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Energy Water Nexus – Policy Options For States

NASEO Annual Meeting

September 25, 2018

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About NCSL

- **Bipartisan organization**
 - Serves 7,383 legislators and 30,000+ legislative staff across 50 states, as well as commonwealths and territories

- **Services**
 - State policy research
 - Technical assistance and training
 - Provide a forum where policymakers can exchange ideas
 - Lobbying for states' interests at the federal level



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Legislative Action Shapes the Energy and Water Systems

- **Energy and Water Planning Approaches**
- **Energy Mandates: Renewable Energy Standards, Efficiency requirements**
- **Environmental Permitting**
- **Regulation for gas and oil extraction**





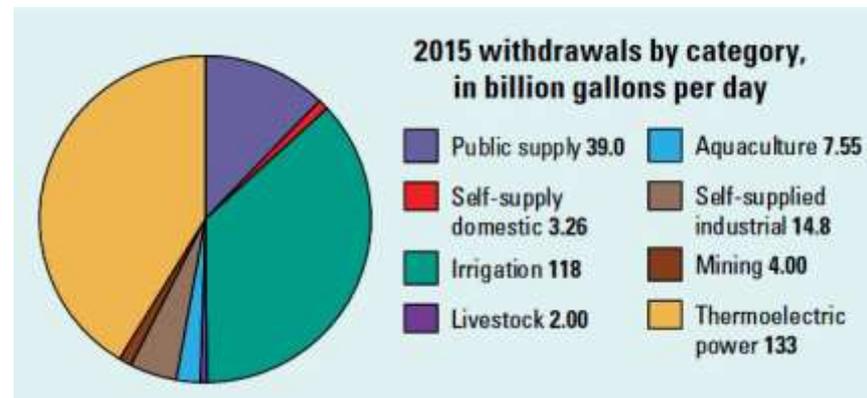
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Energy Water Nexus Issues

- Electricity generation accounts for approximately 45 percent of water withdrawals in the U.S.
- U.S. population is expected to grow nearly 20 percent by 2050
- Growing drought concerns and concerns around water security
- A rapidly changing electricity mix



Source: USGS



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Decision-making in the Energy-Water Arena is Fragmented and Complex

- State entities involved in planning the electric grid do not usually coordinate their plans with those that are responsible for water resource planning and development
- Many stakeholders: state agencies, electric utilities and power plant owners, state legislatures, state courts, tribal governments, public utility commissions, data warehouses
- The many laws and policies that are involved in energy and water systems can make crafting effective approaches challenging



