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The Energy-Water Nexus—How Policymaking is Shaping Generation and Usage Profiles in the Regional Southwest

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Concept of an Energy-Water Nexus

The "*energy-water nexus*" exemplifies a commonly-referenced and recurring theme in contemporary environmental policy discussions. At its core, this term refers to the significant complexity and interdependency that exists between the energy and water sectors: *i.e.*, that *energy* is needed to pump, treat, and transport water and wastewater; and *water* is needed to extract, generate, and transport energy, as well as to operate and cool thermoelectric power plants for electricity production.[1]

Despite such recognized interdependency between the energy and water sectors, there has been a historical lack of effective policy frameworks put in place to support the sustainable use and development of energy and water resources in conjunction with one another.[2] This is attributable to a fragmented oversight system wherein policies on water and energy resources are routinely established in isolation, based on their independent sectors.[3] Given the significant degree of interconnection between the energy and water industries, policymakers should alternatively focus on taking a more comprehensive and interdisciplinary approach to the effective management of these two resources. This would require regulators and policymakers to consider the impacts of water policies and regulations on energy supply and demand, as well as the impacts of energy policies and regulations on water demand and availability. Adequately addressing western drought issues depends on the more efficient use of water and energy – making this nexus even more compelling.

Although the "energy-water nexus" is conceptually broad by nature, this article focuses on recent energy generation and water usage trends in the regional Southwest and how the future of the energy-water nexus is being shaped by a heightened interdisciplinary policy development approach. To understand baseline energy and water consumption, a summary of national and regional water use trends is provided. Three Southwestern states have been chosen to illustrate examples of the connection between energy use and water consumption. This article will address the following: (I) overview of the energy-water nexus at the national level; (II) outline of

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[1] *See* David Gold & Jason Bass, *The Energy –Water Nexus: Socioeconomic Considerations and Suggested Legal Reforms in the Southwest*, 50 Nat. Resources J. 563, 563 (2010); Melissa Lamberton et al., *The Water-Energy Nexus*, Arroyo 1 (2010); Rackley, J & Wasserman, A., *Advancing the Energy-Water Nexus: How Governors Can Bridge Their Conservation Goals*, National Governors Association, 1−2 (2017); Jeremy Fisher & Frank Ackerman, *The Water-Energy Nexus in the Western States: Projections to 2100*, Stockholm Environmental Institute 8 (2011).
[2] Karen Hussey & Jamie Pittock, *The Energy-Water Nexus: Managing Links between Energy and Water for a Sustainable Future*, Ecology & Society 17(1), 31 (2012).
[3] *Id.*

current energy generation and water usage trends for the regional Southwest; and (III) identification of prospective impacts of recently-established regulations and policies on the future of the energy-water nexus in the Southwest.

I. The Energy-Water Nexus at the National Level

From a *national perspective*, the thermoelectric generating industry represents the single largest withdrawal user of water in the United States, closely followed by the irrigation/agricultural industry.[4] A 2014 USGS report showed that in 2010, approximately 161 billion gallons of water per day were withdrawn for use by the thermoelectric power industry (excluding hydroelectric power) in the United States, compared to 115 billion gallons per day by the irrigation/agricultural sector.[5] See Figure 1. In 2010, thermoelectric power withdrawals constituted approximately 45% of the Nation's total water withdrawals, 38% of its total freshwater withdrawals, and 50% of its total fresh surface-water withdrawals.[6] In contrast, withdrawals by the irrigation/agriculture sector accounted for approximately 33% of the Nation's total water withdrawals, 38% of its total freshwater withdrawals, and 57% of its total fresh surface-water withdrawals.[7]

As shown in Figure 2, the thermoelectric power industry withdrawals declined by 20% from 2005-2010, reflecting the implementation of more efficient and less water-intensive cooling systems and generating technologies at power plants.[8] These statistics emphasize the significant impacts that the energy sector can have on overall water usage. Comparatively, the Nation's total irrigation withdrawals declined by 9% from 2005-2010, indicative of a recognized shift towards more water-efficient irrigation systems.[8]

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[4] *See Overview of the Water-Energy Nexus in the United States*, National Conference of State Legislatures (2014); *see also* Hussey & Pittock, *supra* note 2.

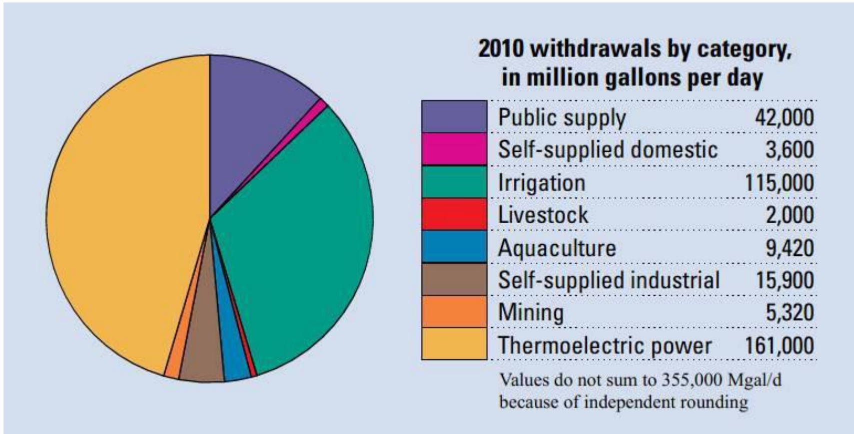
[5] Molly A. Maupin & Joan F. Kenny et al., *Estimated Use of Water in the United States in 2010*, U.S. Geological Survey Circular 1405 at 7 (2014).

[6] *Id.* at 40; USGS *Summary of Estimated Water Use in the United States in 2010*, 1 (2014), https://pubs.usgs.gov/fs/2014/3109/pdf/fs2014-3109.pdf; USGS *Thermoelectric Power Water Use*, https://water.usgs.gov/watuse/wupt.html (last updated Dec. 9, 2016).

[7] Molly A. Maupin & Joan F. Kenny et al., *Estimated Use of Water in the United States in 2010*, U.S. Geological Survey 7, 25 (2014), https://pubs.usgs.gov/fs/2014/3109/pdf/fs2014-3109.pdf; USGS *Summary of Estimated Water Use in the United States in 2010*, 1 (2014); USGS *Irrigation Water Use*, https://water.usgs.gov/watuse/wuir.html (last updated Dec. 9, 2016).

