Enabling Pathways for Water/Wastewater Utilities to Contribute to a Renewable Energy Future

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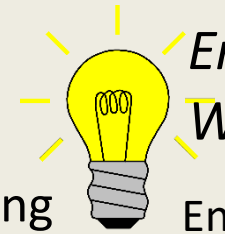
COMMUNICATING THE SCIENCE – IDENTIFYING POLICY THEMES
Align Regulatory Incentives for Safety, Reliability and Just and Reasonable Rates In the Era of Climate Change
Water Research Foundation & Colorado State University
Virtual Conference
September 17, 2020

The Water/Energy Nexus, Defined

The Embedded Water In Energy

- *Water is used throughout the Energy Lifecycle*
- Water may be used for *Energy resource extraction*, *e.g.* in fracking
- Water may be used in *Energy resources production*, *e.g.* some water is used in solar panel production and to keep solar panels clean
- Water is used in thermal power plants for *Energy Generation;* water is converted to steam to turn a turbine; water is used for cooling
- Water affects *Energy resource maintenance*, *e.g.* drought may compromise trees near power lines
- Water is the *"fuel" for hydroelectric power production, source for hydrogen, is used to produce ethanol and many biofuels*



Embedded Energy in Water

Energy is used throughout the Water and Wastewater Lifecyle

Energy may be used in *Water extraction*, *e.g.* in groundwater pumping

Energy is used in *Water treatment*

Energy may be used in *Water conveyance*, *e.g.* water projects that convey water in aqueducts, particularly when water must travel up hill

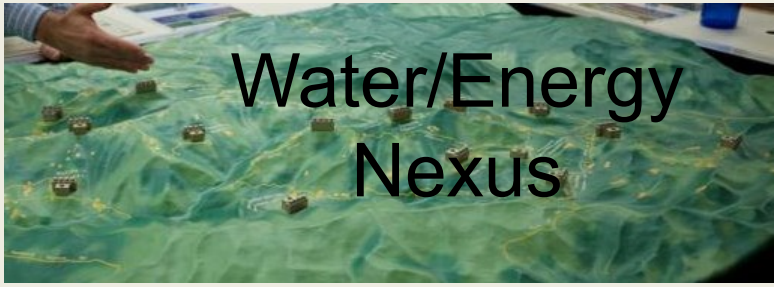
Energy may be used for *Water Storage, Pumping and after treatment*

