American Rivers
Thriving By Nature

Energy Policy


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The future holds great challenges for the nation's water resources. Shifting weather patterns, more damaging floods, and rising water shortages will threaten communities, the economy, and the environment. This chapter is part of a larger report, ***Weathering Change: Policy Reforms That Save Money and Make Communities Safer***, which shows what the federal government must do to help the nation confront these looming challenges.

To see the entire report, visit www.AmericanRivers.org

Introduction:

Often lost in the debate over the nation's energy future is the limit that water will place on how and where we develop new energy sources. With very few exceptions, water is a key input to the production of the energy we use. Power plants withdraw large amounts of water to drive turbines and provide cooling. Emerging energy technologies such as solar thermal energy, biofuels, and carbon capture and sequestration similarly require vast quantities of water. The extraction of fossil fuels such as natural gas and coal has dramatic impacts on surrounding water resources. At the same time, the transport and use of water consumes large quantities of energy. With rising energy demands, shifting precipitation patterns, and more frequent droughts, many parts of the country lack sufficient water to meet projected water needs. Better planning and increased investment in energy and water efficiency are essential to ensuring a reliable energy system and clean water for the future.

Power plants use huge amounts of water, which is a growing concern as droughts become more common.

I. Today's Policy

Inefficient water and energy use and a lack of coordinated planning make it more difficult to secure clean water for the future and prepare for the challenges of a changing climate.

Water use of energy: Coal, natural gas, nuclear, and petroleum power plants generate 90 percent of the nation's electricity, and they require tremendous amounts of water to operate.[1] Thermoelectric power plants withdraw 143 billion gallons of freshwater every day — 41 percent of the nation's total.[2] Most use "once-through" cooling systems that withdraw large quantities of water to cool their turbines and then discharge the water back to the source. Water discharged from coal and nuclear power plants is on average 17ºF warmer than when it is withdrawn,[3] and many coal plants discharge water at temperatures of over 100 degrees in the summer.[4] These discharges can decrease water quality, cause algal blooms and bacterial growth, and harm or kill fish and wildlife. A number of states including California, New York, and New Jersey have taken initial steps to ban once-through cooling systems due to their water quality impacts.[5] Many more modern facilities use closed loop cooling systems that recycle cooling water. These plants withdraw substantially less water but lose more to evaporation, resulting in a higher overall consumptive use of water.

Electricity demand is expected to increase 30 percent by 2035, but finding water for new power plants will be increasingly difficult.[6] In many places, water use already exceeds the renewable supply, and 70 percent of U.S. counties could be at risk of water shortages by 2050 as a result of climate change.[7] In these places, there is simply not enough water to add significant new power generation capacity and continue to meet existing needs. In addition, thermal pollution from once-through cooling systems present a growing challenge for power plants and surrounding ecosystems. In the summer of 2010, high river temperatures caused the Tennessee Valley Authority to reduce power production at the Browns Ferry nuclear facility for over 40 consecutive days, resulting in a loss of $50 million.[8] While planners originally assumed that the river would only rarely pass the 90ºF threshold, elevated temperatures have been common in recent years, causing energy bills to spike for local residents.

Finally, hydroelectric power, which supplies about 7 percent of the nation's electricity, has a significant impact on water resources and is uniquely vulnerable to climate change. Large dams and reservoirs fundamentally change the hydrology of a river, altering water quality, changing downstream flows, and blocking fish migration. These changes place

considerable stress on ecosystems and aquatic species. In addition, the energy production potential of many hydroelectric facilities will change in a warming climate. Evaporation from reservoirs will increase, and shifting precipitation patterns will leave some facilities unable to generate electricity at current levels. Water levels in Lake Mead, for example, have been dropping steadily in recent years, and there is a 50 percent chance that they could fall enough to largely stop power generation by 2017.[9] Climate change will exacerbate the negative impacts of hydropower and make it a less reliable source of electricity.

Despite the complex interdependency between water and energy and the looming problems that climate change presents to both, planning for the resources operates largely independently.[10] Energy and water planning and permitting are generally not conducted in an integrated manner, leading to energy infrastructure that has dramatic impacts on surrounding ecosystems and is poorly equipped to deal with changing water availability.