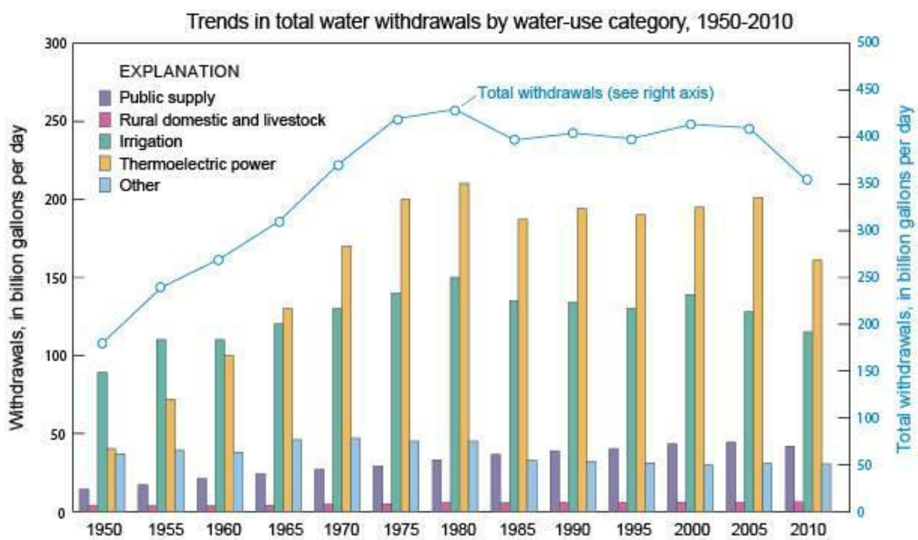
[8] *Id.*

Figure 1



Source: USGS, *Summary of Estimated Water Use in the United States in 2010* (2014).

Figure 2



Source: Molly A. Maupin & Joan F. Kenny et al., *Estimated Use of Water in the United States in 2010*, U.S. Geological Survey 7, 46 (2014).

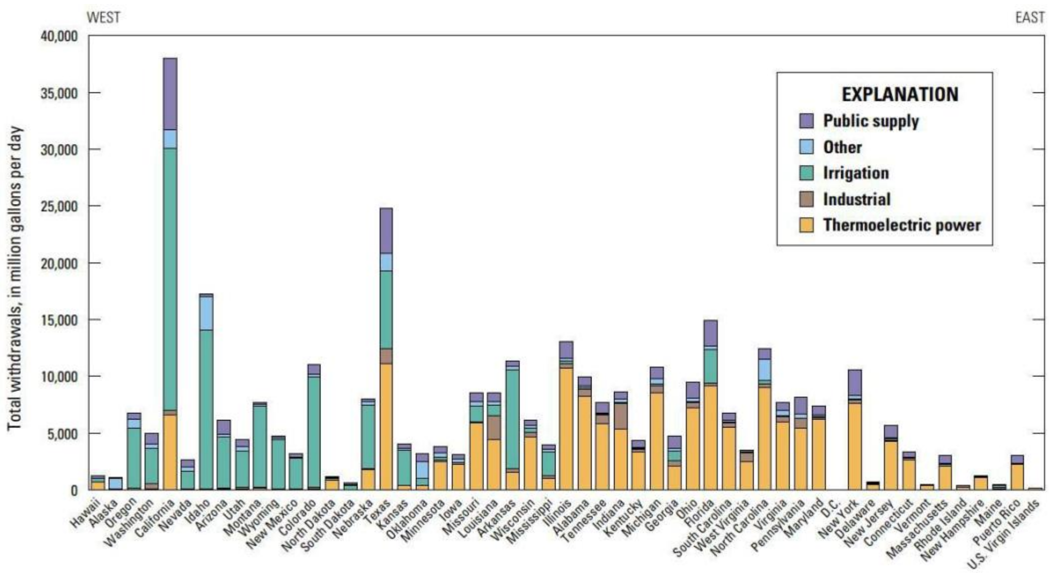
II. Energy Generation and Water Use Trends in the Regional Southwest

It is important to note that the predominant source of water withdrawals greatly varies from a *regional perspective*. As depicted in Figure 3, irrigation currently serves as the largest source of total water withdrawals in the majority of Western States, while thermoelectric power withdrawals constitute the largest water use sector in most Eastern States.[9] This regional variance is because water for thermoelectric power is routinely used in the process of generating electricity from nuclear, coal, natural gas, and oil power

[9] *Id.*

plants that require water to cool plant equipment.[10] The highest concentration of thermoelectric generating plants has historically occurred along the Eastern Coast of the United States.[11] In comparison, irrigation withdrawals are typically highest in Western States where the average annual precipitation is generally insufficient to support crop production without supplemental water sources.[12]

Figure 3
Total water withdrawals by state and bar chart showing categories by state from west to east, 2010



Source: Molly A. Maupin & Joan F. Kenny et al., *Estimated Use of Water in the United States in 2010*, U.S. Geological Survey 7, 16 (2014).

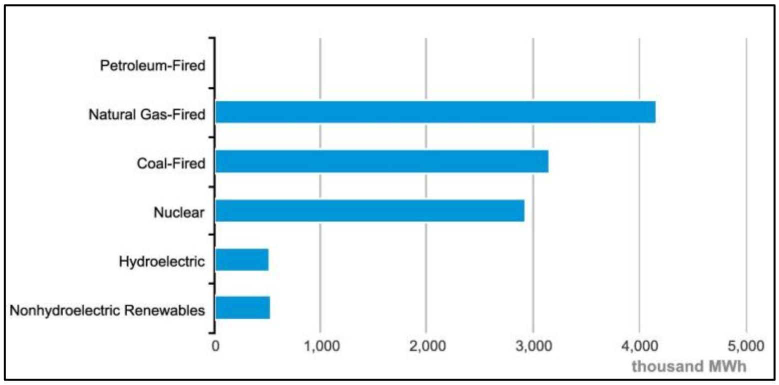
A. Arizona

Arizona currently has one of the most diversified energy portfolios in the regional Southwest. In terms of overall generation capacity, natural gas recently surpassed coal as Arizona's largest source of net generation for the first time in 2016.[13] Figure 4 shows natural gas and nuclear energy supplied approximately one-third of Arizona's total generation capacity in 2016, followed by coal which provided a little more than one-fourth of the State's total generation.[14] The remainder of Arizona's generation profile comes from renewable energy resources, which in 2016 encompassed approximately 12% of Arizona's net generation. One-tenth of that renewable energy generation occurred in the form of distributed renewable

[10] *Id.*
[11] *Id.*
[12] USGS *Irrigation Water Use*, https://water.usgs.gov/watuse/wuir.html (last visited Jan. 4, 2017).
[13] U.S. EIA *Arizona State Profile and Energy Estimates*, https://www.eia.gov/state/analysis.php?sid=AZ#54 (last visited Jan. 4, 2017).
[14] *Id.*

energy, while slightly more than one-half of the State's renewable energy generation came from utility-scale hydroelectric power.[15] In terms of distributed renewables, solar energy encompassed 5% and wind power provided only 0.5% of Arizona's net generation capacity in 2016.[16][17]

<u>Figure 4</u>
Arizona Net Electricity Generation by Source in 2016



Source: U.S. Energy Information Administration (2015), https://www.eia.gov/state/?sid=AZ.

