.pdf (Sept. 15, 1977, last updated Apr. 17, 2001).

40. The first dam has been traced to Egypt in the third millennium B.C.E. In the last two decades of the Nineteenth Century, the technology for larger concrete and arch dams encouraged the construction of larger storage dams. *See* Heloisa Yang et al., *The History of Dams* (1999), http://cee.engr.ucdavis.edu/faculty/lund/dams/Dam_History_Page/History.htm.

41. The leading history remains SAMUEL P. HAYS, CONSERVATION AND THE GOSPEL OF EFFICIENCY (1959). Recent historians argue that the movement was not as directed by the scientific and political elite as Hays argues, *see e.g.* JOHN F. REIGER, AMERICAN SPORTSMEN AND THE ORIGINS OF CONSERVATION 3 (3rd ed. 2001) and. RICHARD W. JUDD, COMMON LANDS, COMMON PEOPLE: THE

of scientific conservation argued that the federal government would be a more efficient natural resource developer compared to the private sector and that federal regulation was necessary to ensure that resources were more efficiently developed when the private sector was allowed to exploit them.[42]

In the name of science and efficiency, engineers and others posited a vision of water management which resulted in the full development of river basins.[43] Humans would improve upon nature by turning unruly and often dangerous rivers into managed "working rivers."[44] The cornerstone of efficiency was the concept of the multiple use of water of all resources. As applied to water, dams and reservoirs would provide flood control protection and water for irrigation, while also generating hydroelectric energy.[45]

The Conservation Era actually did not result in the construction of many multiple purpose dams and reservoirs. President Theodore Roosevelt's plans for a national water development policy fell victim to the debate over public versus private hydroelectric development. In 1920, Con-Congress resolved the debate and enacted the Federal Water Power Act, which became the Federal Power Act in 1935.[46] The Act chose private over public hydroelectric power development.[47] The Act required proposed facilities on navigable rivers to obtain a federal license for projects that were in the public interest[48] and in accordance with a comprehensive plan for the development of the river.[49] However, the planning requirement was never implemented by the Federal Power Commission.[50]

By 1920, small plants on mountain streams near cities generated forty percent of the nation's electricity from hydro.[51] Reservoir construction

ORIGINS OF CONSERVATION IN NORTHERN NEW ENGLAND 10–11 (1997), and that multiple purpose water was the product of the interplay between regional politics and the vision of progressive, elite scientists and engineers, *see* DONALD J. PISANI, WATER, LAND, AND LAW IN THE WEST: THE LIMITS OF PUBLIC POLICY, 1850–1920 at 122–23 (1996).

42. *See generally* Hays, *supra* note 41.

43. National Research Council, U.S. Army Corps of Engineers Water Resources Planning a New Opportunity for Service 36–41 (2004).

44 The distinction between a working river, which is dammed and managed for flood control, irrigation, hydroelectric generation and municipal water supply, and a river that works by providing a wide range of ecosystem services is made in Report of Western Water Policy Review Commission, WATER IN THE WEST: CHALLENGE FOR THE NEXT CENTURY 2-13 (1998).

45. *See* Yang, *supra* note 40.

46. Federal Power Act, ch. 285, 41 Stat. 1063 (1920) (codified as amended at 16 U.S.C. §§ 792–828c (2006)).

47. *Id.*

48. *Id.* § 797(e).

49. *Id.* § 803(a).

50. *Id.* §§ 792, *et seq*.

51. WATER ENCYCLOPEDIA, *supra* note 5.

accelerated rapidly after the 1920s and did not level off until the 1980s.[52] Most dams were initially built by public utilities and irrigation districts as politicians rejected public power in the 1920s.[53] The Bureau of Reclamation did build a few reservoirs, such as the Theodore Roosevelt Dam upstream from Phoenix, Arizona on the Salt River, with hydro facilities.[54] The New Deal revived the idea of public power and public river development. The Tennessee Valley Authority's experiment to use dams to "re-engineer" a backward region has been described as "[a] turning point in the history of large dams . . ." because for "the first time . . . the idea of regulating the entire river basin through a series of multiple purpose dams had been put into practice."[55] Hydroelectric generation became an integral part of many of the large publically-financed multiple purpose dams in the West, such as the Grand Coulee and Hoover Dams, and the chain of large reservoirs built on the Missouri River.[56] Hydro revenues helped to finance subsidized irrigation and free flood control.[57] However, even as large federal dams were being built, hydro's share of energy supply progressively declined as coal, oil, and gas dominated the energy market outside of the Pacific Northwest and California.[58]

Hydro dominates electricity production in the Pacific Northwest,[59] but natural gas, coal, and nuclear are the major sources of electricity in the rest of the country.[60] At the present time, hydro supplies between seven and

52. U.S. Geological Survey, *Hydroelectric Power Water Use*, WATER SCIENCE FOR SCHOOLS, http://ga.water.usgs.gov/edu/wuhy.html (last updated Mar. 30, 2010).