Energy may be used in *Water Distribution*

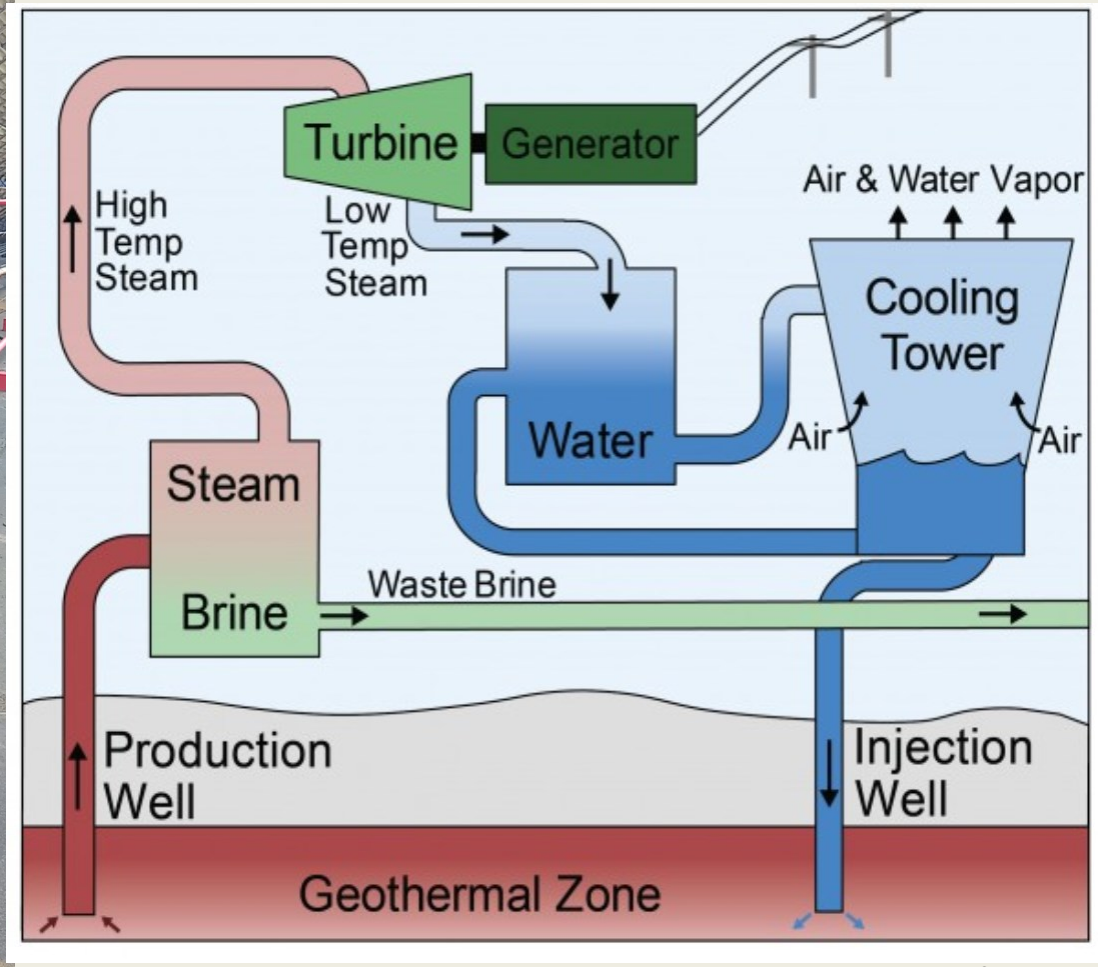
Energy may be used to *Heat Water*

Energy is *embedded in Cool Water*

CalPine Geothermal Power Plant