Likewise, Arizona has also developed a diverse supply portfolio for effectively managing the State's water resources in light of susceptibility to drought-prone conditions. Arizona's water supplies are comprised of the following major resources: (1) groundwater from underground aquifers and reservoirs; (2) Colorado River water pursuant to Arizona's 2.8 million acre-feet annual allocation; (3) surface water from lakes, river, and streams; and (4) reclaimed water from treated wastewater.[17] The majority of Arizona's water supplies come from Colorado River water and groundwater sources. In 2017, approximately 41% of Arizona's total water supplies came from groundwater resources, closely followed by Colorado River water at 38%.[18] The remainder of Arizona's water supplies came from surface water at 18% and reclaimed water at 3%.[19]

In terms of overall water usage, Arizona's total statewide water withdrawals were approximately 6,820,000 acre-feet in 2010.[20] Arizona's allocation of withdrawals can be further subdivided into the following subcategories: irrigation (5,120,000 acre-feet), public supply[21] (1,360,000 acre-feet), thermoelectric power[22]

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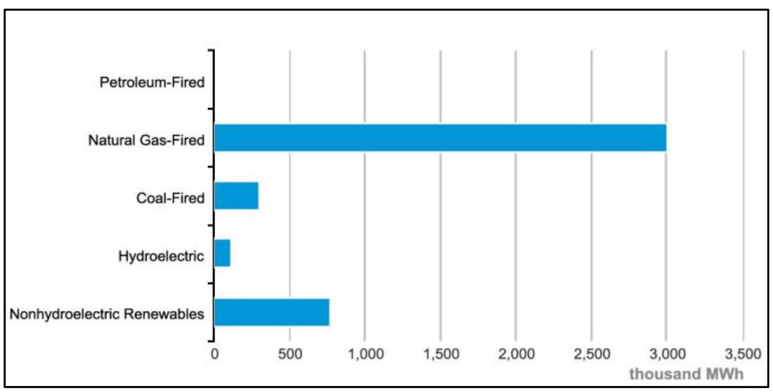
[15] *Id.*
[16] *Id.*
[17] Ariz. Dept. of Water Res., *Arizona's Water Facts*, http://www.arizonawaterfacts.com/water-your-facts (last visited Jan. 4, 2017).
[18] *Id.*
[19] *Id.*
[20] Maupin et al., *supra* note 7, at 9.
[21] "Public-supply" water use is water that is withdrawn by public and private water suppliers that supply water to at least 25 people or have a minimum of 15 connections. Public-supply water is supplied for a

(117,000 acre-feet), mining (97,000 acre-feet), aquaculture (53,000 acre-feet), domestic (30,000 acre-feet), livestock (30,000 acre-feet) and industrial[23] (14,000 acre-feet).[24] According to this data, the majority of water withdrawals in Arizona, approximately 75%, are made to support the State's irrigation industry, followed by the public supply withdrawals (19%) and the thermoelectric power withdrawals (1.7%). While the agricultural industry continues to serve as the largest source of water withdrawals in Arizona, the importance of conserving water use within the energy generation process should not be discounted, given that the thermoelectric power industry represents the third highest source of water withdrawals in the State.

B. Nevada

Similar to Arizona, natural gas constituted Nevada's largest source of net electricity generation in 2016, comprising nearly three-fourths of the State's overall generation profile.[25] See Figure 5. Renewable energy resources, including hydropower, accounted for more than one-fifth of Nevada's in-state electricity generation, half of which comes exclusively from geothermal energy.[26] Unlike Arizona, where coal-fired power comprises a larger part of the State's net generation capacity, coal-fired power supplied only approximately 5% of Nevada's total net electricity generation in 2016.[27]

Figure 5
Nevada Net Electricity Generation by Source in 2016



Source: U.S. Energy Information Administration (2016), https://www.eia.gov/state/?sid=NV.

variety of uses, such as domestic, commercial, industrial, thermoelectric-power and public water use. *See id.* at 18.

[22] "Thermoelectric power" water use refers to water that is used in generating electricity with steam-driven generators. *See id.* at 40.

[23] "Industrial" water use refers to withdrawals that are used in the process of producing commodities. *See id.* at 34.

[24] *See id.* at 11.

[25] *See* U.S. EIA *Nevada State Profile and Energy Estimates*, https://www.eia.gov/state/analysis.php?sid=NV (last visited Jan. 4, 2017).

[26] *Id.*

[27] *Id.*

Nevada serves as an additional example of a state in the regional Southwest that is subject to ongoing drought conditions, making effective management of water resources critical. In terms of Nevada's water resource portfolio, approximately 70% of the State's overall water supply comes from the Colorado River and other surface water resources.[28] Nevada is allocated 300,000 acre-feet per year of Colorado River water, representing the smallest share of Colorado River apportionments.[29] The State's groundwater resources provide the remaining 30% of Nevada's overall water supplies.[30] Ongoing drought conditions experienced in the Colorado River Basin since 2000 have caused the water levels in Lake Mead to drop, thereby potentially impacting the amount of Colorado River water available to both Arizona and Nevada users in the near future.[31]

According to USGS data, Nevada's total water withdrawals in 2010 were approximately 2,940,000 acre-feet.[32] Nevada's water withdrawals for 2010 can be further subdivided as follows: irrigation (1,760,000 acre-feet), public supply (651,000 acre-feet), mining (388,000 acre-feet), aquaculture (55,000 acre-feet), thermoelectric power (36,000 acre-feet), domestic (33,000 acre-feet), livestock (6,000 acre-feet) and industrial (6,000 acre-feet).[33] Similar to Arizona, irrigation withdrawals constitute the primary water use in Nevada, approximately 60%. Nevada's thermoelectric power industry comprises approximately 1.2% of the State's water use. As discussed above, in view of the prospective impact that ongoing drought conditions may have on future Colorado River water supplies to Southwestern states, water resource management efforts within the confines of Nevada's energy sector could result in substantial net conservation savings to the State.

C. California

Similar to Arizona and Nevada, natural gas constituted the majority of California's net electricity generation for 2016, comprising approximately half of the State's overall generation profile.[34] See Figure 6. Renewable energy resources, including hydropower, comprised an additional two-fifths of the State's overall generation capacity.[35] Hydropower supplied less than one-tenth of California's electricity generation in 2016 while non-hydroelectric renewables provided more than one-fourth of the State's generation.[36] More specifically, solar renewables