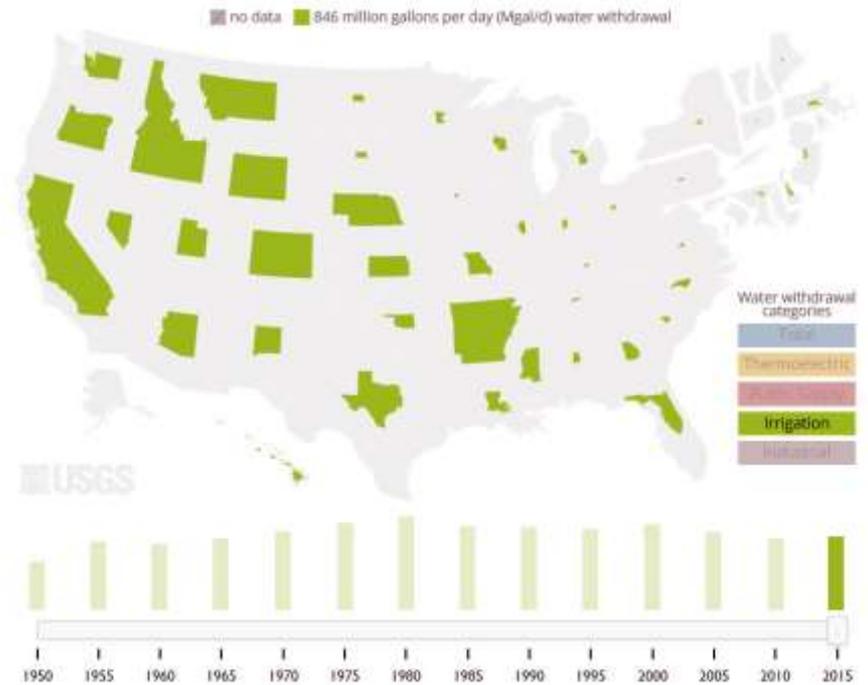
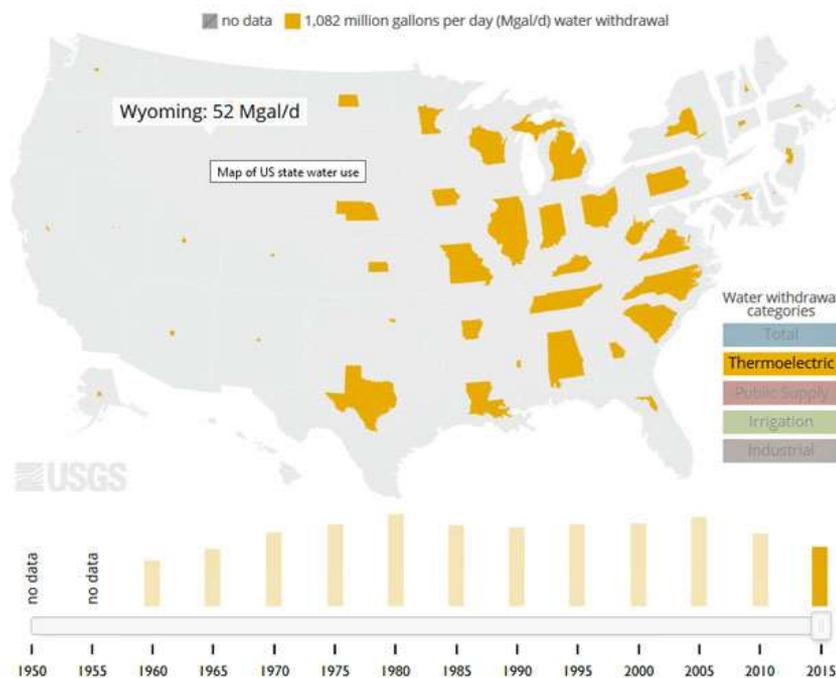
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Nexus Issues are Regional In Nature

- In the West: Agricultural irrigation is the largest water user
- In the East: A combination of municipal, industrial and thermoelectric uses dominate





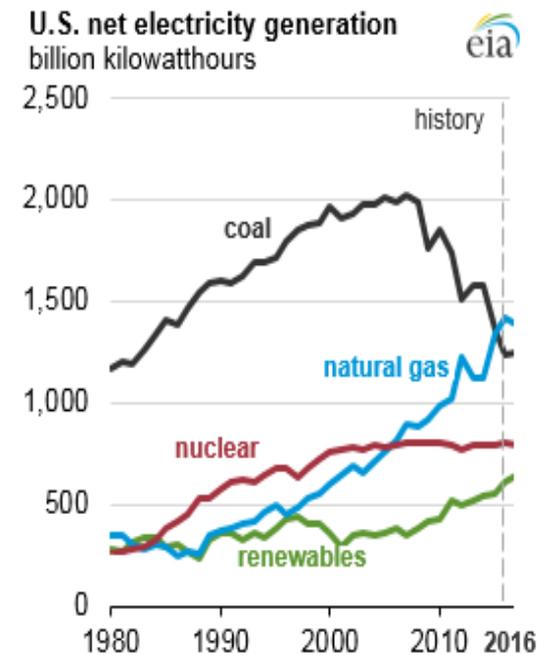
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Changing Energy Mix