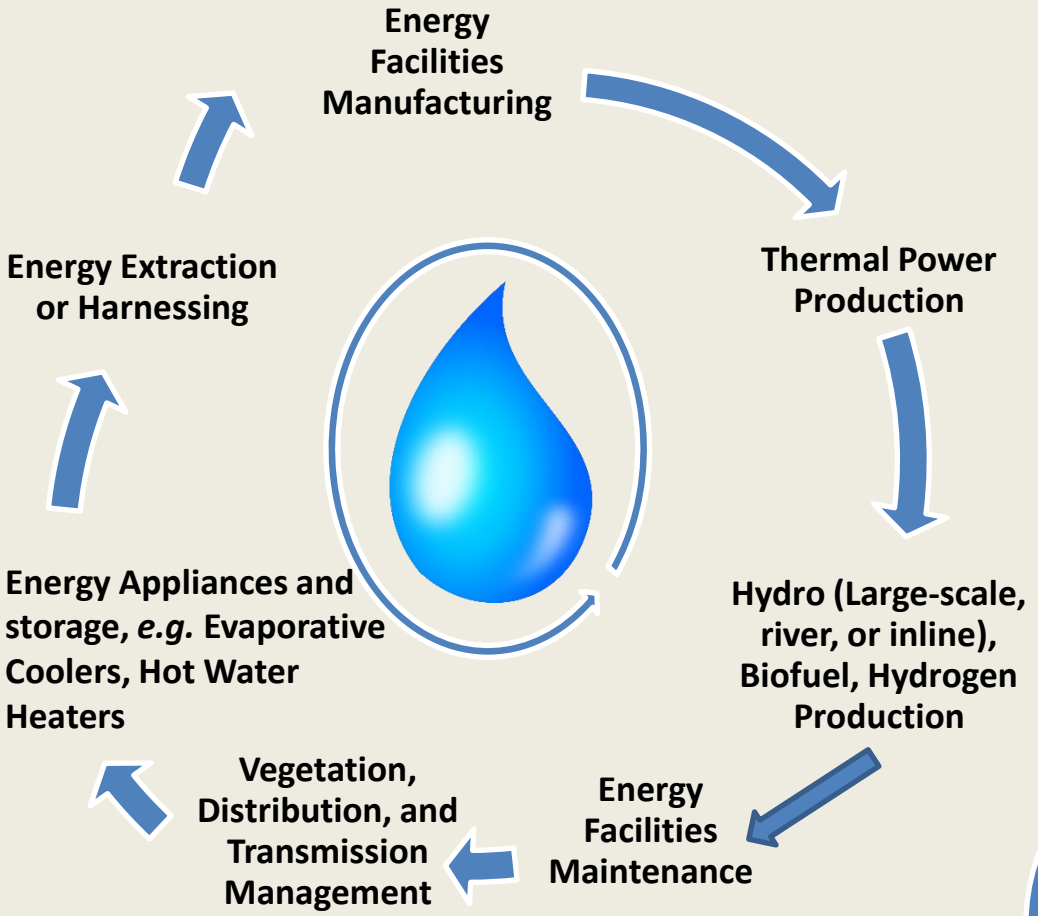


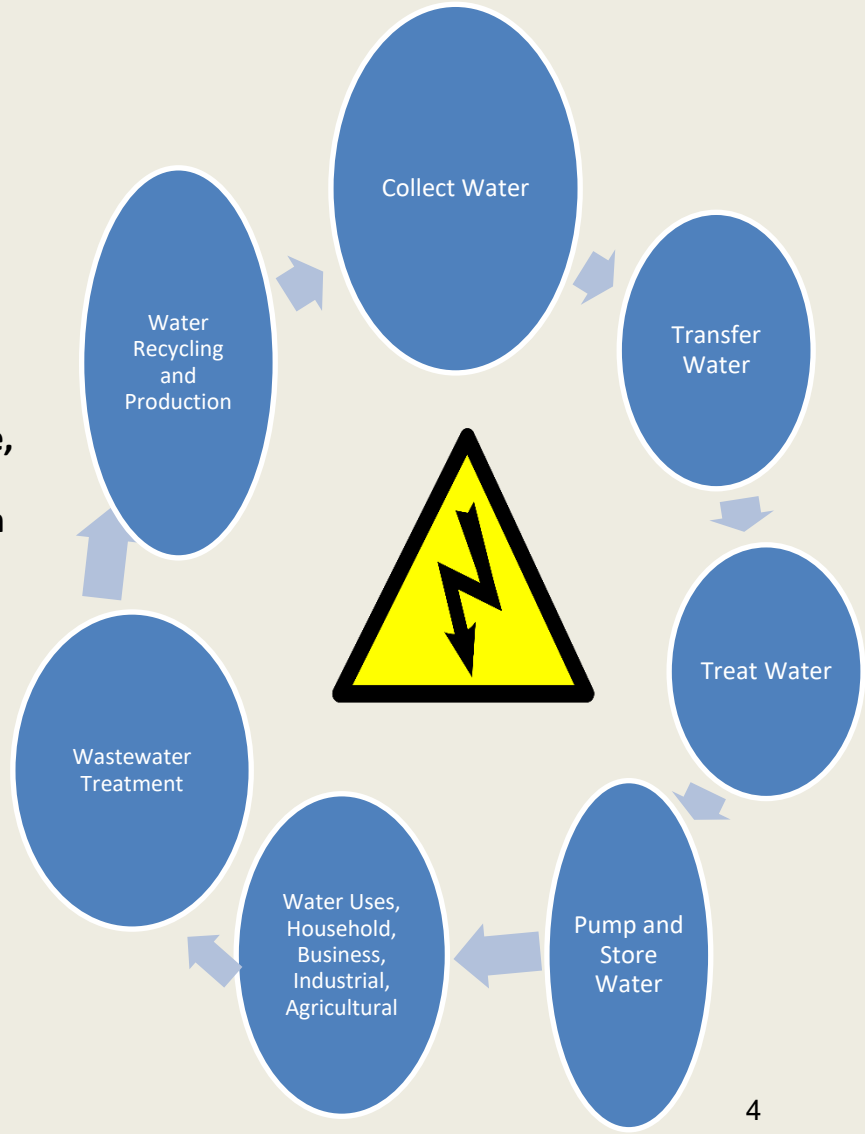
Video of CalPine's Cooling Tower by then CPUC Commissioner Catherine Sandoval.



Graphic from U. Michigan Center for Sustainable Systems.