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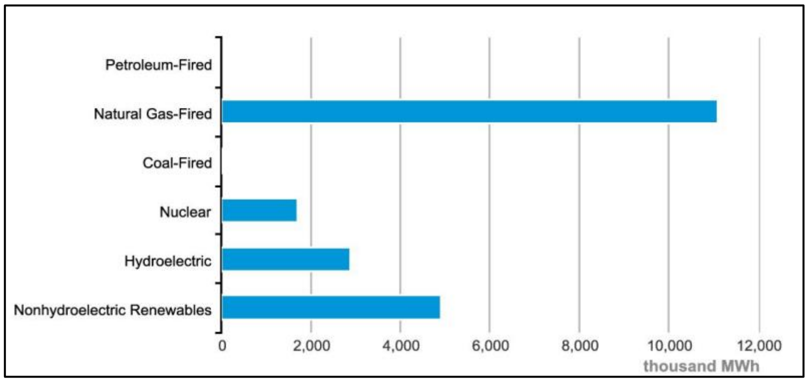
[28] U.S. EPA, *Saving Water in Nevada* (May 2016), https://www.epa.gov/sites/production/files/2017-02/documents/ws-ourwater-nevada-state-fact-sheet.pdf.
[29] *See* S. Nev. Water Auth., *SNWA Water Resource Portfolio*, https://www.snwa.com/assets/pdf/wr_plan_chapter3.pdf (last visited Jan. 4, 2018).
[30] U.S. EPA, *Saving Water in Nevada* (May 2016), https://www.epa.gov/sites/production/files/2017-02/documents/ws-ourwater-nevada-state-fact-sheet.pdf.
[31] *Id.*
[32] Maupin et al., *supra* note 7, at 9.
[33] *Id.* at 11.
[34] U.S. Energy Info. Admin. *California State Profile and Energy Estimates*, https://www.eia.gov/state/analysis.php?sid=CA.
[35] *Id.*
[36] *Id.*

encompassed approximately 43% of California's net generation in 2016.[37] Unlike Arizona, nuclear power supplied only approximately one-tenth of California's net generation in 2016.[38] Additionally, coal-fired power plays a less significant role in overall generation capacity in California than in Arizona, comprising only 0.2% of California's net generation.[39]

<u>Figure 6</u>

California Net Electricity Generation by Source in 2016



Source: U.S. Energy Information Administration (2016), https://www.eia.gov/state/?sid=CA

California relies on a diverse set of local, state, and federal surface water and groundwater projects to supply the State's overall water needs.[40] Local surface water and groundwater projects supply the majority of California's water supplies. On average, between 1998 and 2005, local surface water projects comprised approximately 55% of California's water supplies.[41] Groundwater served as the second largest water resource at 22%, followed by federal surface water projects (12%), Colorado River water (7%), and State surface water projects (4%).[42] California is also the largest user of the Colorado River, which is entitled to 27% of Colorado River water supplies at an allocation of 4.4 million acre-feet per year.[43]

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[37] *Id.*
[38] *Id.*
[39] *Id.*
[40] Cal. Leg. Analyst's Office, *The Role of Water Transfers in Meeting California's Water Needs* (Sept. 8, 1999), http://www.lao.ca.gov/1999/090899_water_transfers/090899_water_transfers.html.

[41] Kamyar Guivetchi, Cal. Dept. of Water Res., Presentation before the CA State Assembly Committee on Regional Approaches to addressing the State's Water Crisis (Mar. 20, 2013), https://mavensnotebook.com/wp-content/uploads/2013/08/Storage-Hearing-DWR-03-20-2013.pdf.
[42] *Id.*
[43] Pub. Policy Institute of California's Water Policy Center, *The Colorado River* (Oct. 2016), http://www.ppic.org/content/pubs/report/R_1016EHR.pdf.

From a withdrawal perspective, California represents a substantially larger overall water user on an annual basis than Arizona or Nevada. In 2010, California withdrew a total of 42,600,000 acre-feet, compared to the combined withdrawal of 9,760,000 acre-feet in Arizona and Nevada that same year.[44] An in-depth look at California's water usage profile indicates the following allocation of withdrawals: irrigation (25,800,000 acre-feet), thermoelectric power (7,403,000 acre-feet), public supply (7,060,000 acre-feet), aquaculture (1,090,000 acre-feet), industrial (449,000 acre-feet), mining (306,000 acre-feet), livestock (211,000 acre-feet) and domestic (193,000 acre-feet).[45]

Similar to Arizona's profile, the irrigation sector represented the largest water user in California, constituting approximately 61% of the State's total withdrawals in 2010. Additionally, California's thermoelectric power sector also has a significant impact on the State's total water usage in terms of withdrawals, constituting approximately 17%. However, due to California's uniquely situated geographical location, the predominant source of water for driving thermoelectric power generation in the State comes from saline water (7,330,000 acre-feet) compared to freshwater (73,000 acre-feet).[46] Approximately 95% of California's total saline water supply is used towards the State's electricity generation.[47][48] California's substantial reliance on water resources for electricity generation provides an opportunity for the State to utilize effective management strategies to reduce its overall water use within the energy sector.

III. Impact of Recent Policy Initiatives on the Energy-Water Nexus

An in-depth look at the energy generation and water usage profiles of the select states outlined above demonstrates the significant impacts that the energy and water sectors can have on one another; especially within the arid and drought-prone regional Southwest environment. Since the thermoelectric power generation sector has historically constituted a major source of withdrawal on many Southwestern states' vital water resources, regulators within these states are taking an increasingly interdisciplinary approach to the effective management of these resources. To achieve a more sustainable use and development of energy and water resources, policymakers have begun to more comprehensively evaluate the impacts of water policies and regulations on energy supply and demand, as well as the impacts of energy policies and regulations on water demand and availability. The below discussion highlights some of the recent interdisciplinary policy initiatives undertaken by regulators within Arizona, Nevada, and California to support

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[44] Maupin et al., supra note 7, at 9.
[45] *Id.* at 11.
[46] *Id.*
[47] USGS, California Water Science Center, *California Water Use, 2010*, https://ca.water.usgs.gov/water_use/2010-california-water-use.html (last visited Jan. 4, 2018).

compatible resource development and management between the energy and water sectors.

A. *Renewable Portfolio Standards*

One policy initiative that currently assists state regulators and policymakers in addressing the need to mitigate water withdrawals for use in the energy production process occurs in the form of a Renewable Portfolio Standard ("RPS"). Also referred to in Arizona as a "Renewable Energy Standard and Tariff" ("REST"), an RPS is a regulatory mechanism which requires utility companies to source a specified percentage of the energy that they generate or sell from renewable resources.[48] While the concept of an RPS varies across jurisdictions, this regulatory mechanism generally establishes incremental targets that require utilities to increase their total production of energy from renewable energy resources over a specified period.[49]

Although primarily perceived as a means for reducing greenhouse gas emissions, effective renewable portfolio standards can also result in substantial water withdrawal and usage savings from heightened renewable energy resource generation that are less water-intensive than some fossil fuel generation. This is because electricity generation from renewable energy resources, such as solar photovoltaics and wind, is generally less water-intensive than as observed in conventional fossil fuel energy production.[50] The implementation of impactful renewable portfolio standards can greatly benefit water-stressed states in the form of realized water use reduction savings. For example, in 2013, the United States' overall water withdrawals and consumption were reduced "by 830 billion gallons and 27 billion gallons, respectively."[51] These reductions "amount[ed] to approximately 2% of both total 2013 power sector water withdrawals and consumption."[52] These power-sector water use reductions are directly attributable to heightened electricity generation from renewable energy resources that are used by utilities to comply with state-mandated renewable portfolio standards.[53]

i. <u>Arizona</u>

[48] Solar Energy Industries Association, *Renewable Energy Standards*, https://www.seia.org/initiatives/renewable-energy-standards (last visited Jan. 4, 2018); *see also* Office of Energy Efficiency and Renewable Energy, U.S. DEPARTMENT OF ENERGY, *Renewable Portfolio Standards Resources*, https://energy.gov/eere/slsc/renewable-portfolio-standards-resources (last visited Jan. 4, 2018).
[49] *Id.*
[50] *See* Rabia Ferraukhi et al., International Renewable Energy Agency, *Renewable Energy in the Water, Energy and Food Nexus* 12-13 (Jan. 2015), http://www.irena.org/DocumentDownloads/Publications/IRENA_Water_Energy_Food_Nexus_2015.pdf.
[51] Ryan Wiser et al., *A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards*, Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory 26 (2016), http://www.nrel.gov/docs/fy16osti/65005.pdf.
[52] *Id.* at viii.
[53] *See id.* at 26-32.