53. *See generally* Hays, *supra* note 41.

54. .U.S. Dep't of Interior, *The History of Hydropower Development in the United States*, BUREAU OF RECLAMATION HYDROELECTRIC POWER, http://www.usbr.gov/power/edu/history.html (last updated Aug. 12, 2009).

55. Ravi Baghel and Marcus Nüsser, Discussing Large Dams in Asia after the World Commission on Dams: Is a Political Ecology Approach the Way Forward?, 3 Water Alternatives 231, 235.

56. *See* John R. Ferrell, The Big Dam Era: A Legislative and Institutional History of the Pick-Sloan Missouri River Basin Program 130 (1993).

57. "[T]he drive to economical use of capital investment has placed growing emphasis upon power as the principal and often the only feasible means for recovering project costs." 3 U.S. Water Res. Policy Comm'n Water Resources Law: The Report of the President's Water Resources Policy Commission 259 (1950).

58. *See* U.S. Dep't of Interior, *supra* note 54.

59. Hydro provides about two-thirds of the power in this region, *see* U.S. Envtl. Protection Agency, *Hydroelectricity*, CLEAN ENERGY, http://www.epa.gov/cleanenergy/energy-and-you/affect/hydro.html (last updated Dec. 28, 2007), but coal is a major source of energy in states such as Oregon.

60. *See* U.S. Envtl. Protection Agency, *Natural Gas*, CLEAN ENERGY, http://www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html (last updated Dec. 28, 2007); U.S. Envtl. Protection Agency, *Nuclear Energy*, CLEAN ENERGY, http://www.epa.gov/cleanenergy/energy-and-you/affect/nuclear.html (last updated Dec. 28, 2007); U.S. Environmental Protection Agency, *Coal*, CLEAN ENERGY, http://www.epa.gov/cleanenergy/energy-and-you/affect/nuclear.html (last updated March 8, 2010).

nine percent of the nation's energy, and future projections hold that figure relatively constant.[61] The current non-carbon star is revived and safer nuclear power which already generates seventy percent of the nation's non-carbon energy.[62] As mentioned earlier, the two related reasons for hydro's decline are the exhaustion of good dam sites in the American West and elsewhere and public opposition to the loss of free-flowing rivers and scenic canyons which resulted from the Big Dam Era.[63]

B. From Scenic Rivers to Ad Hoc Flow Releases

For every action, there is a reaction. Starting in the 1950s, the preservation movement, the precursor to the modern environmental movement, mounted increasingly effective political campaigns against individual proposed dams.[64] Eventually, the movement tapped into fiscal pressures on the federal government and a growing Congressional disinterest in promoting regional development in the Southeast and West through subsidized water development.[65] In retrospect, 1968 marks the end of the Big Dam Era, although the afterglow lingered until the Reagan Administration.

In 1968, the Sierra Club led a successful campaign to ban two cash register dams at either end of the Grand Canyon,[66] and in that same year Congress passed the Wild and Scenic Rivers Act.[67] This Act protects most of the major undeveloped sites from hydroelectric dams.[68] State wild and

61. *See* U.S. Dep't of Interior, *supra* note 54.

62. Matthew L. Wald, *Edging Back to Nuclear Power*, N.Y. TIMES, Apr. 22, 2010, at.F1.

63. *Supra* pp. 3–4.

64. Initially, the promise of federal scientific management of natural resources united the utilitarian and spiritual wings of the conservation movement, but the movement split into the rational exploitation, conservation, and preservation movements after the federal government allowed Hetch Hetchy Valley, next to Yosemite National Park, to be flooded for a reservoir to supply San Francisco. *See* RICHARD WHITE, "ITS YOUR MISFORTUNE AND NONE OF MY OWN:" A HISTORY OF THE AMERICAN WEST 4123 (1991); see *also* ELMO R. RICHARDSON, DAMS, PARKS & POLITICS: RESOURCE DEVELOPMENT & PRESERVATION IN THE TRUMAN-EISENHOWER ERA (1973).