Emerging energy technologies: America's energy landscape is changing rapidly due to emerging technologies and growing demand for clean energy sources. These shifts present a new set of challenges for water management. Some solar thermal power plants (though not photovoltaics) can consume up to four times more water per megawatt hour than natural gas plants and 60 percent more than coal-fired facilities.[11] What's more, the areas with the most consistent sunshine such as the southwestern U.S. have the least amount of available water. A number of proposed solar projects in the western U.S. have switched to less water-intensive designs in order to win approval from regulators and the public. Similarly, carbon capture technology could more than double the water consumption of coal-fired power plants per unit of energy produced.[12] Finally, biofuels have the potential to dramatically affect the quantity and quality of water supplies across the country. It takes, on average, 100 gallons of water to make a single gallon of ethanol in the U.S., although in certain regions that rely on irrigated agriculture, it can take several times that amount.[13] Water used in ethanol production in the U.S. increased by 246 percent from 2005 and 2010.[14]

Energy extraction: The process of extracting energy resources from the earth has long had negative impacts on water supplies. In recent years some of the most damaging extraction processes have become more widespread and now pose a growing threat to water resources. Since the 1990s, mountaintop removal coal mining has rapidly expanded across Appalachia. The process involves clearing away vegetation, blowing the tops off of mountains, and dumping the resulting fill material in adjacent river valleys. It is difficult to overstate the devastation this process causes. Nearly two thousand miles of streams have been buried.[15] Flooding in surrounding communities has increased as mountains are stripped of vegetation.[16] Contamination of streams and water supplies can cause dire health problems for nearby residents.[17] Decreased water quality in downstream waterways also harms fish and wildlife.[18]

Another damaging practice that has witnessed explosive growth in recent years is natural gas extraction through a process known as "hydraulic fracturing." The process involves injecting chemical-laden fluids into wells at high pressures to create fractures in rock formations and release natural gas. It requires vast quantities of water and exposes aquifers to hundreds of chemicals, many of them toxic. The chemical contents are often kept secret. Thousands of cases of contamination have been documented thus far.[19] Drinking water has been contaminated with benzene and other chemicals, houses have exploded due to the build-up of methane, and numerous cases of life-threatening illnesses have been recorded.[20] New York City has concluded that the process poses an unacceptable risk to their drinking water supply and should be banned throughout the watershed.[21] Unfortunately natural gas extraction is exempt from the Safe Drinking Water Act and numerous other environmental protections,[22] meaning that there is little the federal government can do to regulate the process.

II. Risks and Consequences

Energy and water are inseparable. Water is already a limiting factor for energy extraction and electricity generation. As precipitation patterns shift and drought becomes more frequent, it will be even more difficult to meet the needs of existing activities, much less secure vast quantities of water for a rapid expansion of traditional and emerging energy technologies. The water quality impacts of energy activities will also be an increasing concern. Cooling water discharges from power plants will place a growing stress on waterways and wildlife

as temperatures continue to rise. Power plants may have to shut down with increasing frequency to avoid violating permit requirements. Failure to consider this complex relationship between water and energy will lead to worsening water problems as the climate continues to shift.

The consequences of unsustainable mining and drilling practices are very worrisome in light of climate change. While the effects are localized, they pose a dire and unnecessary threat to communities and ecosystems. The loss of vegetation from mountaintop removal greatly increases the risk of flooding especially as climate change brings more extreme storms. The contamination of surface and groundwater resources is also troubling at a time when water supplies are becoming less reliable due to shifting precipitation patterns and rising drought. Degrading existing water resources only exacerbates the risk of water shortages in an uncertain future.

III. Preparing for the Future

By better integrating planning of water and energy resources, embracing more efficient technologies, and curtailing the most damaging energy extraction processes, we can reform wasteful practices and help secure water and energy for years to come.

Integrate energy and water management: Growing energy needs, over allocated water resources, and a changing climate present a looming crisis that cannot be ignored. There are many steps we can take in the short-term to avoid this conflict. First, we must better integrate energy production and water resources planning. In a future defined by less reliable water supply, it is essential that water is a primary consideration in the development of new energy sources and production facilities. This requires a better understanding of the link between energy production and water availability in different regions of the country. The Department of Energy (DOE) has spent several years developing an Energy-Water Research Roadmap that is intended to identify key challenges and an integrated approach to addressing them through coordinated action among state and federal agencies. Unfortunately, the Department has repeatedly refused to release the report.[23] DOE should release it immediately.