From a comparative perspective, Arizona currently has one of the least aggressive renewable portfolio standards in the United States. In 2006, the Arizona Corporation Commission ("ACC") approved a REST, which requires investor-owned utilities and electric cooperatives to generate 15% of their total megawatts sold from renewable resources by 2025.[54] As part of the REST, 30% of renewable energy produced must be derived from distributed energy technologies by 2025.[55] Moreover, affected utilities are also required to file annual implementation plans describing how they will comply with satisfying the RES rules.[56]

The ACC may soon address whether to make substantive changes to the State's current REST, after a docket was opened in August 2016 to evaluate the merits of modernizing and expanding Arizona's REST rules. The initial inquiry raised in this docket focused on whether Arizona's renewable energy target could be increased to 30% by 2030 without causing undue impacts to affected utilities and their ratepayers.[57]

However, this docket has since evolved such that the Commission is now considering the adoption of a broader clean energy reform policy in the form of a proposed "Arizona Energy Modernization Plan" ("Plan").[58] Pursuant to this Plan, proposed modifications to Arizona's current renewable energy policy include, but are not limited to: (1) rebranding the REST the "Clean Resource Energy Standard and Tariff" ("CREST"), to encourage heightened development of diversified energy policies relating to clean energy resources; (2) adding a new clean energy target requiring that 80% of Arizona's energy portfolio come from clean energy resources by 2050; (3) incorporating a target of 3,000 MWs of deployed energy storage by 2030; (4) requiring regulated utilities to procure 60 MWs of electricity from a bioenergy generating station as a means of protecting Arizona's forest health; and (5) requiring regulated utilities to propose Electric Vehicle charging infrastructure within future CREST implementation plans to equip citizens with more charging options to facilitate widespread adoption of electric vehicles in Arizona.[59]

If the Commission decides to address this issue, increasing the amount of electricity generation that must come from clean energy resources would have a positive net benefit on the State's water resource management in terms of lowering the amount of

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[54] *See* ARIZ. CORP. COMM'N. Decision No. 69127, Docket No. RE-00000C-05-0030 (Nov. 14, 2006), available at http://www.azcc.gov/divisions/utilities/electric/res.pdf; *see also* A.A.C. R14-2-1801 through R14-2-1815 (ACC REST Rules).

[55] ARIZ. CORP. COMM'N. Press Release, *Commissioners Approve Rules Requiring 15 Percent Of Energy From Renewables By 2025* (Nov. 1, 2006), http://www.azcc.gov/divisions/utilities/electric/environmental.asp.

[56] A.A.C. R14-2-1812.

[57] *See* Letter from Commissioner Doug Little "Review, Modernization, and Expansion of the Arizona Renewable Energy Standard and Tariff Rules" (Aug. 22, 2016), Docket No. E-00000Q-16-0289, http://images.edocket.azcc.gov/docketpdf/0000172774.pdf.

[58] *See* Letter from Commissioner Andy Tobin, ARIZ. CORP. COMM'N, *Arizona's Energy Modernization Plan*, Docket No. E-00000Q-16-0289 (Jan. 30, 2018), http://images.edocket.azcc.gov/docketpdf/0000185386.pdf .

[59] *Id.*

total water withdrawals and consumption emanating from the thermoelectric-power sector.

ii. Nevada

Currently, Nevada has a slightly more aggressive RPS than Arizona's REST. Nevada first established its RPS via adoption by the Nevada Legislature in 1997, and the RPS has since undergone several modifications in subsequent legislative sessions.[60] Under the current standard, regulated electric utilities must generate 25% of their total electricity for sale from renewable energy resources by 2025.[61] Nevada's RPS also contains an additional requirement that at least 5% of the total renewable energy in the portfolio must be generated by solar facilities through 2015 and at least 6% must be generated by solar facilities beginning in 2016.[62] Similar to Arizona, the Public Utilities Commission of Nevada requires regulated electric utilities to submit annual filings documenting their compliance with the RPS.[63] Given its status as the "driest state" in the United States,[64] some policymakers in Nevada are actively encouraging heightened proliferation of renewable energy generation as a means to conserve its vital water resources.

iii. California

In contrast to Arizona and Nevada, California's RPS represents one of the most ambitious standards in the Nation.[65] Similar to Nevada, California also established its RPS via state legislative enactment in 2002, and has since accelerated its RPS in a series of subsequent legislative actions.[66] California's current RPS requires regulated electric utilities to supply 50% of their total retail electricity sales from eligible renewable energy resources by 2030.[67] Directly attributable to this aggressive RPS requirement and the retirement of traditional energy resources, California experienced the largest water withdrawal and consumption reductions of any state from proliferated renewable energy generation in 2013.[68]

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[60] NEV. PUB. UTILITIES COMM'N., *Renewable Portfolio Standard*, http://puc.nv.gov/Renewable_Energy/Portfolio_Standard/ (last visited Jan. 4, 2018).
[61] SB 358 (2009); Nev. Rev. Stat. § 704.7821.
[62] *Id.*
[63] Nev. Pub. Utilities Comm'n., *Renewable Portfolio Standard*, http://puc.nv.gov/Renewable_Energy/Portfolio_Standard/ (last visited Jan. 4, 2018).
[64] *Saving Water in Nevada*, EPA (May 2016), https://www.epa.gov/sites/production/files/2017-02/documents/ws-ourwater-nevada-state-fact-sheet.pdf.

[65] *California Renewables Portfolio Standard (RPS)*, PUB. UTIL. COMM'N OF CAL., http://www.cpuc.ca.gov/renewables/ (last visited on Jan. 4, 2018).
[66] *Id.*
[67] S.B. 350 (2015); *see also* Cal. Pub. Util. Code § 399.11 *et seq*.
[68] Wiser et al., *supra* note 52.