65. *Id.*

66. Philip L. Fradkin, A RIVER NO MORE: THE COLORADO AND THE WEST 228–34 (1981) tells the story of the history of the two dams and the political campaign to defeat them. The two proposed dams, Marble and Bridge Canyons, were solely for the generation of hydroelectric power as two large carry-over and hydro projects, Hoover and Glen Canyon dams, had already been built outside the Park. *Id.* The hydro revenues were initially to be used for a massive inter-basin transfer from the Columbia River to Arizona and California. *Id.* FRADKIN, A RIVER NO MORE tells the story of the history of the two dams and the political campaign to defeat them. *Id.* After Senator Henry Jackson of Washington State blocked the proposed transfer, the case for the power revenue shifted to supplying the Central Arizona Project and southern California. *Id.* Ironically, to meet these objectives, large coal burning plants were constructed near Page, Arizona and set off a decades long air pollution battle. *Id.*

67. Wild and Scenic Rivers Act, 16 U.S.C. §§ 1271–1287 (2006).

68. *Id.*

scenic river programs protect other rivers.[69] The dam building agencies, and the West in particular, did not initially appreciate the significance of these two events. Multiple purpose projects continued to be proposed until Jimmy Carter's infamous "hit list" in 1977 administered the "coup de grace.[70]" This and the Reagan Administration's interest in ending federal water development subsidies convinced the Western states that the federal money spigot was shut.[71] Since the 1980s, the federal budget dollars devoted to water are increasingly being spent on aquatic ecosystem restoration rather than dam construction.[72]

The environmental movement also affected dam operations. These laws do not displace hydropower generation but these laws impact individual dam operations and result in the partial or even total subordination of power generation to downstream flow regulation.[73] The Clean Water Act requires that all "point sources" of pollution acquire a discharge permit and that their discharges do not violate state water quality standards.[74] Initially, an influential District of Columbia Circuit Court of Appeals decision rejected the argument that dams were point sources.[75] However, the state of Washington ultimately found a way to subject dam releases to state regulation.

Section 401 of the Clean Water Act requires that federal licenses obtain a state certification that the operation of the project will not violate state water quality standards.[76] However, power releases were not considered pollution discharges because nothing was added to the water and the successor to the Federal Power Commission, FERC, was assumed to have exclusive jurisdiction over the operation of federally licensed dams.

Courts held that FERC had the exclusive authority to regulate the operation of its licensed facilities to honor the fiction that the agency was conducting the unified river basin planning required by the Federal Power Act.[77] Courts consistently held that the Federal Power Act preempted state

69. 16 U.S.C. § 1273(b) (2006).

70. DAVID L. FELDMAN, WATER POLICY FOR SUSTAINABLE DEVELOPMENT 50–51, explains why President Carter tried to curb the power of Congress to distribute federal "pork" through inefficient water projects. The political firestorm that resulted is discussed in MARC REISNER, CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER 319–43 (1986).

71. *Id.*

72. *Id.*

73. The United States stands in stark contrast to most other nations where hydropower generation is privileged over other, even higher valued, uses of water. Bauer *supra* note 35,at 105.

74. 33 U.S.C. § 1312.

75. Nat'l Wildlife Fed'n v. Gorsuch, 693 F.2d 156, 161 (D.C. Cir. 1982).

76. 33 U.S.C. § 1341(a).

77. 1st Iowa Hydro-Elec. Coop. v. Fed. Power Comm'n, 328 U.S. 152, 181 (1946).

law efforts to regulate flows from FERC licensed dams.[78] But, the environmental movement resulted in both legislative and ultimately judicial curbs on its exclusive jurisdiction. FERC's discretion was first curbed by Congress in 1986.[79] The Federal Water Power Act of 1920 authorized fifty-year renewable licenses.[80] As the original licenses reached their golden anniversary, Congress amended the Federal Power Act; the Electric Consumers Protection Act of 1986 requires that FERC give equal weight to the benefits of relicensing the project and to "the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat) . . . ."[81] Hydro-rich states such as Oregon have a similar rigorous review process for new and re-licensed non-FERC facilities.[82]

FERC's discretion was further curtailed by the Supreme Court in one of its pro-environmental decisions. *PUD No. 1 of Jefferson County v. Washington Department of Ecology*[83] holds that state imposed minimum flows for fish protection and aesthetic enhancement are included in Section 401 certification.[84] Section 401 certification applies to both public utilities and state-operated hydroelectric facilities, and FERC must accept the 401 conditions imposed by the state.[85] Thus, the section provides a frequently used opportunity for environmental NGOs to impose minimum flow or environmental flow release conditions on FERC licensees.[86]

The Endangered Species Act is another source of mandatory flow conditions for at risk species which can curtail dam operations and subor-

78. *Id.* at 182.