Energy in Water





Water in Energy

Graphics by Professor Catherine Sandoval

Energy is a Major Cost for Water & Wastewater Utilities

Used In

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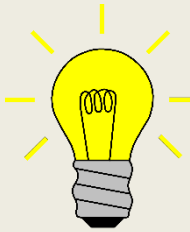


Electrical energy purchases represent well over 10% of total operating costs at drinking water and wastewater utilities

Significant number of utilities in the United States (U.S.) having energy costs that exceed 30 percent of total costs.

Water & Wastewater Utilities are Major Energy Users:

In 2012, the United States public water supply and treatment, and wastewater treatment sectors consumed 39.2 and 30.2 billion KWh (or TWh), respectively. This represented 1.85% of electricity use across the U.S. (WRF, 2014).

As identified in: Opportunities and Barriers for Renewable and Distributed Energy Resource Development at Drinking Water and Wastewater Utilities, **Steven Kenway, Steven Conrad, Maria P. Jawad, Jonathan Gledhill and Ramon Bravo, James McCall, Alice Strazzabosco, Carol Howe**

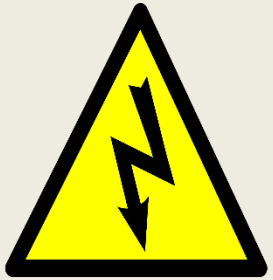
Energy From Water & Wastewater, Energy Use, Self-Generation, Export & Demand Response Opportunities

- **Water and Wastewater Utilities may Generate Energy for On-site Energy Needs**

Water/Wastewater Potential For Energy Generation and Demand Response

- Primary Forms of Energy Potentially Available for Export by Water and Wastewater Utilities:

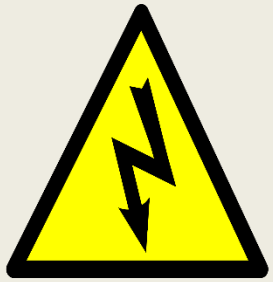
- *Solar*
- *Biogas*
- *In-line Hydro*
- *Potential site for wind generation*
- *Demand Response*



Water and Wastewater Utility Opportunities for Distributed Energy Resource Generation for Export Depend On:

Water in Energy

- ***Leadership***
- ***Regulations, Laws, & Policy Goals including Clean Energy Regulations/Goals & Programs and Tariffs***
- ***Markets***
- ***Technical Issues including Interconnection Opportunities (partially a regulatory issue, are tariffs and programs available to facilitate DER interconnection)***
- ***Location***
- ***Size***
- ***Cost/Financing***



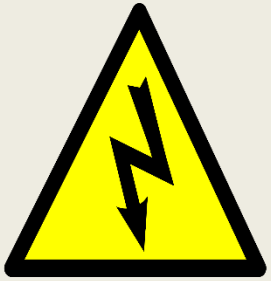
Air Pollution & Safety Regulations Must Be Considered in Examining Opportunities for Biogas Combustion for Electricity Generation

Water in Energy

Example: CalOSHA Process Safety Management Applies to Wastewater Sector Use, Combustion, or Hold Biomethane Produced On-site through Anaerobic Digestion for Retail Sale or Pipeline Injection.

§5189. Process Safety Management of Acutely Hazardous Materials (b) EXCEPTIONS state:
Hydrocarbon fuels used solely for workplace consumption (e.g. comfort heating propane, gasoline for motor vehicle refueling) if such fuels are not part of a process containing another acutely hazardous chemical covered by section 5189."

Exemptions to this standard available for Publicly Owned Treatment Works (POTW) based on quantity of biogas used in retail sale or pipeline injection, *e.g.*
Scenario 1: POTW X generates 100,000 pounds of biogas. It uses 91,000 pounds for its on-site energy and/or heating needs and injects 9,000 pounds into the common carrier pipeline. Since less than 10,000 pounds is injected, the exemption is granted.