Based on this research, the federal government should take the lead in promoting meaningful integrated planning for energy development across the country. Water managers and planners should be involved in energy development decisions at all levels of government to ensure that new energy facilities will not place an unmanageable burden on local water resources. Many permitting decisions occur at the state level, but the federal government can influence energy installations on federal lands, nuclear and hydropower projects that require federal licenses, and projects that receive financial backing from the federal government. In these cases, the federal government should require energy developers to first demonstrate that all reasonable efforts have been taken to meet energy needs by increasing efficiency. Where new energy facilities cannot be avoided, federal agencies should require water assessments to demonstrate that the project will have sufficient water for future operations (including projected climate change impacts) and that it will not have substantial negative impacts on other water users including ecosystems. Any new facility must be required to employ the most water-efficient energy technologies. Federal agencies should also work with states to encourage them to implement similar measures in energy permitting at the state level.

Congress can play an important role in promoting integrated planning. Future energy legislation should instruct federal agencies to incorporate these requirements into their operations and funding decisions. In addition, Congress should revisit energy incentives it has enacted and ensure that federal funding is not supporting emerging technologies that cause unmanageable impacts on water resources.

Second, there must be a national effort to use energy and water more efficiently. Congress should authorize and appropriate additional funding for the WaterSense program, which educates consumers about water efficient products. The EPA should step up its efforts to work with state and local governments to implement water conservation and efficiency programs across the country. The federal government can also significantly reduce water use in its operations by strengthening efficiency requirements in federal facilities and better integrating water efficiency and reuse into guidelines under the National Environmental Policy Act and federal Principles and Standards.[24] Finally, the federal government can establish nationally consistent metrics for assessing water use efficiency and work to make the data available to the public.[25]

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Energy efficiency efforts should be similarly expanded given the potential benefits for water resources. Congress should increase funding for a broad suite of existing energy efficiency programs including EnergyStar, research and development efforts, and grant programs. The Department of Energy should expand its existing work with state and local governments to improve energy efficiency, building on successful state-level demand management programs. Aggressive investments in energy efficiency could eliminate the need to build 1,300 power plants in the next twenty years.[26] California is now projecting that demand-side measures will cause the net peak demand for electricity generated in power plants to decrease between 2011 and 2020 under every one of a variety of scenarios.[27]

Finally, there is an urgent need to reduce water use at new and existing power plants. These efforts must be carefully balanced, as efforts to reduce withdrawals can increase water consumption. If new power plants are built with closed loop cooling systems, for example, water consumption for electrical energy production could double by 2030.[28] At the same time, continued use of once-through cooling systems will have increasing impacts on water quality and aquatic species as temperatures rise and could cause power plants to shut down with increasing frequency. Sandia National Laboratories and the National Energy Technology Laboratory are researching advanced cooling technologies and the use of alternative water sources for cooling. Congress should significantly increase funding for this research to more rapidly bring these technologies to market.[29] At the same time, EPA must continue to work with states to encourage adoption of the most water-efficient technology under Section 316(b) of the Clean Water Act. New power plants are currently required to use closed loop cooling at a minimum, but rules for existing plants have been stalled due to lawsuits. Existing plants should be required to retrofit once-through cooling systems, and EPA should continue to drive movement toward the most efficient cooling technologies as they become commercially viable.

Improve oversight of damaging extraction practices: Hydraulic fracturing and mountaintop removal pose an unacceptable threat to water resources and will severely undermine communities' ability to adapt to a changing climate. Congress should pass legislation to regulate natural gas extraction under the Safe Drinking Water Act and other environmental laws to ensure that drilling does not continue to threaten drinking water supplies and harm surrounding communities. Congress should also require companies to reveal the chemicals that they use in the fracturing process. Members of Congress have introduced legislation that would have accomplished both of these goals, but it has thus far failed to become law.[30] Likewise, action is needed to put an end to mountaintop removal operations. While EPA has issued regulations that would strengthen scrutiny of this practice,[31] the agency has continued to approve new mountaintop removal projects under the new rules.[32] Legislation clarifying that the material blasted from the tops of mountains cannot be dumped into surrounding waterways has failed to win passage in Congress thus far.[33]

Saving energy saves water and vice versa.

IV. Benefits of Being Prepared

Our current system of managing water and energy puts us on an unsustainable path that will inevitably lead to shortages and economic disruptions. By using both resources more efficiently and planning new energy projects with future water availability in mind, we can make responsible and cost-effective investments that will prepare us for the daunting water challenges that we face. Reforming the most egregious mining and drilling practices will likewise protect increasingly valuable water resources and preserve the natural landscapes that buffer communities from extreme floods. Degrading water and land resources as we face the looming threat of climate change is clearly moving in the wrong direction. Addressing these problems in the near term, as difficult as it may be, will better prepare us for a more volatile and uncertain future. ■

FOOTNOTES

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