79. *See, e.g.*, 16 U.S.C. § 797(e).

80. 16 U.S.C. § 799 (2006).

81. 16 U.S.C. § 797(e). The first case to construe the amendment, *National Wildlife Federation v. Federal Energy Regulatory Commission*, 801 F.2d 1505, 1513 (9th Cir. 1986), held that FERC must either prepare a comprehensive plan for the river or require permittees to evaluate the cumulative adverse environment impacts of the project.

82. Adell Amos, Freshwater Conservation in the Context of Energy and Climate Policy: Assessing Progress and Identifying Challenges in Oregon and the Western United States, 12 U. DENV. WATER L. REV. 1, 122–31 (2008).

83. 511 U.S. 700, 723 (1994).

84. *Id.* at 723. Subsequent cases have extended the reach of Section 401. *See* Daniel Pollak, *S.D. Warren and the Erosion of Federal Preeminence in Hydropower Regulation*, 34 ECOLOGY L. Q. 763, 763–64 (2007).

85. Wash. Dept. of Ecology, 511 U.S. at 723; 33 U.S.C. § 1341 (2006).

86. *E.g.*, In the Matter of Petitions for Water Quality Certification for the Re-Operation of Pyramid Dam for the California Aqueduct Hydroelectric Project Federal Energy regulatory Commission Project No. 2426, Cal. EPA, State Water Resources Control Board, Order WQ 2009-0007 (License requires state to operate project to stimulate natural flow conditions "to the extent operationally feasible" to protect the federally listed arroyo toad but rejected NGO petition to increase summer minimum flows).

dinate hydroelectric generation to environmental protection.[87] Courts have ordered releases from dams to protected listed species and have held that diversions can constitute a Section 9 taking.[88] Finally, Indian water rights settlements are another source of minimum flows.[89] Indian Tribes have federal reserved water rights which entitle them to the water necessary to support the purposes for which their reservation was established.[90] In the past twenty years, these rights have been quantified primarily through Congressional settlement acts, and some impact dam operation.[91] For example, in 2004, the state of Idaho, the federal government, and the Nez Perce tribe entered into a creative settlement that provides for a more stable flow regime on Lower Snake River, which can benefit both salmon restoration efforts and hydropower generation.[92]

C. From Ad Hoc Flow Releases to Rivers That Work

The end of the Big Dam Era ultimately changed our perception of rivers and dams in ways that pose major constraints for ramping up hydro. It replaced the conservation era vision of hard working rivers, the stewardship idea of a river that works for a wider variety of uses including aquatic ecosystem protection.[93] The idea that most of our remaining high quality "natural" rivers should run wild has eventually evolved into the broader idea that maximum hydroelectric generation capacity should be subordinated to the conservation of aquatic ecosystems and the promotion of white water rafting. And, dams now are seen both as the source of the problem of de-

87. A. Dan Tarlock, James N. Corbridge, Jr., David H. Getches & Reed D. Benson, WATER RESOURCE MANAGEMENT 737–47 (6th ed. 2009).

88. *Id.* at 740–42.

89. *E.g.*, Stipulation of the Settlement, Natural Res. Def. Council v. Rodgers, Case No. CIV S-88-1658 LKK/GGH, 4–5 (E.D. Cal. 2006). The Settlement provides for both instream flows and flows to support irrigation diversions.

90. Winters v. United States, 207 U.S. 564, 576 (1908).

91. *See e.g.* Ann R. Klee & Duane Mecham, The Nez Perce Indian Water Right Settlement—Federal Perspective, 42 IDAHO L. REV. 595, 596 (2006).

92. Basically, the settlement will release water that willing state water rights holders deposit into water banks. *See id.* at 611–18. The broader question of the merits of salmon restoration efforts in the Columbia-Snake River basin, including the breaching of Snake River dams, is beyond the scope of this article. *See* Michael C. Blumm, Erica J. Thorson & Joshua D. Smith, *Practiced at the Art of Deception: The Failure of Columbia Basin Salmon Recovery Under the Endangered Species Act*, 36 ENVTL. L. 709 (2006).