B. Integrated Resource Planning

Integrated resource planning represents an additional policy tool that is becoming increasingly utilized by state utility regulators for analyzing the prospective impacts of projected energy generation portfolios on a multitude of environmental considerations, including water withdrawals and consumption. At its core, an integrated resource plan ("IRP") is a utility plan developed "for meeting forecasted annual peak and energy demand, plus some established reserve margin, through a combination of supply-side and demand-side resources over a specified future period."[69] In developing an IRP, utilities engage in a forecasted planning process to identify "the lowest practical costs at which a utility can deliver reliable energy services" to its ratepayers.[70] While individual resource planning requirements may differ depending on the applicable jurisdiction, many states now require regulated utilities to address how various projected generation and demand scenarios may impact water consumption reduction efforts within the confines of submitted IRPs.[71]

i. <u>Arizona</u>

Arizona first adopted its Resource Planning and Procurement Rules in 1989, which were subsequently amended by the Commission in June of 2010 via Decision No. 71722.[72] Under the Commission's existing IRP rules, load-serving entities must submit a 15-year IRP forecast every two years.[73] As part of submitted mandated filings, load-serving entities are required to report historic water consumption quantities to the Commission.[74] Additionally, load-serving entities are also required to consider the prospective impacts of forecasted electricity generation resource scenarios on overall water consumption.[75] While the Commission does not expressly prohibit water-intensive forms of generation within the context of integrated resource planning, the Commission does require load-serving entities to consider available alternatives for reducing water consumption.[76]

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[69] Rachel Wilson & Bruce Biewald, *Best Practices in Electric Utility Integrated Resource Planning: Examples of State Regulations and Recent Utility Plans*, REGULATORY ASSISTANCE PROJECT 4 (Jun. 2013), http://www.raponline.org/wp-content/uploads/2016/05/rapsynapse-wilsonbiewald-bestpracticesinirp-2013-jun-21.pdf.

[70] *Id.*

[71] *See* Jessica Rackley & Aliza Wasserman, *Advancing the Energy-Water Nexus: How Governors can Bridge their Conservation Goals*, National Governor's Association (Jun. 2017), https://www.nga.org/files/live/sites/NGA/files/pdf/2017/1706Ener.

[72] Decision No. 71722 1-2; (June 3, 2010), Docket No. Docket No. RE-00000A-09-0249.

[73] A.A.C. R14-2-703(C)-(D). A "load-serving entity" refers to "a public service corporation that provides electricity generation service and operates or owns, in whole or in part, a generating facility or facilities with capacity of at least 50 megawatts combined." A.A.C. R14-2-701(26).

[74] A.A.C. R14-2-703(B)(1)(q).

[75] A.A.C. R14-2-703(D).

[76] *Id.* § R14-2-703(D)(17).

Within the context of recently submitted 2017 IRP filings, two of the State's largest investor-owned utilities, Arizona Public Service Company ("APS") and Tucson Electric Power Company ("TEP") outlined objectives for achieving water usage savings, attributable to changing resource demands and a growing recognition of the interdependency of the energy-water nexus by utilities. According to APS, non-renewable groundwater usage across its fleet "is expected to be reduced by almost half from 13% in 2016 to only 7%" over the next ten years.[77] APS also reports that it "expects to meet increasing energy needs while reducing … water intensity by … 29%" during the 2017-2032 forecasting period.[78] Similarly, TEP comments on the importance of effectively managing water resource availability in conjunction with securing reliable power generation within its 2017 IRP filing.[79] Further, TEP forecasts being able to achieve a 100% reduction in surface water consumption and nearly 30% reduction in overall water consumption by 2032 under its Reference Case Plan resource scenario.[80]

There was also a notable consensus among APS and TEP that the following initiatives will assist utilities in achieving such significant water consumption reductions during the forecasting period: (1) investing in more water-efficient technologies at both existing and new plants; (2) retirement of older, water-intensive coal-fired generation units; and (3) increased penetration of less water-intensive, renewable energy resources within selected portfolios.[81]

ii. Nevada

Pursuant to enacted legislation, Nevada also requires its investor-owned utilities "to have plans in place to meet Nevada's future water and energy resource needs."[82] In Nevada, IRPs cover a forecasting period of 20 years and must be filed every three years.[83] Akin to Arizona, Nevada's IRP rules require regulated utilities to address the importance of water consumption reductions within the forecasting planning process. In accordance with NAC § 704.9359, regulated electric utilities

[77] ARIZ. PUB. SERV. 2017 Integrated Resource Plan, at 22 (Apr. 2017), https://www.aps.com/library/resource%20alt/2017IntegratedResourcePlan.pdf. This plan was submitted as part of the Commission's Docket No. E-00000V-15-0094 (Resource Planning and Procurement in 2015 and 2016).

[78] Id.

[79] TUCSON ELEC. POWER 2017 Integrated Resource Plan 269 (Apr. 3, 2017), https://www.tep.com/wp-content/uploads/2016/04/TEP-2017-Integrated-Resource-FINAL-Low-Resolution.pdf. This plan was submitted as part of the Commission's Docket No. E-00000V-15-0094 (Resource Planning and Procurement in 2015 and 2016).

[80] *Id.*

[81] *See* ARIZ. PUB. SERV. 2017 IRP; TEP 2017 IRP.

[82] PUB. UTIL. COMM'N, *Planning for Nevada's Water and Energy Needs* (Jan. 7, 2013), http://puc.nv.gov/uploadedFiles/pucnvgov/Content/Consumers/Be_Informed/Fact_Sheets/Fact_Sheet_IRP.pdf.

[83] NEV. REV. STAT. § 704.741 (2017); NEV. ADMIN. CODE § 704.9215 (2017). The requirement to submit IRPs is limited to "any public utility in the business of supplying electricity which has an annual operating revenue … of $2,500,000 or more."

must identify "[t]he environmental costs to the State associated with operating and maintaining a supply plan or demand side plan." This mandated analysis of environmental costs to the State expressly includes the quantification of water consumption across projected supply and demand plans.[84] Moreover, in reviewing the adequacy of submitted IRPs, the Nevada Public Utilities Commission must "[c]onsider the value to the public of using water efficiently" when selecting preferred measures and sources of supply set forth by utilities in their IRPs.[85]

iii. California

Unlike Arizona and Nevada, California currently does not have integrated resource planning requirements in place for regulated electric utilities.[86] However, this is soon to change. As part of the recently passed Senate Bill ("SB") 350 in 2015, the California Public Utilities Commission ("CPUC") is actively engaged in a rulemaking process[87] to establish substantive IRP filing requirements for California's electric load-serving entities.[88] In accordance with SB 350, publicly-owned electric utilities with an average load of greater than 700-gigawatt hours must submit their first IRPs to the California Energy Commission ("CEC") by January 1, 2019, and update such plans accordingly at least once every five years thereafter.[89]

The substantive IRP filing requirements, as determined by the CPUC, are intended to enable load-serving entities to better assist the State in reducing greenhouse gas emissions from 1990 levels by 40%, and achieving 50% renewable energy procurement status by 2030.[90] In August 2017, the CEC published a set of guidelines aimed at providing public insight as to how the Commission intends to administer its subsequent reviews of publicly owned utility IRPs once the CPUC has established the substantive IRP filing requirements.[91] In addition, the CPUC recently filed a Proposed Decision, inviting public comment on recommended substantive

[84] NEV. ADMIN. CODE § 704.9359 (2017).
[85] NEV. REV. STAT. § 704.746(6)(b) (2017).
[86] Rachel Wilson & Paul Peterson, *A Brief Survey of State Integrated Resource Planning Rules and Requirements*, at 15 (Apr. 28, 2011), http://www.cleanskies.org/wp-content/uploads/2011/05/ACSF_IRP-Survey_Final_2011-04-28.pdf.
[87] CAL. PUB. UTIL. COMM'N Rulemaking 16-02-007, Informal Pre-Workshop Comments of the Cal. Indep. Sys. Operator on Energy Div. Preliminary Concept Paper (2016).
[88] *See* CAL. PUB. UTIL. COMM'N, *Integrated Resource Plan and Long Term Procurement Plan*, http://www.cpuc.ca.gov/irp/ (last visited Jan. 4, 2018); CAL. AIR RES. BD., *Integrated Resource Plans-GHG Planning Targets*, https://www.arb.ca.gov/cc/sb350/sb350.htm (last visited Jan. 4, 2018).

