

Hydroelectric Projects: Purposes, Impacts, and Regulation

Maria Rice

Hydropower is a valuable energy source in the United States, and hydropower projects can provide a clean and renewable fuel source, backup power during electricity outages, flood control, irrigation, and water supply.¹ The removal of the Lower Klamath Hydroelectric Project was one of the largest dam removal projects.² This project was made up of four hydroelectric dams built between 1922 and 1964 as means of flood control and generation of hydroelectric power.³ The National Oceanic and Atmospheric Administration “conducted a consultation on the dam removal under the Endangered Species Act.”⁴ In their biological opinion, they provided that they expected some short term impacts on the fish in the river due to turbidity, but long term benefits to the fish and an overall increase in populations.⁵ To further explore the process involved with hydropower projects, this blog will provide a general overview of hydropower projects, the environmental concerns that arise with their construction and use, and the methods of regulation.

“Hydroelectric projects convert the potential or kinetic energy of water into electricity.”⁶ A conventional hydroelectric project in America “convert[s] the potential energy of water impounded by a dam (the reservoir or impoundment) to electricity.”⁷ In order for this to happen, the dam creates a reservoir, which creates the hydraulic head.⁸ The water from the reservoir flows through the penstock and into the powerhouse, which contains the turbine.⁹ The flowing water spins the turbine and generator, thus creating electricity.¹⁰

¹ *Hydropower Primer*, OFFICE OF ENERGY PROJECTS/FEDERAL ENERGY REGULATORY COMMISSION, 3 (2017), <https://www.ferc.gov/sites/default/files/2020-04/HydropowerPrimer.pdf>

² Marcus Kahn, *6 Things You Need to Know About the Klamath River Dam Removals*, AMERICAN RIVERS (June 23, 2023), <https://www.americanrivers.org/2023/06/6-things-you-need-to-know-about-the-klamath-river-dam-removals/#:~:text=Damming%20on%20the%20Klamath%20has,restoring%20habitat%20for%20other%20species> [https://perma.cc/5NY9-RRWP].

³ Francisco L. Nodarse, *The Winners, the Losers, and the Landscape That Might Emerge If the Klamath River Dams Disappear*, STANFORD UNIVERSITY (updated Nov. 18, 2020), <https://andthewest.stanford.edu/2020/the-winners-the-losers-and-the-landscape-that-might-emerge-if-the-klamath-river-dams-disappear/#:~:text=The%20Klamath%20complex%20consists%20of,electricity%20to%20about%2070%2C000%20people> [https://perma.cc/KG49-K3MC].

⁴ *Klamath River Reshapes Itself as Flushing Flows Move Reservoir Sediment Downriver*, NOAA FISHERIES (Mar. 7, 2024), <https://www.fisheries.noaa.gov/feature-story/klamath-river-reshapes-itself-flushing-flows-move-reservoir-sediment-downriver> [https://perma.cc/N4ZM-3ANC].

⁵ *Id.*

⁶ *Hydropower Primer*, *supra* note 1, at 4.

⁷ *Id.* at 8.

⁸ *Id.* A hydraulic head is “a value that measures the amount of mechanical energy available in water in a river, stream or even lake. The hydraulic head is equivalent to the water level in a static (non-flowing) water body.” *Hydraulic head*, ENERGY EDUCATION, https://energyeducation.ca/encyclopedia/Hydraulic_head (last visited Oct. 27, 2024) [https://perma.cc/B36V-QERH].

⁹ *Hydropower Primer*, *supra* note 1, at 8. The penstock is “an enclosed pipe-like structure that typically conveys water directly from a reservoir to a powerhouse,” and a powerhouse is “the building that houses the project’s turbines/generating units.” *Id.* at 7.

¹⁰ *Id.* at 8.

