NGA
NATIONAL GOVERNORS ASSOCIATION

White Paper

Advancing the Energy-Water Nexus: How Governors Can Bridge Their Conservation Goals

Executive Summary

Energy and water are critical resources that rely on each other to be extracted, transported and used. However, because states typically regulate energy and water separately, they can miss opportunities for cost-effective conservation of both resources. Particularly where there are concerns around water availability, states will want to examine how to meet energy demand with as little water as possible. Recent flooding in the spring of 2017 has led to record low levels of drought in the country; however, a few months prior severe drought was present in some part of 32 states. Most states that confront floods also confront droughts at other times of the year, since droughts can increase water vapor in the atmosphere which can lead to more severe floods.

To lower the cost and environmental impact of electricity, states will want to manage water resources with as little energy consumption as possible. Opportunities may also exist to integrate energy and water conservation efforts to unlock benefits for both systems. Governors play an important role in coordinating and integrating such efforts, as they have a unique ability to break down regulatory silos to create better policy designs that can leverage limited state funds, avoid waste and protect the environment.

The "energy-water nexus" is a term used to capture the interdependencies of these two critical resources. A large amount of energy is used to pump, treat and transport water. A substantial amount of water is used to extract, generate and transport energy, and to cool some types of power plants. This paper examines the resource conservation aspects of the energy-water nexus that can be improved through better state policy design. Many of the ideas in this paper were discussed at an experts roundtable hosted by the National Governors Association Center for Best Practices in February 2016, which brought together a diverse set of stakeholders—including state and federal officials, electric and water utilities, environmental organizations and academics—to review a draft set of policy recommendations. An earlier paper, S*tate Practices to Protect Drinking Water Resources While Developing Shale Energy*, examined how states can address the interdependency of energy developed with hydraulic fracturing and water quality and quantity.[1]

Bridging energy and water conservation policy designs offers governors three potential benefits:

- Water efficiency programs can yield substantial energy savings and may do so at a lower cost than programs designed for energy efficiency alone;
- Conservation of water resources can help mitigate potential increases in consumer bills from expected new infrastructure investments; and
- Even in those parts of the country where water scarcity is not a challenge, integrated resource decisions can help both energy and water consumers.

Governors seeking to advance energy and water savings simultaneously can take the following 12 actions, which span activities that can be taken by the governor's office or in partnership with environmental agencies, health agencies, utility regulators and energy and transportation agencies. State silos often prevent the optimal management of energy and water. Governors can uniquely help address unintentional state silos, encouraging state agencies to take a more holistic and effective approach.

A governor's office can:

- Convene a multiagency and stakeholder working group to identify how the state can better integrate energy and water considerations in state policies;
- Consider legislation to create tax incentives for water conservation investments; and
- Include water efficiency projects in legislation authorizing Property Assessed Clean Energy programs.

Water agencies can:

- Update State Revolving Loan Fund guidance on asset management to help optimize water utility infrastructure investments; and
- Amend permit language for electricity generation and transmission by adding criteria about water minimization considerations.

Utility regulators can:

- Allow electric utilities to be compensated for water conservation and indirect energy savings in their energy efficiency programs;
- Include water co-benefits in electric utility planning processes and considerations of new electricity capacity;
- Require water audits to encourage replacement of leaky water pipes and consider a water loss standard; and
- Examine water rate designs that support conservation while also maintaining utilities' financial stability.

Energy agencies can:

- Provide technical assistance to water and wastewater facilities on energy efficiency improvements; and
- Encourage public water utilities to use energy savings performance contracts, to invest in energy efficiency and on-site generation.

Transportation agencies can:

- Consider using permeable paving when feasible.

Additional efforts can be pursued in conjunction with state legislatures, as noted above.

Background

The energy and water sectors are mutually dependent in many ways. The energy sector supports water production and management, including: extracting, pumping, purifying, heating, cooling, transporting and treating. Water is used in many aspects of energy development including: extracting coal, oil and gas; growing plants for biofuels; and operating and cooling thermoelectric power plants.

Water scarcity is acute in some localities and will increase as populations grow. Recent flooding in the spring of 2017 has led to record low levels of drought in the country; however, a few months prior severe drought was present in some part of 32 states. Most states that confront floods also confront droughts at other times of the year, since droughts can increase water vapor in the atmosphere which can lead to more severe floods. While southern and western states have more frequent statewide challenges with water scarcity, the issue affects most states.