93. The distinction between a working river, which is dammed and managed for flood control, irrigation, hydroelectric generation, and municipal water supply, and a river that works by providing a wide range of ecosystem services is made in WESTERN WATER POLICY REVIEW COMMISSION, WATER IN THE WEST: CHALLENGE FOR THE NEXT CENTURY 2–13 (1998). Rivers that work can accommodate sustainable, non-wasteful levels of consumptive use and non-consumptive uses such as hydroelectric power generation. *Id.* at 3-2 to 3-3.

graded aquatic ecosystems and part of the solution. They can be re-operated to move the flow regime closer to pre-dam conditions.

There are several strands of resource stewardship. One posits that rivers should be managed and "restored" to maximize the maintenance of the ecosystem "services" that they provide such as biodiversity, polluter filtering, and flood retention."[94] Ecosystem service provision is an anthropocentric concept and grounded in benefit-cost analysis.[95] The idea is to value items which have traditionally not been monetized and thus were ignored in decisions to modify rivers.[96] A more radical stewardship version argues that a river's natural hydrograph should be restored, within the bounds of reason, to support the stream's historic functions regardless of whether these functions can be quantified as ecological services.[97]

The end product of both strands of stewardship thinking is a synthetic "normative river"[98] which accepts the reality that a return to pre-development (dam) conditions is unrealistic on large, regulated rivers. Instead, the goal is to create a new managed hydrograph that performs a reasonable range of these functions within the constraints such as existing water rights and the legislative mandates which control reservoir operation.[99] The normative river has not been codified as a restoration standard or expressly adopted as agency policy, but it is no longer an abstract idea. Numerous ad hoc experiments are trying to implement it de facto or de jure.[100] The most ambitious is the Comprehensive Everglade's Restoration Plan, enacted as part of the omnibus Water Resources Development Act in 2000,[101] which seeks to recreate a normative river of grass in the Ever-

94. *See* James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607 (2000) and J.B. RUHL, STEVEN E. KRAFT & CHRISTOPHER L. LANT, THE LAW AND POLICY OF ECOSYSTEM SERVICES (2007).

95. RUHL, KRAFT,*supra* note 94, at 12.

96. *Id.* at 24.

97. *E.g.*, Independent Scientific Group, Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem 506–07 (Sept. 10, 1996) (unpublished manuscript), *available at* http://www.nwcouncil.org/library/1996/96-6/default.htm.

98. The concept was first introduced in a report on Columbia River salmon restoration. *Id.* For a full articulation of the principle *see* Jack A. Stanford et al., *A General Protocol for Restoration of Regulated Rivers*, 12 REGULATED RIVERS 391 (1996).

99. *See* Independent Scientific Group, *supra* note 97, at 55.

100. King County Department of Natural Resources and Parks, Development of Hydrological and Biological Indicators of Flow Alteration in Puget Sound (2005); Comprehensive Everglades Restoration Plan, Pub.L. No. 106-541 §§ 601, 602 (2000).

101. Comprehensive Everglades Restoration Plan §§ 601, 602; Water Resources Development Act 33 U.S.C. § 2201 (2000). *See generally* DAVID MCCALLY, THE EVERGLADES: AN ENVIRONMENTAL HISTORY (Raymond Aresenault & Gary R. Mormino eds., 1999); STEVEN M. DAVIS & JOHN C. OGDEN, EVERGLADES: THE ECOSYSTEM AND ITS RESTORATION (Winifred A Park ed., 1994); Carl Walters, et al., *Experimental Policies for Water Management in the Everglades*, 2 Ecological Applications 189 (1992).

glades after decades of human alteration. The ecosystem depends on seasonal sheet flows of water from Kissimmee River in central Florida and Lake Okeechobee.[102] To make South Beach and Miami, South Beach and Miami, these flows were substantially diverted for agricultural and urban development and flood control.[103] The objective of the legislation is no less than to replumb the Everglades to restore some measure of pre-diversion flows.[104]

The normative river's ultimate conclusion is that many dams, including those that generate hydroelectricty, should be removed.[105] Removal is an option for dams as many of them, especially smaller ones, have exceeded their planned useful life or no longer perform their intended functions.[106] At the present time, some small, marginal hydroelectric dams have been removed in Maine,[107] and a dam removal program on the Elwha River in Washington state is going forward with "all deliberate speed."[108] More ambitious dam removal proposals for large dams have been put forth.[109] These include breaching four dams on the Lower Snake River to

102. *See* DAVIS & OGDEN *supra* note 101, at 50–51.

103. *Id.* at 53–55.

104. U.S. Army Corps of Engineers & South Florida Water Management Dist., Central and Southern Florida Comprehensive Review Study: Final Integrated Feasibility report and Programmatic Environmental Impact Statement, iii (1999). *See* Michael Voss, *The Central and Southern Florida Project Comprehensive Review Study: Restoring the Everglades*, 27 Ecology L. Q. 751, 758 (2000).