Water/Renewable Energy/Grid Integration

- Grid Integration Policies Needed to Increase:

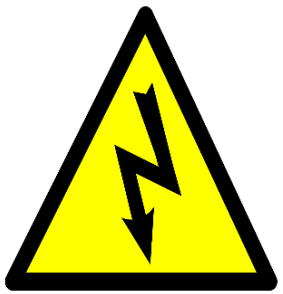
- Certainty about Costs & Timeline (both of which influence feasibility and financing)

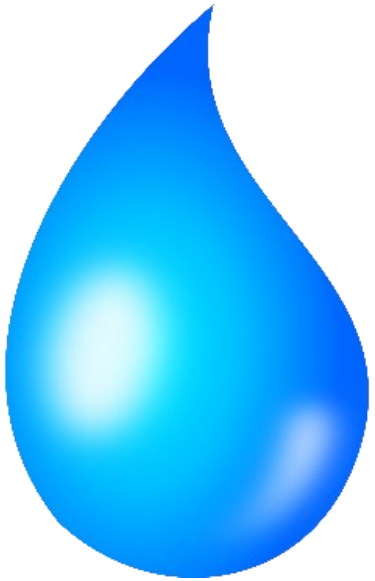
- Market design including net metering policies, tariffs

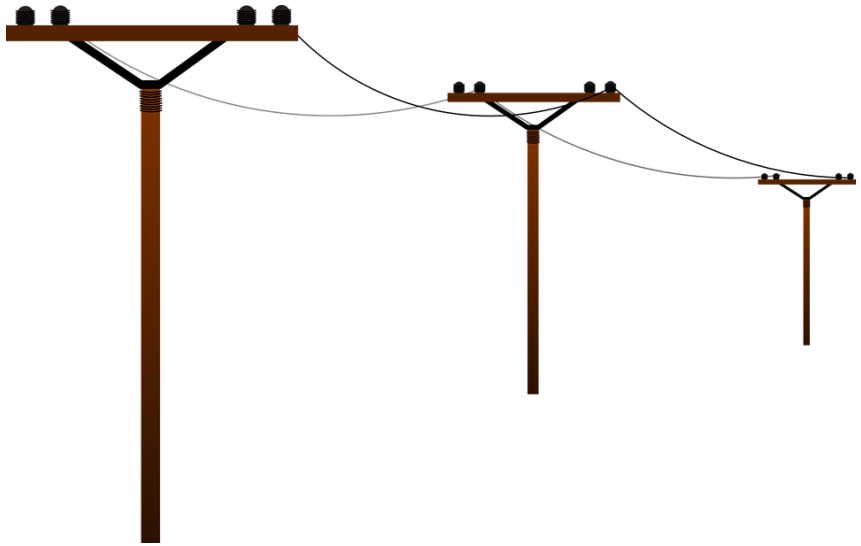
- Resource contracts

- Water & Waterwater Utilities & Customers Need Safe and Reliable Energy

- Water & Waterwater Utilities & Customers Can Contribute to Energy Reliability, Safety, Just & Reasonable Rates & Forestall Climate Change through Demand Response, Incorporation of Energy Efficiency, Using and Generating Renewable Energy