Hydropower dates back as far as 202 BC, where a vertical-set water wheel was used to power trip hammers which pounded and hulled grain, broke ore, and were used to make paper.¹¹ In the United States, hydropower began with the use of dams over 200 years ago.¹² Hydroelectric projects are utilized all throughout the United States, and they generate roughly 48% of all renewable energy generation.¹³ Hydroelectric projects are owned by many different entities, including private companies, private citizens, municipalities, and both state and federal government agencies.¹⁴ Most of the hydroelectricity in the United States is produced at dams constructed by the federal government.¹⁵

While dams have a myriad of benefits, they can also be of environmental concern. For hydroelectric projects regulated by the Federal Energy Regulatory Commission (FERC), 18 C.F.R. § 4.34(i), § 4.38(f), § 4.41(f), § 4.51(f), § 4.61(d), § 5.18(b), and § 16.8(f), address the environmental issues posed by hydropower projects.¹⁶ “Generally, applicants are required to describe the existing resources in the project area, impacts that would occur during the construction and/or operation of the project, and proposed measures for mitigating the project’s effects or enhancing resources in the project area.”¹⁷ The factors to consider include geology and soils, such as shoreline erosion and erosion from ground disturbance, water use and quality, aquatic resources, wildlife and botanical resources, threatened or endangered species, recreation, aesthetics, cultural and tribal resources, land use, socioeconomics, and comprehensive plans.¹⁸

The Federal Energy Regulation Commission regulates non-federal hydroelectric projects through the authorization of construction and operation.¹⁹ The Federal Power Act (FPA) was enacted in 1935 and gave the FERC (formerly FPC) jurisdiction over non-federal hydropower projects in the United States.²⁰ There are 3 parts to the FPA, which address hydropower licensing, administration, safety, electric transmission, and wholesale sales rates and services.²¹ The first part says that non-federal hydroelectric projects require FERC authorization if the project is located on navigable U.S. waters; is located on federal land or a reservation; makes use of surplus waters from a federal dam; or “is located on a non-navigable stream over which Congress has Commerce Clause jurisdiction, is constructed or enlarged after 1935, and affects interstate commerce, usually by connecting to the interstate grid.”²² When the FERC decides whether to authorize a particular project, they must consider the purpose of the project and the power of the project, as well as energy conservation, wildlife, protection of recreation, and other environmental factors.²³ The

¹¹ *A brief history of hydropower*, IHA, <https://www.hydropower.org/iha/discover-history-of-hydropower> (last visited Oct. 27, 2024) [<https://perma.cc/MKN6-UM7J>].

¹² *Hydropower Primer*, *supra* note 1, at 3.

¹³ *Id.* at 1.

¹⁴ *Id.*

¹⁵ *Hydropower explained*, U.S. ENERGY INFORMATION ADMINISTRATION (June 21, 2024), <https://www.eia.gov/energyexplained/hydropower/where-hydropower-is-generated.php> [<https://perma.cc/CJA6-4HBM>].

¹⁶ *Hydropower Primer*, *supra* note 1, at 11.

¹⁷ *Id.*

¹⁸ *Id.* at 11-16.

¹⁹ *Id.* at 17.

²⁰ *Id.*

²¹ *Id.*

²² *Id.*

²³ *Id.*

licenses must also be adapted to the comprehensive plan for the improvement or development of a waterway, with public use in mind.²⁴ This requires the FERC to weigh the benefit of the particular hydropower project and the potential detriment to the area. Any license that is issued must also include conditions, based on recommendations from both federal and state fish and wildlife agencies, in order to “protect, mitigate damages to, and enhance, fish and wildlife related habitat.”²⁵ The FPA shows clear intent from the federal government to regulate hydropower projects and to consider, before licensing, whether the benefits of the project will outweigh the potential harm to the environment.

In addition to the FPA, there are a myriad of other acts that impact the development of hydropower projects. In 1969, Congress passed the National Environmental Policy Act (NEPA), which directs federal agencies to appropriately consider the environment in their decision making.²⁶ NEPA covers a range of actions including making decisions on permit applications, federal land management actions, and constructing highways and other types of public facilities.²⁷ NEPA requires either an environmental impact statement or an environmental assessment, depending on the project in question, for proposed actions.²⁸ Hydropower licensing or exemption actions require the preparation of one of these documents to analyze the environmental impact of the proposed action, as well as alternatives.²⁹ In order to create these documents, the FERC staff issue an initial Scoping Document, which is used to describe the proposed project and any expected environmental issues.³⁰ This Scoping Document is then open for public comments, sometimes public meetings, and revision.³¹ During the scoping process, either the environmental assessment or the environmental impact statement are prepared.³² Once the comments have been reviewed and any appropriate revisions have been made, the final environmental assessment or environmental impact statement are prepared, and the final versions will address all of the comments and then recommend alternatives, which could include whether or not the license should be issued or if there should be conditions to said license.³³

The Clean Water Act (CWA) provides a framework for regulation of pollutants and water quality standards in United States waters.³⁴ An applicant for a FERC license must obtain either a certification or a waiver of certification “from the appropriate state pollution control agency verifying compliance with the CWA before the Commission can issue a license for a project. The

²⁴ *Id.* at 18.