Additionally, population growth and migration patterns indicate that southern states with existing water stress will face increased stress on their limited water resources.[2]

Water consumes 13 percent of U.S. energy, which is equivalent to the energy used by 40 million Americans annually.[3] Electricity consumes 4 percent of water, largely due to evaporation and leaks.[4] Forty percent of freshwater withdrawals is used for power plant operation and cooling, which can present a constraint in some areas, even though that water is not consumed but rather is returned to the watershed after cooled.[5] Some nuclear plants and hydroelectric plants have had to shut down or curtail generation due to insufficient water availability. This problem is likely to become more common, based on weather and population patterns.[6]

The “energy-water nexus” is a term used to capture the interdependencies of these two critical resources, including their impacts on quantity and quality. This paper focuses on the question of quantity and opportunities for states to conserve both resources.[7] One important aspect of the energy-water nexus is the quality and quantity of water affected by hydraulic fracturing practices. Opportunities for states to address those risks responsibly are covered in an earlier paper.[8]

Many of the ideas presented in this paper were discussed at an experts roundtable hosted by the National Governors Association Center for Best Practices in February 2016. The roundtable brought together a diverse set of stakeholders—including state and federal officials—representatives of electric and water utilities and environmental organizations and academics to discuss a draft set of policy options.

Bridging energy and water conservation policy designs offer governors three potential benefits:

- Water efficiency programs can yield substantial energy savings and may do so at a lower cost than programs designed for energy efficiency alone;
- Conservation of water resources can help mitigate potential increases in consumer bills from expected new infrastructure investments; and
- Even in those parts of the country where water scarcity is not a challenge, integrated resource decisions can help both energy and water consumers.

Regulatory Silos Are Barriers Uniquely Suited to Be Addressed by Governors

While energy and water are interdependent resources, states typically manage them under separate agencies. Energy is generally overseen by a combination of the state’s public utility commission (PUC), oil and gas commission, environmental office, and energy office. Water is overseen by a state’s health and environmental agencies (e.g., the natural resource department—which may include a drinking water office, clean water office and wastewater office), as well as oil and gas commission, water council, agricultural department and public utility commission. The state transportation department does not directly oversee either resource, but it has substantial indirect impacts by determining the runoff and permeability of pavement materials, which affects the volume of stormwater entering the energy-intensive wastewater system. Agencies that oversee one sector do not typically consider the regulatory impacts and compliance costs for other sectors. Governors are uniquely positioned to convene interagency entities and encourage a conversation about holistic cost considerations that span state agencies.

Water Conservation Can Be a Cost-Effective Route to Energy Efficiency

Based on emerging evidence from **California**, states may wish to compare the costs of reducing energy use through energy efficiency measures with indirect savings from water conservation measures. Water conservation measures enacted under California Governor Jerry Brown’s 2015 drought directive resulted in a 24 percent reduction in water use. The University of California at Davis (U.C. Davis) found that the residential water conservation efforts over a three-month period— primarily reduced lawn watering—resulted in indirectly saving 460 gigawatt hours of energy due to reducing the quantity of energy needed to treat and pump water. This quantity is equivalent to the energy saved from all of the state’s investor-owned utility energy efficiency programs over the same period.[9] States should not expect the same high levels of conservation for a continuous program because the study looked only at the summer season, when the opportunity to reduce lawn watering is highest. Another caveat is the public was required to conserve by executive order and had to undertake stringent water conservation because of the extreme drought during that time. Water conservation is less likely to have such high public motivation in normal times. Keeping these caveats in mind, the research indicates that states can save substantial levels of energy and water through water conservation.

Another finding of the U.C. Davis study was that the cost of the water conservation measures was roughly one-third that of the energy efficiency programs.[10] While specific costs will differ by state—depending on the energy intensity of the water system and cost of energy efficiency—this emerging research suggests that other states should consider evaluating the costs associated with their energy and water efficiency programs. This may call for gathering data on the energy intensity of the water system to be able to determine the cost of indirect energy savings. Indeed, more widespread collection and synthesis of energy and water data at the state level could help to identify new opportunities for energy and water savings. An ongoing project by the U.S. Department of Energy may help inform those efforts. It seeks to collect data and map flows of energy and water at the state level—including energy consumption for public water supply, wastewater treatment and irrigation—and estimate missing data.[11]

Energy Efficiency Can Mitigate Water Bill Impacts from Rising Water Prices

The price of water is expected to increase around the country, as close to three-fourths of water utilities are unable to cover their maintenance and replacement costs and need to raise rates, in part because federal funds such as the Environmental Protection Agency's State Revolving Loan Fund and other grant programs have declined.[12] Higher water bills will likely pose a particular hardship for low-income residents and municipal governments, with the latter spending 33 percent of their energy bill on water and wastewater plants.[13] There are substantial opportunities for drinking water and wastewater facilities to reduce their energy bills by an average of 15 to 30 percent and offset pending rate increases for residents, local governments and states.[14] Most water utilities in the U.S. are small-scale operators that lack the resources to identify opportunities for efficiency gains, so state governments can play an important role in facilitating education on those opportunities.

Policy Options for Governors to Advance the Energy-Water Nexus

Governors can promote policies to improve the efficient use of both energy and water through the following 12 actions. The list covers actions by the governor's office, environmental and natural resource agencies, utility regulators and energy and transportation agencies and is organized by the state office most appropriate to lead the activity. The legislature can play an important role in many of these, as is noted specifically in some of the actions.