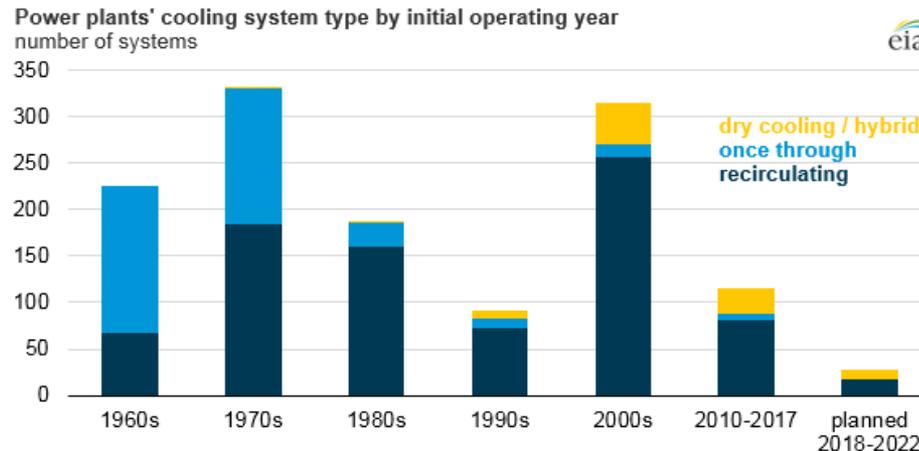
- Coal provided more than half of the nation's electricity in 2005, 30 percent in 2017
- Gas rose to 31%
- nuclear power and hydropower have remained steady, around 20 percent and 7 percent,
- Wind and solar 4 percent of generation in 2010 to nearly 8 percent in 2017





Electricity Generation Water Intensity

- Age of plant, generation source and cooling system design biggest factors
- Converting from once through to recirculating uses just 2% as much water, leading to a dramatic reduction in the amount of water withdrawals. two-thirds of U.S. thermoelectric capacity is now used recirculating systems.
- Dry cooling systems are costly and reduce powerplant efficiency, but use about 95% less water.

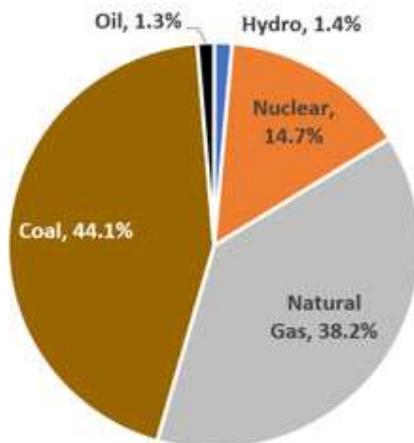




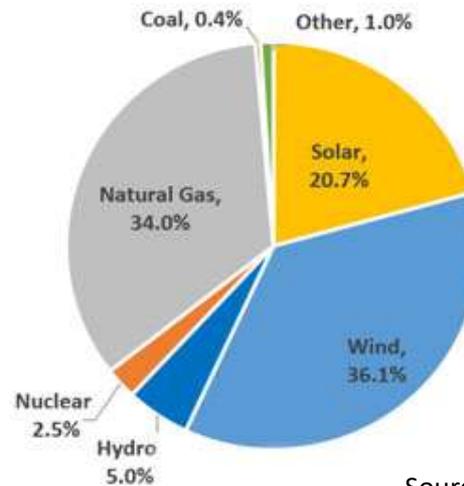
Electricity Generation Water Intensity

- Trend is toward less intensive generation
 - Thermoelectric power withdrawals in 2015 for were 18 percent less than in 2010
 - Irrigation withdrawals were 2 percent greater

Proposed Wholesale Retirements
June 2018 - June 2021



Proposed Wholesale Additions
June 2018 - June 2021



Source: FERC, AEE



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Effects of Water Scarcity on Electricity Generation

- Higher summer temperatures increase electricity demand for cooling while reducing plant efficiency and lowering power line carrying capacity
- 2007 droughts in the Southeast caused thermal generators, including Brown's Ferry nuclear plant in Alabama, to experience shutdowns and curtailments due to water shortages.
- Record flooding of the Mississippi River basin in 2011 caused substations in Nebraska to shut down
- The ERCOT grid operator, during Texas' 2011 drought, warned that extended drought conditions could force power plants offline