105. *See* INDEPENDENT SCIENTIFIC GROUP *supra* note 97, at 510–11.

106. THE HEINZ CENTER, Dam Removal Research: Status and Prospects 58, 60 (H. William & L. Graf ed. 2002).

107. A Maine conservation organization, the Penobscot River Restoration Trust, raised $25 million to supplement a $15 million federal grant to purchase and remove two hydroelectric dams at the lower end of the river and to build a fish run around a third. Katie Zezima, *Maine Conservationists Reach Milestone in Plan to Buy 3 Dams*, N.Y. TIMES, Aug. 22, 2008, at A16. The hope is that fish will return to the watershed. *Id.* The river was a major source of economic development as logs were floated from the headwater forests to downstream paper mills, but much of the resulting pollution has now been cleaned up. *Id* at A13.

108. The efforts to remove the dam were triggered by a major Supreme Court decision, *Washington v. Wash. State Commercial Passenger Fishing Vessel Ass'n*, 443 U.S. 658 (1979), which recognized on and off reservation tribal fishing rights for several reservations in Washington state including one downstream from two dams on the salmon-rich Elwha River, Glines Canyon and Elwha Dams mounted. *Id.* at 679. In 1992, Congress authorized their removal, Elwha River Ecosystem and Fisheries Restoration Act, Pub. L. No. 102-495, (1992), and the two dams were purchased by the federal government in 2000, Lynda V. Mapes, *Dying river gets closer to a cure*, SEATTLE TIMES, Feb. 11, 2000, at A1; removal is slated to start in 2012, Lynda V. Mapes, *Dam's removal will have to wait*, SEATTLE TIMES, Apr. 24, 2007, at B4. The removal will be the largest removal to date, and environmentalists are setting their sights on some of the nation's biggest dams. Jeffery J. Duda et. al, 82 NORTHWEST SCIENCE 1, 1 (2008).

109. Michael Paulson, *Clinton Urged to Weigh NW Dam Removal*, SEATTLE POST-INTELLIGENCER, Aug. 5, 1999 at A1; Sarah E. Null & Jay R. Lund, *Reassembling Hetch Hechy: Water Supply Without O'Shaughnessy Dam*, 42 JOURNAL OF THE AMERICAN WATER RESOURCE ASSOCIATION 395, 395 (2006); Scott K. Miller, *Undamming Glen Canyon: Lunacy, Rationality, or Prophecy?* 19 STAN. ENVTL. L.J. 121 (2000), reviews proposals to take down Glen Canyon Dam.

support salmon runs in the Columbia River basin,[110]removing O'Shaughnessy Dam north of Yosemite National Park,[111] and even taking down the mighty Glen Canyon Dam on the Colorado River.[112] Ironically, FERC has become a dam removal agency. The Federal Power Act has been construed to give FERC the authority to deny a license renewal application and order that a dam be decommissioned if it has become uneconomic.[113]

III. HYDRO'S POSSIBLE FUTURE

Any prediction about the direction of future energy policy is extremely risky as geopolitical developments, global economic cycles, and other events such as the 2010 Gulf of Mexico oil spill[114] make energy policy a fast moving target. This said, the five most likely scenarios for hydro's future are (1) the dawn of a new golden age of dam building, (2) the federal repeal or substantial modification of many federal environmental statutes

110. The efforts to restore Salmon runs on the Columbia and its tributaries is an epic tale and illustrates the role that dam removal can play in the future resolution of such conflicts. After a court suggested that the federal government study removing eleven dams on the Columbia and the Snake Rivers [NEEDS A CITATION], the Clinton Administration (1992–2000) began a study to assess the consequences of breaching four major dams on the Snake River. *See* Paulson *supra* note 109. However, the Bush II Administration rejected the idea, Felicity Barringer, *Government Rejects Removal of Dams to Protect Salmon*, N.Y. TIMES, Dec. 1, 2004 at A1, although, a 2002 Rand Corporation Report found that four Lower Snake River could be removed with no disruption to the regional economy, PERNIN ET AL., *supra* note 29, at 32.