Governor's Office Actions

A governor's office can promote all of the measures discussed in this paper, and is uniquely suited to advance the following measures.

1. Convene a multiagency and stakeholder working group to identify how the state can better integrate energy and water considerations in state policies. Agencies overseeing various aspects of energy and water management can collaborate to assess the key opportunities for executive, regulatory and legislative actions. The working group should include representatives from the energy agency, drinking water and wastewater offices, transportation agency and agricultural agency, plus utility regulators, legislators and consumer advocates. Stakeholders, including public and private water and energy utilities, should be engaged to provide input on where they see regulatory barriers. The working group can institutionalize the efforts by integrating them into state energy and water plans and planning processes. State examples are:

- **Arizona** Governor Doug Ducey created a Water Augmentation Council in 2015, composed of energy and water state agencies, agricultural stakeholders and municipal utilities. The council investigates opportunities for new water resources as well as water conservation opportunities and considers the energy-intensive impact of water treatment options.[15]

- In **California**, the Water-Energy team of the

- Climate Action team, mandated by legislation has been working on identifying opportunities for large energy and water efficiencies since 2006. Eleven state agencies participate in the working group, including the governor's office of planning, the public utility commission and the agriculture department.[16] In 2016, the working group appointed under California Governor Jerry Brown deliberated on the California Water Action Plan, which includes several of the recommendations featured in this paper.[17]

2. Consider legislation to create tax incentives for water conservation investments. Many states offer tax incentives for energy efficiency investments, but few include similar measures for water efficiency investments. Governors can propose legislation adopting state tax incentives for water conservation measures, such as dual-flush toilets. The effectiveness of energy efficiency tax incentives – which also should be considered for water tax incentive design – depends on careful policy design, including systematically updating the incentives to achieve more savings and educating stakeholders on how to use them.[18] A state example is:

- **New Mexico** offers a sustainable building tax credit for new homes that contain a certain number of water conservation measures.[19] The credit amount is based on the square footage of the home and the water efficiency certification rating achieved.[20]

3. Include water efficiency projects in legislation authorizing Property Assessed Clean Energy (PACE) programs. Under a PACE program, property owners are loaned funds for the up-front cost of clean energy investments and they repay it through an assessment added to their property tax bills.[21] In many states, the PACE-enabling legislation does not specify whether water efficiency measures can qualify, creating uncertainty and missing an opportunity for advancing measures that can achieve indirect energy savings and other benefits. Governors can include water conservation investments as an eligible use of PACE through legislation or amendments to existing law that enables PACE. Depending upon the legislative language, states may also be able to add a designation through regulation. State examples are:

- Legislation authorizing PACE in **Michigan** and **Utah** explicitly allows water efficiency improvements in their definitions of eligible energy efficiency upgrades.[22]

Water Agency Actions

A water agency is uniquely suited to advance the following measures.

4. Update State Revolving Loan Fund guidance on asset management to help optimize water utility infrastructure investments. It is a best practice for water utilities to create an asset management plan, which entails a lifecycle cost analysis of conducting repairs versus doing replacements or upgrades.[23] These plans identify cost-effective options and tend to result in increased conservation of energy and water by identifying system upgrades that conserve energy and reduce water leaks and also save the utility money over the long term.[24] Such planning processes and upfront investments are not always done because they can be challenging for water utilities that lack the technical expertise and because of competing funding priorities.

Municipal water systems help finance a substantial portion of their expenses through state revolving loan funds, which are allocated by the U.S. Environmental Protection Agency to each state to distribute. Federal law requires that certain applicants for Clean Water State Revolving Loan Funds have an asset management plan, and states have discretion in defining and enforcing these plans.[25] A governor may want to direct state agencies to give higher rankings to applications with robust asset management plans.

Additionally, since there are no federal requirements for asset management plans in the use of Drinking Water State Revolving Loan Funds, governors may want to require or give higher ranking to applications that include such plans. Governors can also direct state agencies or ask public utility commissions to provide technical and financial management assistance to small water utilities to develop asset management plans because they often face resource constraints.[26] State examples are:

- **Nebraska** requires that applicants for Clean Water State Revolving Loan Funds have asset management plans that use a lifecycle analysis methodology for at least five years and up to twenty years.[27]
- Starting in 2018, **Washington** state will require applicants to the Drinking Water State Revolving Loan Fund to have an asset management program.[28]

5. Amend permit language for electricity generation and transmission by adding criteria about water minimization considerations. Thermoelectric power plants withdraw and consume water to turn the turbines and cool the plant. Some technologies reduce the amount of water withdrawn but increase the amount of water consumed or reduce their energy efficiency, so utilities and states must consider which issue to prioritize for specific sites. There are multiple variables that determine the best technology for a particular power plant, so it is not necessarily appropriate for a state to set a water efficiency standard requirement for all power plants. A state can ask electric utilities to consider and explain their consideration of technologies that reduce water withdrawal or consumption. Similarly, states can include a question on permits for transmission lines regarding the water availability in the location of the connecting generator. Additionally, states can encourage the consideration of impacts on water demand when planning for new electricity transmission infrastructure.[29] State examples are:

- The **Colorado** Water Conservation Board publishes a list of voluntary Best Management Practices for water utilities that includes considering generating and cooling technologies that maximize water conservation.[30]
- The Arizona Power Plant and Transmission Line Siting Committee, established through state legislation, evaluates applications within the state to build power plants and transmission projects.[31] The committee cannot deny approval to a project based on substantial water usage, but it can impose stipulations on the water source and volume. Many applications are granted approval if the applicant agrees to perform certain tasks such as establishing mandatory groundwater monitoring programs and establishes a groundwater impact mitigation trust funds.[32] The Arizona's public utility commissions (PUCs) also addressed this issue (see below).

Utility Regulator Actions

The following measures are uniquely suited for utility regulators to advance.

6. Allow electric utilities to be compensated for water conservation and indirect energy savings in their energy efficiency programs. PUCs approve electric and gas utility spending on energy efficiency by using cost-benefit tests that include a variety of variables and co-benefits. Typically, water savings is not one of the co-benefits. PUCs may be able to amend the methodology to include water conservation co-benefits if their statute authorizes consideration of environmental impacts. Governors can encourage a review of the cost-benefit analysis to include water conservation co-benefits as a state policy goal, although this may require legislation. Separately, PUCs can create protocols for calculating the indirect energy savings garnered from water conservation measures so that electric utilities can document their savings and be authorized to recover their costs on those investments. A state example is:

- To begin this type of process, the California PUC developed a Water-Energy Program Cost Effectiveness Calculator that estimates the indirect energy savings of water conservation measures.[33]

7. Include water co-benefits in electric utility planning processes and considerations of new electricity capacity. PUCs can adjust their guidelines for utility planning processes—such as integrated resource planning—that assess the relative costs and benefits of various generation and demand reduction options to include consideration of water conservation impacts.[34] Additionally, a regional approach toward water planning may help in addressing longer-term reliability and supply considerations for the electric utility sector. State examples are:

- The Arizona PUC revised its integrated resource plan rules in 2010 to require reporting on water consumption. The state did not prohibit water-intensive generation but required consideration of alternatives. The utilities responded by no longer proposing the most water-intensive types of technologies.[35]

- The Colorado PUC requires electric utility integrated resource plans to include annual water withdrawal and consumption data for each existing generator, as well as the water intensity of the existing generating system as a whole.[36] For new resources the PUC only requires water consumption data for resources that the utility plans to own.[37]

- The California PUC, when considering a power plant retrofit request, required a study to consider alternative options with a cost-benefit analysis that included the economic value of the water that would not be withdrawn if the power plant was replaced with energy conservation and renewable energy.[38] The study found several cost-effective alternatives, in part because of the consideration of the co-benefits of water savings, and the power plant was retired. This cost-benefit test was not for energy efficiency, but the general approach could be relevant to developing this type of analysis.

8. Require water audits to encourage replacement of leaky water pipes and consider a water loss standard. Roughly 23 percent of the country's water—approximately 7 billion gallons a day—is wasted through leaking pipes.[39] This substantial loss of water leads to substantial waste of energy and therefore wasteful expenses in both water and energy bills. Wastewater systems also have substantial leakage, with an estimated 10 billion gallons of raw sewage leaking into our waterways annually.[40] Leaking water pipes can be mitigated by advanced leak monitoring, advanced pressure monitoring and fixing and replacing leaking pipes.

States can take several actions to reduce waste from leaks. First, state regulators can require water utilities to monitor and report leaking pipes. The monitoring process raises awareness and increases the likelihood utilities will fix the leaks. Private water utilities, which make up around 8 percent of the market nationally, typically track this information for their shareholders, but public water utilities, which are usually smaller, do not often track this. A state can require leak monitoring and provide clear guidance on cost recovery for the equipment and staff needed to monitor. Second, states can establish a maximum allowable leak rate, called a water loss standard. Some states have adopted rapid rate recovery mechanisms—to allow utilities to be compensated for pipe replacements without needing to submit a full rate case—to accelerate the replacement of aging leaking water mains, thus reducing wasted water and wasted energy.[41] Some state ratepayer advocates assert that if a state pursues that route, it should require that the resulting cost-savings be shared with ratepayers. State examples are:

- **Georgia** passed a Water Stewardship Act in 2010 that requires water utilities to compile annual water audits and develop water loss control plans by using free tools. The state dedicated part of its state revolving loan funds to train small water utilities and authorized grants based on the water utility's ability to achieve meaningful reductions in water loss.[42]

- **Tennessee** established guidelines for water loss reporting and control through legislation in 2007.[43] Utility districts, cities and other water systems are required to use a water loss evaluation tool developed by the American Water Works Association to calculate performance indicators and validity scores indicative of system performance. Tennessee's current water loss standard allows water utilities to lose no more than 20 percent of their water.[44] Water systems with excessive unaccounted for water loss may be investigated by the Utility Management Review Board.