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State Solutions

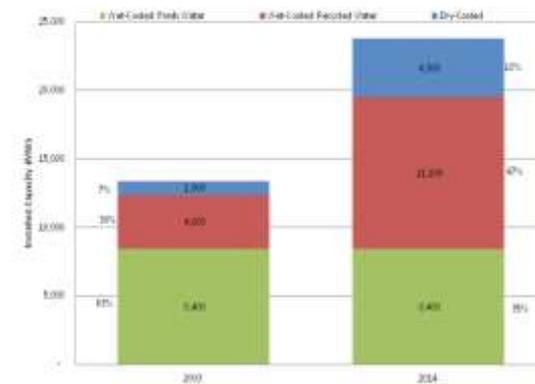
- Commission research and form working groups
- Include water in Integrated Resource Plans
 - AZ and CO
- Reduce water use through renewable energy and efficiency mandates
 - 29 states with renewable requirements
 - 26 states have efficiency requirements



State Solutions

- Establish cooling system requirements
 - CA Once-Through Cooling Phase-Out
 - California Energy Commission directed developers to propose plants that use dry cooling or recycled wastewater. 85% of those built since the 2003 actions use dry cooling or recycled water
- Include Energy in State Water or Energy Plans
 - New Mexico, North Dakota
- Create Environmental Permitting Requirements for Power Plants

Figure 13: Cooling Process for Operating Power Plants That Have a Steam Cycle

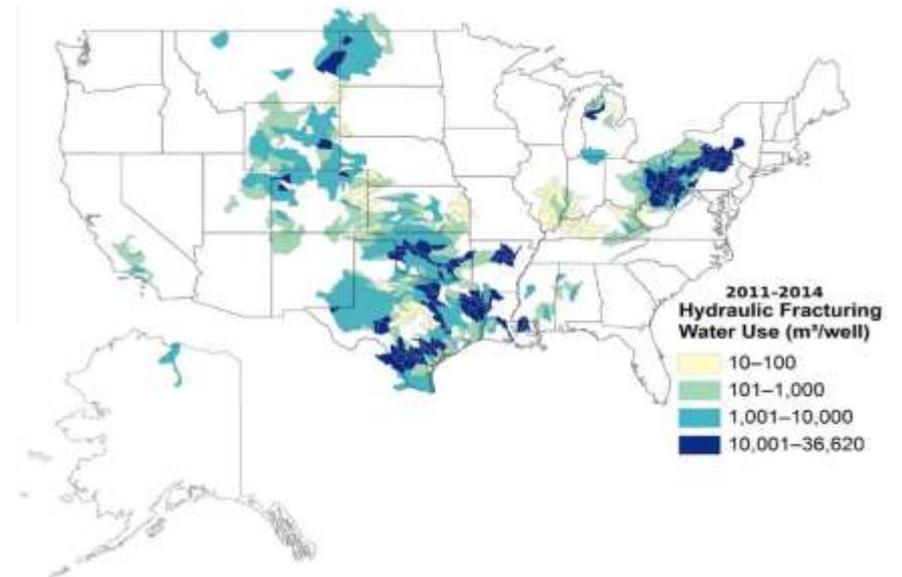
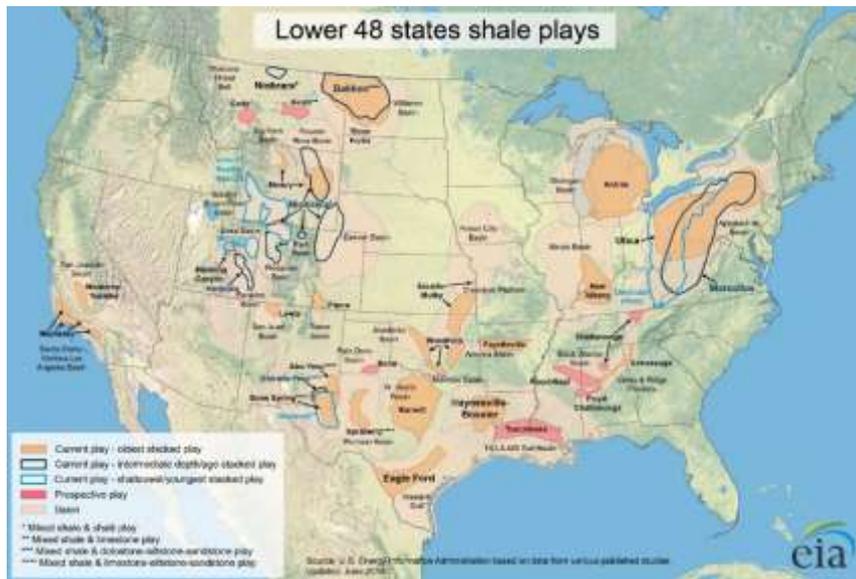