111. O'Shaughnessy Dam in the Hetch Hetchy Valley in Yosemite National Park, supplies the city of San Francisco with water and power. *See* NULL & LUND *supra* note 109, at 395. The decision to build the dam was one of the great natural resource fights of the Conservation Era and played a major role in splitting the movement into the utilitarian, multi-use, and preservation wings and still resonates in California. *See* RICHARD WHITE, "IT'S YOUR MISFORTUNE AND NONE OF MY OWN": A HISTORY OF THE AMERICAN WEST 413 (1st ed. 1991). California environmentalists have long dreamed of restoring the valley to John Muir's vision of it as the "flow of nature." MICHAEL COHEN, THE PATHLESS WAY: JOHN MUIR AND THE AMERICAN WILDERNESS 330 (1984). *See* SPRECK ROSEKRANS et al., PARADISE REGAINED: SOLUTIONS FOR RESTORING YOSEMITE HETCH HETCHY VALLEY (Environmental Defense 2004) for a comprehensive effort to simulate a removal debate. In 1987, President Reagan's Secretary of the Interior, Donald Hodel, was the first high ranking official to suggest removal. Dianne Feinstein, *San Francisco Doesn't Savor Hodel's Hetch Hetchy Proposal*, L.A. TIMES, Oct. 31, 1987 at 9. Environmentalists viewed the suggestion as a ploy to split green northern California. Carl Pope, *Undaming Hetch Hetchy*, SIERRA MAG., Dec. 1987 at 35. In 2007, the Bush II Administration proposed a $7,000,000.00 removal feasibility study, Michael Doyle, *$7m Hetch Hetchy study in budget*, THE FRESNO BEE, Feb. 8, 2007 at B2, but Senator Diane Feinstein, the former mayor of San Francisco and Hetch Hetchy defender was not amused. *Id.*

112. *See* MILLER *supra* note 109, at 121 (reviewing proposals to take down Glen Canyon Dam). The issues raised by dam removal are beyond the subject of this paper. *See* HEINZ CENTER, *supra* note 106; Symposium, *Dam Removal and River Restoration* 52 BIOSCIENCE 641 (2002).

113. City of Tacoma, Wash. v. Fed Energy Reg. Comm'n, 460 F. 3d 53, 74 (D.C. Cir. 2006); *see also* Jackson County, North Carolina v. Fed Energy Reg. Comm'n, 589 F.3d 1284, 1291 (D.C. Cir. 2009) (FERC reasonably accepted surrender of license and plan to remove dam and powerhouse and had no power to compel transfer of license to county).

114. Campbell Robertson & Leslie Kaufman, *Officials Say Oil Leak May Be 5 Times as Much as Thought*, N.Y. TIMES, Apr. 29, 2010 at A14.

which constrain hydro power production, (3) federal preemption of state laws which constrain hydro power production, (4) the maintenance of status quo, and (5) the adoption of GCC adaptation strategies which make hydroelectric generation one among many relevant factors to be considered in dam operation and river basin planning and water allocation. A case can be made for each of these strategies—all have been placed on the adaptation agenda—but the last two are the likely outcomes for hydroelectric generation, at least for the foreseeable future.

The first option, dam building, is creeping back on the water-policy agenda after a three decade plus hiatus.[115] For example, in May of 2007, Governor Arnold Schwartzenegger called for the construction of two new hydroelectric dams to help meet the state's ambitious greenhouse gas emission targets.[116] However, this option is unlikely for fiscal and political reasons. Politically, the federal government has largely exited from water policy leadership after Congress stopped funding large-scale water development.[117] The two once dominant water agencies, the U.S. Army Corps of Engineers and the Bureau of Reclamation, were left in place to manage their legacy projects, but they must share power with other agencies, the states, and powerful stakeholders and do so with less and less federal funding.[118] In short, they "stranded" agencies in search of a mission. In addition, many new storage facilities may be off-stream and small so the capacity of these for substantial increased hydroelectric generation is unknown. In addition, large dams are large methane emitters[119] as well as sources of renewable energy.[120]

115. Bonner R. Cohen, *Global Warming Creates Need for New Dams: Schwarzenegger*, ENVIRONMENT & CLIMATE NEWS, May 1, 2007.

116. *See* Cohen, *supra* note 115. However, in June of 2010, Governor Schwarzenegger asked the California legislature to pass the necessary legislation to remove an $11 billion water bond initiative from the ballot in the face of substantial opposition to the measure. Patrick McGreevy, *Gov. Wants Water Bond off Ballot*, L.A. TIMES, June 30, 2010, *available at http://www.agency_newsclips@lists.resources.gov*.1.