9. Examine water rate designs that support conservation while maintaining utilities' financial stability. Numerous states have adopted electricity and gas rate structures to encourage conservation while addressing utilities' concerns about lower revenues through various mechanisms. Yet insights from those efforts have not been widely applied to the water sector.[45] While there are important differences in the energy and water sectors, public utility commissions can direct energy rate staff to share their insights with water rate staff, who can use them to examine new water rate designs. Rate structures that have been tried in the energy sector to encourage consumers to conserve include: time variant pricing, demand response programs and tiered or block pricing. Rate structures that have been tried in the energy sector to maintain utilities' financial stability to compensate for reduced sales include: decoupling, performance incentives and rate stabilization funds. Lessons from the use of these rate structures in the energy sector can be explored for the water sector. A state example is:

- In California, the Irvine Ranch Water District public water utility implemented a tiered pricing strategy to encourage conservation by consumers. Each household is charged a base rate for the first tier of water consumed and a higher rate for additional gallons of water. The first tier is set at the volume of water that is typically used for indoor household needs. The second is tied to discretionary uses such as lawns and pools. The utility achieved a 37 percent reduction in water use after it implemented the tiered pricing structure in 1990. Some of the revenue collected from the higher rates funds conservation education.

Energy Agency Actions

An energy agency is uniquely suited to advance the following measures.

10. Provide technical assistance to water and wastewater facilities on energy efficiency improvements. State energy offices manage energy efficiency incentives that can be targeted at water and wastewater facilities, since they use large volumes of both energy and water. The energy offices can create and facilitate the use of educational resources to train the facility managers on energy efficiency. The training can include considering the development of onsite renewable energy generation as well as facility audits. For instance, state energy offices can inform them that the U.S. Department of Energy's Better Plants program offers free energy audits to water and wastewater utilities. State examples are:

- The energy offices in **Nebraska**, **New Hampshire**, **New Mexico** and **Tennessee** are using funds provided by the U.S. Department of Energy's State Energy Program to encourage the adoption of energy efficiency improvements in municipally owned wastewater treatment utilities. They are providing the wastewater utilities with energy audits, technical assistance and funding to implement energy management plans.[46]

- The 2015 **New York** state energy plan directs the energy office and environmental agency to work with wastewater treatment plants to become net energy-neutral.[47] The New York State Energy Research and Development Authority (NYSERDA) first provided funding in 2013 for proposals to help wastewater treatment plants become net energy-neutral.[48] In 2015, NYSERDA proposed to continue technical assistance to up to 78 plants representing 90 percent of the state's wastewater treatment capacity to encourage energy reductions.[49]

11. Encourage public water utilities to use energy savings performance contracts to invest in energy efficiency and on-site generation. For many water systems, the energy bill is both one of the largest and one of the most controllable operating expenses regularly incurred.[50] Energy Savings Performance Contracting (ESPC) is a type of public-private partnership that enables government facilities to obtain financial and technical assistance to reduce energy and water use without tapping into capital budgets. Here is how ESPCs work: an energy service company designs a package of energy cost reduction measures and guarantees the energy cost savings. Financing is arranged through a variety of mechanisms, and the facility pays back the financing out of the revenue stream created by energy bill savings over a term of 10 to 20 years. ESPCs are common in state and local government facilities and are beginning to be used by some small water utilities. The state can support municipal efforts through their ESPC programs that provide technical assistance on how to best design an ESPC contract.[51] The energy office can conduct outreach to water and wastewater utilities and offer them technical assistance.[52] A state example is:

- In **Oklahoma**, the municipality of Ada created ESPCs for water and wastewater utilities that included investments in more efficient pump motors, installing variable frequency drives, heating, ventilation, air conditioning, lighting, and advanced meters.

Transportation Agency Actions

A transportation agency is well-suited to advance the following measures.

12. Consider using permeable pavement when feasible. Stormwater gathers pollutants on paved surfaces and then flows into stormwater systems, where it must be treated as part of an energy-intensive and costly process. Permeable pavement—which allows water to seep into the ground, avoiding treatment and regenerating aquifers—can reduce runoff volumes from intense storms by 75 percent.[53] While the upfront costs for porous asphalt drainage systems are roughly 15 percent higher than for traditional pavement, they can reduce state expenses by around 26 percent when considering the saved stormwater management expenses.[54]Permeable pavement also can reduce state expenses for salting, plowing and patching.[55]

A key challenge to expanding the use of permeable pavement is that state transportation departments oversee state roadways and state transportation funds, while state departments of natural resources and local governments bear the stormwater system costs. Governors can encourage transportation departments to consider costs borne by other agencies and stakeholders and to evaluate when green infrastructure projects such as permeable pavement offer holistic cost-saving opportunities. State examples are:

- The **Massachusetts** Department of Transportation employs several best practices in drainage design to maximize groundwater recharge and minimize runoff, including permeable pavement. The division issued its GreenDOT policy directive outlining these best practices in 2010 and cited them as consistent with the governor's sustainability goals.[56] The Massachusetts Department of Environmental Protection recently documented projects that received awards through the state's Nonpoint Source Competitive Grants Program. Provincetown Harbor and the City of Boston received funding for permeable pavement projects.[57]

- **New York** Governor Andrew Cuomo designated $10 million for innovative green stormwater infrastructure projects, including for permeable pavement projects funded through the Green Innovation Grant Program.[58] Funding for the program originally came from federal funds from the American Recovery and Reinvestment Act of 2009. Now the state funds it with the Clean Water State Revolving Loan Fund.[59] For example, the City of Rome used a Green Innovation grant to replace impervious sidewalks with a specialized permeable pavement, made from recycled tires, to help manage and clean stormwater runoff.[60]

Conclusion

The energy-water nexus provides governors with opportunities to advance energy and water savings simultaneously. A number of states have adopted procedures and promising practices that warrant consideration by other states. Governors who are seeking to bridge their energy and water conservation goals can use the policies presented in this paper to encourage the efficient use of both resources.

Aliza Wasserman
Program Director
Environment, Energy & Transportation Division
NGA Center for Best Practices
202-624-5387

Jessica Rackley
Senior Policy Analyst
Environment, Energy & Transportation Division
NGA Center for Best Practices
202-624-7789

June 2017

Recommended citation format: Rackley, J and Wasserman, A. *Advancing the Energy-Water Nexus: How Governors Can Bridge Their Conservation Goals*. Washington, D.C.: National Governors Association, 2017.