²⁵ *Id.*

²⁶ *Id.* at 20.

²⁷ *What is the National Environmental Policy Act?*, EPA (updated Sept. 4, 2024), [https://www.epa.gov/nepa/what-national-environmental-policy-act#:~:text=The%20National%20Environmental%20Policy%20Act%20\(NEPA\)%20was%20signed%20into%20law,actions%20prior%20to%20making%20decisions](https://www.epa.gov/nepa/what-national-environmental-policy-act#:~:text=The%20National%20Environmental%20Policy%20Act%20(NEPA)%20was%20signed%20into%20law,actions%20prior%20to%20making%20decisions) [<https://perma.cc/9WTX-EJBG>].

²⁸ *Hydropower Primer*, *supra* note 1, at 20.

²⁹ *Id.*

³⁰ *Id.* at 21.

³¹ *Id.*

³² *Id.*

³³ *Id.*

³⁴ *Id.* See also *Summary of the Clean Water Act*, EPA (updated June 12, 2024) <https://www.epa.gov/laws-regulations/summary-clean-water-act> [<https://perma.cc/Y5R8-KXAZ>].

conditions of a water quality certification become mandatory conditions of any license issued.”³⁵ The Endangered Species Act (ESA) is meant to ensure that actions of federal agencies do not jeopardize endangered or threatened species or destroy their critical habitat.³⁶ If a proposed licensing action might impact any of the species in question, preparation of a document concluding whether the proposed action will impact listed species or their critical habitat is required, and, if it is concluded that the action is “likely to adversely affect” a listed species, then a formal consultation with the federal agency responsible for managing that particular species must be done in order to obtain a Biological Opinion.³⁷ This Biological Opinion provides certain measures to avoid and measures to require for the sake of protecting the species.³⁸

The Fish and Wildlife Coordination Act “requires federal agencies granting a license or permit for the control, impoundment, or modification of streams and water bodies to first consult with [Fish and Wildlife Services], [National Marine Fisheries Service], and the appropriate state fish and wildlife agencies regarding conservation of fish and wildlife resources.”³⁹ The Coastal Zone Management Act (CZMA) states that licenses for projects that are in or affect a state’s coastal zone should not be granted unless the state Coastal Zone Management Act agency agrees with the applicant’s certification of consistency with the CZMA program in that state.⁴⁰ Lastly, the Wild and Scenic Rivers Act protects certain rivers and their environments, and the FERC may not license projects that are either on or affecting a river that is protected under the Wild and Scenic Rivers Act.⁴¹

While hydropower projects can provide valuable energy, flood control, irrigation, and water supply among other things, there are important environmental factors to consider when constructing a new dam or modifying an existing dam. The federal government has a legal framework in place to establish methods of monitoring and regulating these important environmental factors.

³⁵ *Hydropower Primer*, *supra* note 1, at 21.

³⁶ *Id.* at 21. *See also Endangered Species Act*, U.S. FISH AND WILDLIFE SERVICE, <https://www.fws.gov/law/endangered-species-act> (last visited Oct. 27, 2024) [<https://perma.cc/DUW4-BKNR>].

³⁷ *Id.* at 21-22.

³⁸ *Id.* at 22.

³⁹ *Id.* at 22. *See also Fish and Wildlife Coordination Act*, U.S. FISH AND WILDLIFE SERVICE, <https://www.fws.gov/law/fish-and-wildlife-coordination-act> (last visited Oct. 27, 2024) [<https://perma.cc/AL6S-AN6C>].

⁴⁰ *Hydropower Primer*, *supra* note 1, at 22.

⁴¹ *Id.* at 23.