Source: California Energy Commission Staff and Quarterly Fuel and Energy Report



Oil and Gas Production

- Since 2008, shale gas production has increased by 9 fold in the Marcellus region
- Nationally Shale oil production has increased by 5 fold since 2008



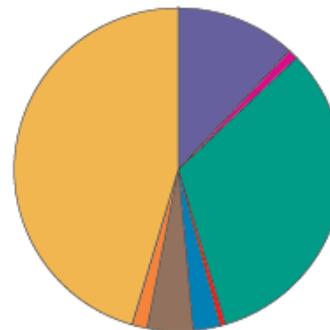
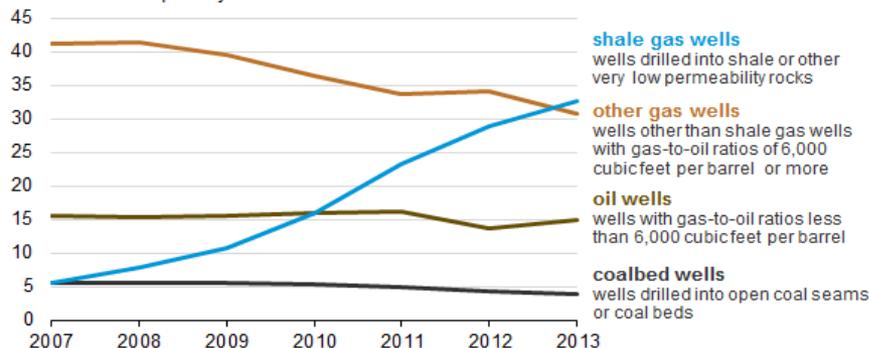
Average water use per-well for hydraulic fracturing, 2011-2014.
Source: USGS.



Oil and Gas Production: Water Consumption

- For every gallon of water used to drill and fracture a well, around nine gallons of produced water will be generated over a well's lifetime, although this varies by region
- Peak drilling activity in the Marcellus -- just over 8 million gallons/day
- Thermoelectric generators in the region -- 150 million gallons/day

U.S. natural gas gross withdrawals by well type (2007-13)
billion cubic feet per day



2010 withdrawals by category,
in million gallons per day

Public supply	42,000
Self-supplied domestic	3,600
Irrigation	115,000
Livestock	2,000
Aquaculture	9,420
Self-supplied industrial	15,900
Mining	5,320
Thermoelectric power	161,000

Values do not sum to 355,000 Mgal/d because of independent rounding



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Oil and Gas Production: Water Quality

- 15 to 80 percent of the water injected during hydraulic fracturing may return to the surface as flowback, depending on the formation
- Above-ground spills, drill casing leaks and wastewater mishandling are some of the more common causes of groundwater contamination.
- Spills and leak potential throughout wastewater management process: transportation, treatment, storage and disposal.



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Oil and Gas Production: Produced Water

- Injection Wells
 - Some estimates claim that more than 90 percent of produced water nationwide is disposed of through injection.
 - In Pennsylvania and West Virginia, which lack injection wells, around 90 percent of produced water may be used to fracture another well
 - In Texas, where injection wells are abundant, around 5% is reused.
 - EPA's Underground Injection Control Program requires states to meet its requirements—34 states have applied for this authority



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Oil and Gas Production: State Policy Actions

- Well casing and mechanical integrity requirements
- Well setbacks
- Disclosure of water sources for oil and gas drilling
- Water management plan requirements
- Public disclosure of the chemicals used in hydraulic fracturing
- Pre- and post-drilling testing
- Open Pit Disposal Requirements



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Closing Thoughts

- Slowdown in legislative activity related to hydraulic fracturing as drilling expansion has ebbed
- The emphasis has been water quality—the need to ensure that nearby water resources aren't contaminated by the drilling activities, including public and private drinking water resources.
- Legislators are much more aware of the water issues related to oil and gas development than electricity generation



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Additional Resources

[NCSL Energy and Environment Database](#)

[NCSL Energy Program](#)