Endnotes

[1] National Governors Association. State Practices to Protect Drinking Water While Developing Shale Energy. (Washington, DC: July 2015). https://www.nga.org/files/live/sites/NGA/files/pdf/2015/1507DrinkingWaterShaleEnergy.pdf.
[2] Henderson, Tim. Americans Are Moving South, West Again. (Washington, DC: The Pew Charitable Trusts, January 8, 2016). http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/01/08/americans-are-moving-south-west-again.
[3] Kelly T. Sanders and Michael E. Webber, "Evaluating the energy consumed for water use in the United States," Environmental Research Letters, Vol. 7, 034034 (2012).
[4] U.S. Department of Energy. The Water-Energy Nexus: Challenges and Opportunities. (Washington, DC: June 2014). https://energy.gov/sites/prod/files/2014/07/f17/Water%20Energy%20Nexus%20Full%20Report%20July%202014.pdf.
[5] Ibid.
[6] Ibid.
[7] The technical terms used in the literature to refer to these indirect impacts on quantity are the "embedded energy" or "embedded water" – meaning the quantity of the resource required to use the other resource.
[8] See Cramer, S. and Wasserman, A. *State Practices to Protect Drinking Water While Developing Shale Energy* (Washington, D.C.: National Governors Association Center for Best Practices, July 9, 2015). https://www.nga.org/files/live/sites/NGA/files/pdf/2015/1507DrinkingWaterShaleEnergy.pdf.
[9] Lohan, Tara. Water Conservation Saves Energy in California. (Water Deeply: June 8, 2016). https://www.newsdeeply.com/water/articles/2016/06/08/water-conservation-saves-energy-in-california. One of the substantial findings is that the electricity savings associated with the observed achievements in water conservation is roughly equivalent to the total first-year electricity savings estimated for all of the energy IOU efficiency programs implemented in the period from July through September 2015 (the period where data was available for both initiatives).
[10] The University of California Davis Center for Water-Energy Efficiency found that water conservation efforts by the state resulted in a 24 percent reduction in 2015 over 2013 levels, creating energy savings of 460 GWh at a cost of $45 million, while the investor-owned utilities' energy efficiency programs that resulted in 460 GWh cost $173 million. This translates into a cost per kWh of $0.38/kWh for the IOU energy efficiency programs and $0.10/kWh for the water conservation programs. https://cwee.shinyapps.io/greengov/.
[11] The U.S. Department of Energy's Office of Energy Policy and Systems Analysis is developing state-level Sankey diagrams of interconnected energy and water flows (based on federal and state data sources). The project is due to be completed in 2017 for California, Colorado, Oklahoma and Texas. An aggregated federal-level energy-water Sankey diagram can be found in The Water-Energy Nexus: Challenges and Opportunities report, published by DOE in 2014.
[12] Black and Veatch Insights Group, 2016 Strategic Directions: Water Industry Report and Congressional Research Service. Water Infrastructure Financing: History of EPA Appropriations. (Washington, DC: April 5, 2012). https://fas.org/sgp/crs/misc/96-647.pdf.
[13] U.S. Environmental Protection Agency. Energy Efficiency in Water and Wastewater Facilities. (Washington, DC: 2013).
[14] Consortium for Energy Efficiency, CEE National Municipal Water and Wastewater Facility Initiative, January 1,2010, p. 1.
[15] Arizona Department of Water Resources. Governor's Water Augmentation Council. Accessed February 2016.
[16] California Climate Change. Water-Energy Team of the Climate Action Team (WET-CAT) (August 2016). Accessed at: http://www.climatechange.ca.gov/climate_action_team/water.html (November 1, 2016).
[17] State of California. California Water Action Plan 2016 Update. (Sacramento, CA: 2016). http://resources.ca.gov/california_water_action_plan/.
[18] American Council for an Energy Efficient Economy, "Energy Efficiency Tax Incentives 2005-2011: How Have They Performed?," (June 2011)
[19] New Mexico. SB 279, An Act Relating to Taxation; Creating a New Sustainable Building Tax Credit with Water Conservation Requirements Pursuant to the Income Tax Act and the Corporate Income and Franchise Tax Act. (Santa Fe, NM: 2015). Accessed at: https://www.nmlegis.gov/Sessions/15%20Regular/final/SB0279.pdf.
[20] State of New Mexico – Taxation and Revenue Department. New Sustainable Building Tax Credit Approval. (New Mexico: April 11, 2016).
[21] U.S. Department of Energy (DOE). Property-Assessed Clean Energy Programs. (Washington, DC: Accessed February 2016). The funding for the Water-Energy grant program was approved by the governor on September 22, 2015, through Senate Bill 101, 3860-101-3228 Section 13 (SB 101), which appropriated $19 million in funding from the GGRF (Health and Safety Code §39710 et seq.) to DWR to continue this grant program.
[22] State of Michigan. 95th Legislature, Regular Session of 2010, Enrolled House Bill No. 5640, Property Assessed Clean Energy. http://www.legislature.mi.gov/documents/2009-2010/publicact/pdf/2010-PA-0270.pdf. State of Utah. 2013 General Session, Enrolled Senate Bill No. 221, Assessment Area Act Amendments. http://le.utah.gov/~2013/bills/static/SB0221.html.
[23] New Jersey Department of Environmental Protection. Asset Management Guidance and Best Practices. (New Jersey, accessed December 22, 2016). http://www.nj.gov/dep/watersupply/pdf/guidance-amp.pdf.
[24] United States General Accounting Office. Water Infrastructure, Comprehensive Asset Management Has Potential to Help Utilities Better Identify Needs and Plan Future Investments. (Washington, DC: 2004). http://www.gao.gov/new.items/d04461.pdf.
[25] The federal Water Resources Reform and Development Act of 2014 (WRRDA). Modifications to the Clean Water Act which were enacted in 2014 require a recipient of a loan for a project that involves the repair, replacement or expansion of a publicly owned treatment works to develop and implement a Fiscal Sustainability Plan (FSP) or certify that it has developed and implemented such a plan. See: http://dnr.wi.gov/Aid/documents/EIF/Guide/FSP.html.
[26] Some public utility commissions offer technical assistance on rate design to small utilities. For example, see Florida Public Service Commission. Rate Case Procedures for Water and Wastewater Utilities. (Florida, accessed November 16, 2016, at: http://www.psc.state.fl.us/Publications/PSCRateCase).

[27] Nebraska Department of Environmental Quality. Guidance Document Fiscal Sustainability Plans for Clean Water State Revolving Loan Funds. (Lincoln, NE: September 2015).

[28] Washington State, Office of Drinking Water. Drinking Water State Revolving Fund Loan Program, 2016 Guidelines. (Olympia, WA: July 2016). Accessed at: http://www.doh.wa.gov/portals/1/Documents/pubs/331-196.pdf.

[29] State agencies can use the DOE-sponsored Energy-Water Decision Support System (DSS) for planners in the Western and Texas Interconnections to identify locations where water constraints may inform relocating transmission locations.

[30] Colorado Water Conservation Board, Department of Natural Resources. Best Management Practices. (Denver, CO: Accessed February 2016).

[31] Arizona Corporation Commission. Arizona Power Plant and Transmission Line Siting Committee. (Arizona, accessed October 26, 2016). http://www.azcc.gov/divisions/utilities/electric/linesiting-faqs.asp.

[32] The National Academies. Addressing the Energy-Water Nexus Power Plants and Partnerships. (Washington, DC: Board on Energy and Environmental Systems Water Science and Technology Board, December 5, 2013); and Richard Rushforth, Water and Power: Inextricably tied to Arizona's Growth.

[33] The California calculator is based on the state's research finding that 20 percent of its electricity is spent moving water, while the national average is close to 13 percent, so states may want to create their own calculator with a rate that is more reflective of the energy-intensity of their water system. For more information on the California calculator methodology see: James J. Hirsch & Associates. Water-Energy Program Cost-Effectiveness Calculator. (Prepared for the California Public Utilities Commission, June 2007). ftp://deeresources.com/Water-Energy/WaterEnergy-CEcalculator-v4.pdf.