[89] SB 350, § 35 (Cal. 2015); *see also* CAL. ENERGY COMM'N, *Integrated Resource Plans (Publicly Owned Utilities)*, http://www.energy.ca.gov/sb350/IRPs/ (last visited Jan. 4, 2018).
[90] SB 350, §§ 2(a)(1)-27(a)(1)(A) (2015); *see also* CAL. ENERGY COMM'N, *Integrated Resource Plans (Publicly Owned Utilities)*, http://www.energy.ca.gov/sb350/IRPs/ (last visited Jan. 4, 2018).
[91] CAL. ENERGY COMM'N, *Publicly Owned Utility Integrated Resource Plan Submission and Review Guidelines* (Jul. 2017), http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-07/TN221045_20170905T172842_Publicly_Owned_Utility_Integrated_Resource_Plan_Submission_and.pdf.

requirements for load-serving entities to follow in filing their prospective integrated resource plans.[92] Although still in the planning/development stages, it is evident from a review of the CPUC's Proposed Decision reveal that, as in the case of Arizona and Nevada's IRPs, California will likewise require load-serving entities to evaluate environmental factors within the confines of their submitted IRPs.[93]

C. Demand Side Management

Many states are currently evaluating water consumption reduction objectives within the power sector exists in the form of demand-side resource management planning. Demand-side management ("DSM") refers to efforts that seek to reduce energy demand by encouraging consumers to adopt behavioral energy efficiency and load management measures.[94] More specifically, DSM efforts focus on the implementation of actions that can be taken "on the customer's side of the meter to change the amount and/or timing of electricity use in ways that…provide benefits to the electricity supply system."[95] Demand-side management planning is routinely effectuated by many states through established regulatory mechanisms, such as requiring utilities to meet quantitative energy savings targets through cost-effective energy efficiency and demand-side measures, or obligating utilities to consider demand-side resources as alternatives for meeting forecasted load growth within the confines of IRPs. Importantly, the implementation of effective demand-side management planning efforts by states can mitigate environmental costs associated with electricity generation, including significant water consumption reductions.[96]

i. Arizona

In Arizona, effective demand-side management planning is provided through established energy efficiency obligations that are mandated by the Arizona

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[92] CAL. PUB. UTIL. COMM'N, Proposed Decision of Commissioner Randolph, *Decision Setting Requirements for Load Serving Entities Filing Integrated Resource Plans* (Dec. 28, 2017), http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M201/K974/201974336.PDF.
[93] *Id.* at 12, 88.
[94] *See* Jeffrey L. Pursley, *The Impact on Consumer Behavior of Energy Demand Side Management Programs measurement techniques and Methods*, at 1 (July 2014), https://digitalcommons.unl.edu/cgi/viewcontent.cgi?referer=https://www.bing.com/&httpsredir=1&article=1049 &context=businessdiss*;* David Crossley, *Effective Mechanisms to Increase the Use of Demand-Side Resources*, at 9 (Jan. 2013), http://www.raponline.org/wp-content/uploads/2016/05/rap-crossley-effectivepoliciesfordsresources-final-24-jan-2013.pdf.
[95] David Crossley, *Effective Mechanisms to Increase the Use of Demand-Side Resources*, at 9 (Jan. 2013), http://www.raponline.org/wp-content/uploads/2016/05/rap-crossley-effectivepoliciesfordsresources-final-24-jan-2013.pdf.
[96] *See* Howard Geller, *The $20 Billion Bonanza: Best Practice Electric Utility Energy Efficiency Programs and their Benefits for the Southwest*, at xviii (Oct. 2012), http://www.swenergy.org/Data/Sites/1/media/documents/publications/20BBonanza/20B_Bonanza-COMPLETE_REPORT-Web.pdf.

Corporation Commission.[97] Having "long recognized the value of energy efficiency," the Commission first adopted rules outlining Energy Efficiency Standards for regulated utilities in 2010.[98] Under the Commission's existing rules, all electric and natural gas utilities in the state must meet prescribed energy efficiency savings by 2020.[99]More specifically, all investor-owned electric utilities must achieve energy savings of 22% of retail sales by 2020 by implementing demand-side management programs that are cost-effective and promote energy efficiency, load management or demand response measures.[100] Additionally, electric distribution cooperatives must propose a goal for each year to achieve at least 75% of the investor-owned utilities' savings requirement.[101] Both investor-owned utilities and electric distribution cooperatives must annually submit an implementation plan to the ACC, outlining any proposed demand-side management programs they intend to utilize to satisfy the Commission's energy efficiency requirements.[102] Moreover, all natural gas utilities are required to achieve a cumulative energy savings of 6% of retail sales by 2020, and likewise, file annual implementation plans identifying proposed demand-side management measures.[103]

Industry stakeholders have projected substantial water savings from the implementation of effective demand-side management measures by regulated utilities. According to the Southwest Energy Efficiency Project, Arizona may achieve approximately 4.1 billion gallons per year in water savings by 2020 through the reduced operation of power plant cooling systems and a strong commitment to effectuating utility energy efficiency programs.[104] This water consumption reduction potential attributable to the ability of energy efficiency to displace the need for new or additional power plant investment emphasizes the significant impacts of effective demand-side management planning on the energy-water nexus.

Moreover, Arizona utilities are placing increased emphasis on the energy-water nexus within the confines of evaluating their demand-side management programs and measures. APS recently outlined energy-water reduction strategies within its proposed DSM implementation plan filing with the ACC. More specifically, APS proposes to offer a non-residential Leak Reduction DSM program,

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[97] ARIZ. CORP. COMM'N, *Energy Efficiency-Electricity and Gas*, http://www.azcc.gov/divisions/administration/energyefficiency.asp (last visited Jan. 4, 2018).

[98] *Id.*; Decision No. 71819 (Aug. 10, 2010), Docket No. RE-00000C-09-0427, http://images.edocket.azcc.gov/docketpdf/0000116125.pdf; Decision No. 72042 (Dec. 10, 2010), Docket No. RG-00000B-09-0428, http://images.edocket.azcc.gov/docketpdf/0000121097.pdf.