117. The water historian Donald Pisani has traced this development through the career of the legendary Commissioner of the Bureau of Reclamation, Floyd Dominy. Donald J. Pisani, *Floyd E. Dominy*, (Sept. 12, 2010, 2:10PM), http://www.waterhistory.org/histories/dominy. During his tenure (1959–1969), he presided over the construction of major dams on the Colorado River and in California. *Id.* The passage of the Central Arizona Project in 1968 marked the effective end of the Big Dam Era, *id.*, although the western states clung to the idea into the 1980s.

118. National research Council, U.S. Army Corps of Engineers Water resources Planning: A New Opportunity for Service 49 (2004) (federal appropriations for U.S. Army Corps of Engineers water projects have fallen from three and a half percent of the federal budget in the first half of the Twentieth Century to two-tenths of one percent today).

119. World Commission on Dams, Dams and Development: A new framework for Decision Making 74, 312 (November 2000) (call for further study because international climate change regime makes no provision for exploring the relationship between dams and climate change).

120. *Id.* at 14.

The federal government could intervene to remove these conditions or to strike a new hydro-fish protection balance, but the political and environmental costs would be substantial.[121] Efforts would be hampered by the lack of coherent United States water policy and a dysfunctional water management structure.[122] Any effort to preempt state law would be met with fierce resistance from the states.

The preservation of the status quo and the gradual integration of hydro in GCC adaptation planning are the two most likely scenarios. A 2010 National Academies study concluded that "[t]he future of hydropower will play out in the public policy debate, where the benefits of the electric power are weighed against its effects on the ecosystem."[123] As previously mentioned, the likelihood of decreased river flows strengthens this conclusion by increasing the risks of any efforts to substantially increase production, such as new reservoir construction or relying on increased releases. Global climate change may increase the use of reservoir reoperation, but any reoperation is likely to subordinate power production to aquatic ecosystem conservation. The failed climate change legislation introduced in 2009 and 2010[124] is a possible indicator of the future. Although the legislation was primarily focused on mitigation, it included adaptation sections.[125] For example, Subtitle E of Clean Energy and Security Act of 2009, the Waxman-Markey Bill, mandated a hyper-rational national and state adaptation planning process to ensure the resiliency of aquatic ecosystems.[126] Given

121. Nonetheless, there is always pressure for subordination. To overcome public opposition to new high voltage power lines, many lines are being planned under rivers and bays. Matthew L. Wald, *A Power Line Runs Through It*: *Underwater Cable an Alternative to Electrical Towers*, N.Y. TIMES, Mar. 17, 2010, at B1. As a president of an offshore cable company noted, "The fish don't vote." *Id*.

122. This conclusion was first reached in National Water Commission, WATER POLICIES FOR THE FUTURE: FINAL REPORT TO THE PRESIDENT AND CONGRESS OF THE UNITED STATES (1973), and echoed in study after study. *E.g.*, National Research Council, U.S. ARMY CORPS OF ENGINEERS WATER RESOURCES PLANNING: OPPORTUNITIES FOR THE FUTURE 46 (2004).

123. The National Academies, *supra* note 28, at 99. The Obama Administration is trying to prove this assessment wrong. In March 2010, the heads of the Departments of Energy and Interior and U.S. Army Corps of Engineers signed a Memorandum of Understanding designed to change the de facto federal policy that hydropower is a "mature, fully developed technology." Sonya Baskerville and Charles R. Sensiba, Hydropower: A Renewable We Can Believe In, 41 ABA Section of Environment, Energy, and Resources, Trends No. 6, p. 5, July/August 2010. The Memorandum commits the federal government to increasing capacity at existing federal dams, installing hydro facilities at federal dams that lack such capacity, and encouraging new projects on federal lands.

124. R. 2454 111th Cong. (1st Sess. 2009) §§ 451–492.

125. H.R. 2454 111th Cong. (1st Sess. 2009) §§ 451–495.

126. H.R. 2454 111th Cong. (1st Sess. 2009) §§ 451–482. To finance planning, each state would have been given carbon allowances to sell, and the proceeds must be used to prepare a state adaptation plan. *Id.* at § 453. Each state plan had to prioritize the particular risks that the state faces and to provide a detailed list of cost-effective projects and strategies to "to assist fish, wildlife, plant populations, habitats, ecosystems, and associated ecological processes in becoming more resilient, adapting to, and better withstanding" the impacts of GCC. *Id.* at § 479 (c)(1)(C).

the futility of mitigation, Congress may eventually be forced to deal with adaptation and to address more directly the question of where hydroelectric generation fits in any national climate change and energy strategy. For the foreseeable future, it continues to be an important but modest energy and climate change adaptation role.