[34] Ceres. Practicing Risk-Aware Electricity Regulation: What Every State Regulator Needs to Know. (Boston, MA: April 2012).

[35] Ibid.

[36] Ibid.

[37] Even though Colorado does not require water consumption data from all new proposals, the rules require water information from the existing high water usage coal plants, and no additional coal plants are allowed under Public Service's plans. Further, most renewable and natural gas resources do not use any evaporative water cooling. Therefore, the existing rules address the existing high water consumption resources and new resources that are viable in Colorado that generally have very low water consumption.

[38] Jim Lazar and Ken Colburn. Recognizing the Full Value of Energy Efficiency. (Montpelier, VT: 2016). http://www.raponline.org/wp-content/uploads/2016/05/rap-lazarcolburn-layercakepaper-2013-sept-9.pdf.

[39] Black & Veatch, "Buried Infrastructure", http://bv.com/reports/2013/2013-water-utility-report/buried-infrastructure.

[40] ITT Corporation, "The Value of Water Survey: Americans on the U.S. Water Crisis," 2010.

[41] Accelerate Energy Productivity 2030 ("AEP 2030") (Alliance to Save Energy, 2015; Part II, pp. 70 – 73).

[42] Information about Georgia's Water System Audit and Loss Control Program can be found at www.gawp.org and https://epd.georgia.gov/ga-water-system-audit-and-water-loss-control-manual.

[43] See Tennessee Code Annotated, Public Chapter 243, HB 743, 2007.

[44] Specifically, non-revenue water as percent by cost of operating system. See Memorandum Re: Water Loss Filing per Section 7-82-401(i) and 68-221-1010(d)(3), Tennessee Code Annotated dated January 31, 2017 at https://www.comptroller.tn.gov/UMRB/PDF/20170306WaterLossReport.pdf.

[45] Pacific Institute, "Pricing Practices in the Electricity Sector to Promote Conservation and Efficiency: Lessons for the Water Sector" (September 2013) http://pacinst.org/app/uploads/2013/09/pacinst-pricing-practices-full-report.pdf.

[46] The project is funded by a 2015 DOE State Energy Program Competitive grant.

[47] New York State. The Energy to Lead, 2015 New York State Energy Plan. (New York: 2015).

[48] New York State Energy Research and Development Authority. PON 2722 Toward Zero Net Energy Wastewater Treatment. (New York: 2013). https://www.nyserda.ny.gov/Funding-Opportunities/Closed-Funding-Opportunities/PON-2722-Toward-Zero-Net-Energy-Wastewater-Treatment.

[49] New York State Energy Research and Development Authority. Clean Energy Fund Information Supplement. June 25, 2015.

[50] UNC Environmental Finance Center, "Finding Money in the Water System Budget: Energy Savings Performance Contracting", (2015)

[51] U.S. Department of Energy. Energy Savings Performance Contracting. (Washington, DC: Accessed January 2017). https://energy.gov/eere/slsc/energy-savings-performance-contracting.

[52] Some water utilities do not pay energy bills because of pre-existing agreements with local governments.

[53] State of Massachusetts. Massachusetts NonPoint Source Pollution Management. http://projects.geosyntec.com/npsmanual/fact%20sheets/permeable%20paving_edited.pdf.

[54] Jeanna Henry, The Bottom Line: Why Permeable Pavements are Good for the Environment and Your Pocket. Washington, DC: July 9, 2015, U.S. Environmental Protection Agency.

[55] Amy Rowe, Green Infrastructure Practices: An Introduction to Permeable Pavement, Rutgers, The State University of New Jersey (February 2012), available at http://njaes.rutgers.edu/pubs/publication.asp?pid=FS1177.

[56] Massachusetts Department of Transportation. GreenDOT Policy Directive. (Massachusetts: June 2, 2010), available at: http://www.massdot.state.ma.us/portals/0/docs/p-10-002.pdf.

[57] Massachusetts Department of Environmental Protection. Indicative Project Summaries, Section 319 NonPoint Source Competitive Grants Program. (Worcester, MA: 2016). http://www.mass.gov/eea/docs/dep/water/319sum12.pdf.

[58] New York State, Environmental Facilities Corporation. Governor Cuomo Announces Consolidated Funding Application for Round 6 Now Open. (New York: accessed August 2016).

[59] Environmental Council of the States. New York's Green Innovation Grant Program and the Upper Susquehanna. (Washington, DC: 2016), accessed at: http://www.ecos.org/wp-content/uploads/2016/06/New-York-GIGP.pdf.

[60] New York State, Environmental Facilities Corporation. GIGP-Funded Projects. (New York: 2016), accessed at: https://www.efc.ny.gov/Default.aspx?tabid=228.