[99] ARIZ. CORP. COMM'N, *supra* note 96.

[100] Ariz. Admin. Code §§ R14-2-2403-R14-2-2404 (2017).

[101] *Id.* at § R14-2-2418.

[102] *Id.* at § R14-2-2405; *Id.* at § R14-2-2418.

[103] *Id.* at §§ R14-2-2503-R14-2-2505.

[104] Geller, *supra* note 95; Southwest Energy Efficiency Project, *Arizona Energy Fact Sheet: Energy Efficiency & Energy Consumption* (Jul. 2017), http://www.swenergy.org/Data/Sites/1/media/documents/publications/factsheets/sweep-az-factsheet-2017-final.pdf.

whereby "APS will work collaboratively with water utilities that have systems with high rates of water leakage to identify the energy savings potential from reduced pumping needs when water leaks are repaired."[105] As part of this program, "APS will provide incentives to water providers that could help pay a portion of the cost of leak repair projects based on the calculated energy savings that result from reduced pumping needs."[106] Additionally, APS plans on expanding its existing Demand Response, Energy Storage, and Load Management Program to examine "pumped water storage…opportunities to save both water and energy in utility water delivery systems" within its service territory.[107] Although not addressed in detail within its proposed 2018 DSM Implementation Plan, TEP indicated that it "plans to explore the water-energy nexus and potential [energy efficiency] related measures."[108] TEP also indicated that "[i]f there are cost-effective opportunities to reduce water loss and achieve energy savings, the Company will file a supplemental program that will be funded as a pilot program."[109]

ii. Nevada

Unlike Arizona, Nevada currently does not have separately established demand-side management or energy efficiency savings objectives in place for its regulated utilities.[110] However, regulated utilities still actively engage in demand-side management planning efforts through Nevada's IRP process.[111] Within their IRPs, Nevada utilities are required to incorporate "a demand side plan," which identifies and evaluates all DSM and energy efficiency programs "for which the utility is requesting Commission approval."[112] In developing a demand-side plan, utilities must assess the impacts of proposed DSM and energy efficiency programs on overall levels of energy consumption and associated factors.[113] As in Arizona, industry stakeholders have projected significant water consumption reduction potentials associated with a heightened focus on the implementation of energy efficiency measures by regulated utilities. The Southwest Energy Efficiency Project estimates that Nevada can achieve approximately 2.4 billion gallons per year in water savings by 2020 through increased proliferation of utility energy efficiency programs and mitigated power plant cooling operations.[114]

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105 ARIZ. PUB. SERV. CO., *Application for Approval of its 2018 DSM Implementation Plan*, at 14 (Sept. 1, 2017), Docket No. E-01345A-17-0134, http://images.edocket.azcc.gov/docketpdf/0000182484.pdf.

106 *Id.* at 14-15.

107 *Id.* at 2.

108 TUCSON ELEC. POWER, 2018 Energy Efficiency Implementation Plan, at 3 (Aug. 1, 2017), Docket No. E-01933A-17-0128 , https://www.tep.com/wp-content/uploads/2017/08/2017_81_tep_ee_implementation_plan.pdf.

109 *Id.*

110 Nevada's Renewable Portfolio Standard requires that 20% of retail electricity sales be met by renewables and energy efficiency by 2015 and 25% by 2025. Energy efficiency is phased out of the RPS by 2025. *See* NRS § 704.7821.

111 *See* NEV. ADMIN. CODE § 704.9215 *et seq*.

112 NEV. ADMIN. CODE § 704.934.

113 NEV. ADMIN. CODE § 704.925.

114 Geller, *supra* note 95; Southwest Energy Efficiency Project, *Nevada Energy Fact Sheet: Energy Efficiency & Energy Consumption* (July 2017),

iii. California

Similar to Arizona, California has also established objective energy efficiency savings targets for its regulated utilities. In 2006, the California Legislature, via Assembly Bill 2021, set in place energy efficiency savings goals that required regulated utilities to achieve a 10% reduction in forecasted electricity consumption within ten years.[115] This bill also directed the CEC and the CPUC to continuously update the State's energy efficiency savings objectives for a ten-year forecast period, every three years.[116] California's energy efficiency targets were most recently revised in October 2015, after the passage of Senate Bill 350.[117]

In accordance with SB 350, California's electric and natural gas utilities must achieve a "cumulative doubling of statewide energy efficiency savings" by January 1, 2030.[118] This bill also requires the CEC "to establish annual targets for statewide energy efficiency savings and demand reduction that will achieve a cumulative doubling of statewide energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030."[119] The CPUC must establish specific "efficiency targets for electrical and gas corporations consistent with this goal."[120]

Although the results of these proceedings are still pending, the CPUC has already weighed in on the importance of addressing the energy-water nexus within the confines of evaluating proposed demand-side management and energy efficiency measures. In addition to recently opening a docket proceeding tailored for addressing the energy-water nexus and to encourage heightened collaboration between investor-owned energy utilities and the water sector,[121] the CPUC has also highlighted the success of various utility-proposed DSM pilot programs at reducing overall water consumption and mitigating the impacts of prolonged drought in the state.[122]

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http://www.swenergy.org/Data/Sites/1/media/documents/publications/factsheets/sweep-nv-factsheet-2017-final.pdf.

115 AB 2021 (2006); *see also* North Carolina Clean Energy Technology center, *California Energy Efficiency Resource Standard*, DSIRE, http://programs.dsireusa.org/system/program/detail/4515 (last visited Jan. 4, 2018).

116 *Id.*

117 AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY, *State Energy Efficiency Resource Standards (EERS)*, at 3 (Jan. 2017), https://aceee.org/sites/default/files/state-eers-0117.pdf.

118 S.B. No. 350 (2015).

119 *Id.*

120 *Id.*

121 CPUC, Petition No. 13-05-008 (Dec. 30, 2013), Docket No. R.13-12-011, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M084/K481/84481715.PDF.

122 CPUC Decision No. 14-10-046 (Oct. 24, 2014), at 90-93, *Decision Establishing Energy Efficiency Savings Goals and Approving 2015 Energy Efficiency Programs and Budgets*, http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M129/K228/129228024.pdf.

Conclusion

Through a series of policy changes, generally Southwestern states have begun moving away from water-intensive coal and nuclear generation resources to natural gas-fired and renewable energy resources. Also, the focus on energy efficiency and demand-side management have resulted in significant water consumption reduction, displacing the need for new or additional power plant investment. Over time, these changes in policy will continue to impact the links between energy generation and water consumption. Additionally, climate change issues and drought will likely accelerate the policy changes through the use of continued programs and behavioral incentives. As can be evidenced by the significant reductions thus far in both energy and water consumption through the implementation of these policy changes and initiatives, their continuation is necessary for sustaining growth in the Southwest. Thus, stakeholders and policymakers will need to continue achieving heightened collaborative planning and more efficient management of the inextricably linked energy and water industries.