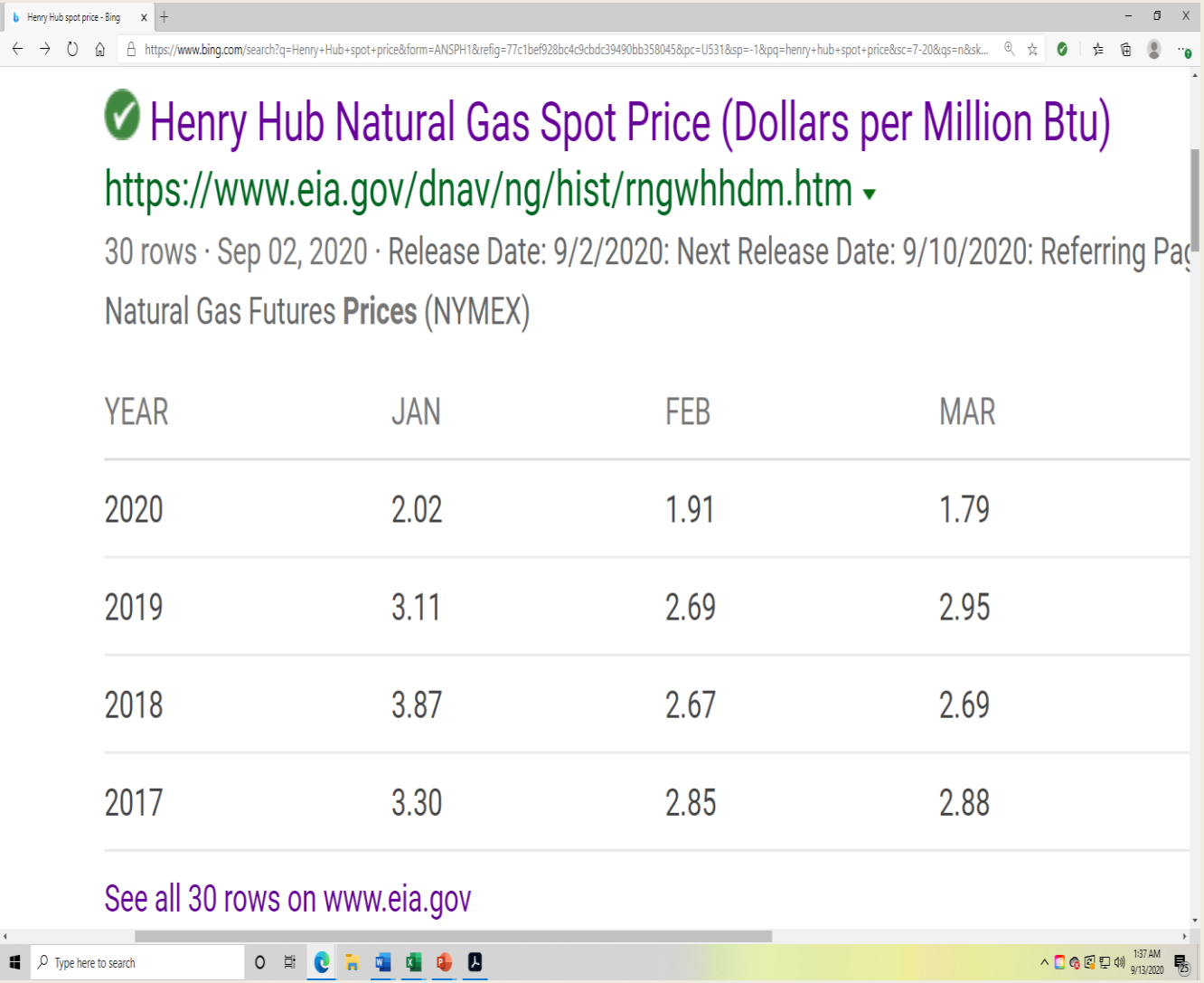






Analyze Price Trends & Carbon Price Policies to Plan Energy Generation Opportunities & Consumption

Henry Hub Natural Gas Spot Prices; COVID-19 Effect:



Henry Hub spot price - Bing

https://www.bing.com/search?q=Henry+Hub+spot+price&form=ANSPH1&refig=77c1bef928bc4c9cbdc39490bb358045&pc=U531&sp=-1&pq=henry+hub+spot+price&sc=7-20&qs=n&sk...

Henry Hub Natural Gas Spot Price (Dollars per Million Btu)

https://www.eia.gov/dnav/ng/hist/rngwhhdm.htm

30 rows · Sep 02, 2020 · Release Date: 9/2/2020: Next Release Date: 9/10/2020: Referring Pag

Natural Gas Futures **Prices** (NYMEX)

YEAR	JAN	FEB	MAR
2020	2.02	1.91	1.79
2019	3.11	2.69	2.95
2018	3.87	2.67	2.69
2017	3.30	2.85	2.88

See all 30 rows on www.eia.gov

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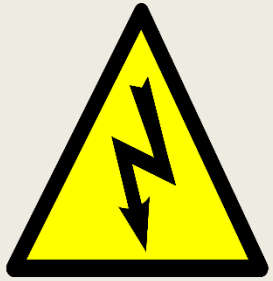
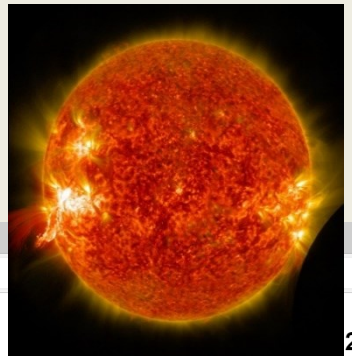
Water in Energy



Power Supply Portfolio, Policies & Investments Must Consider Energy Ecosystems, Balance Variable Resources such as Solar

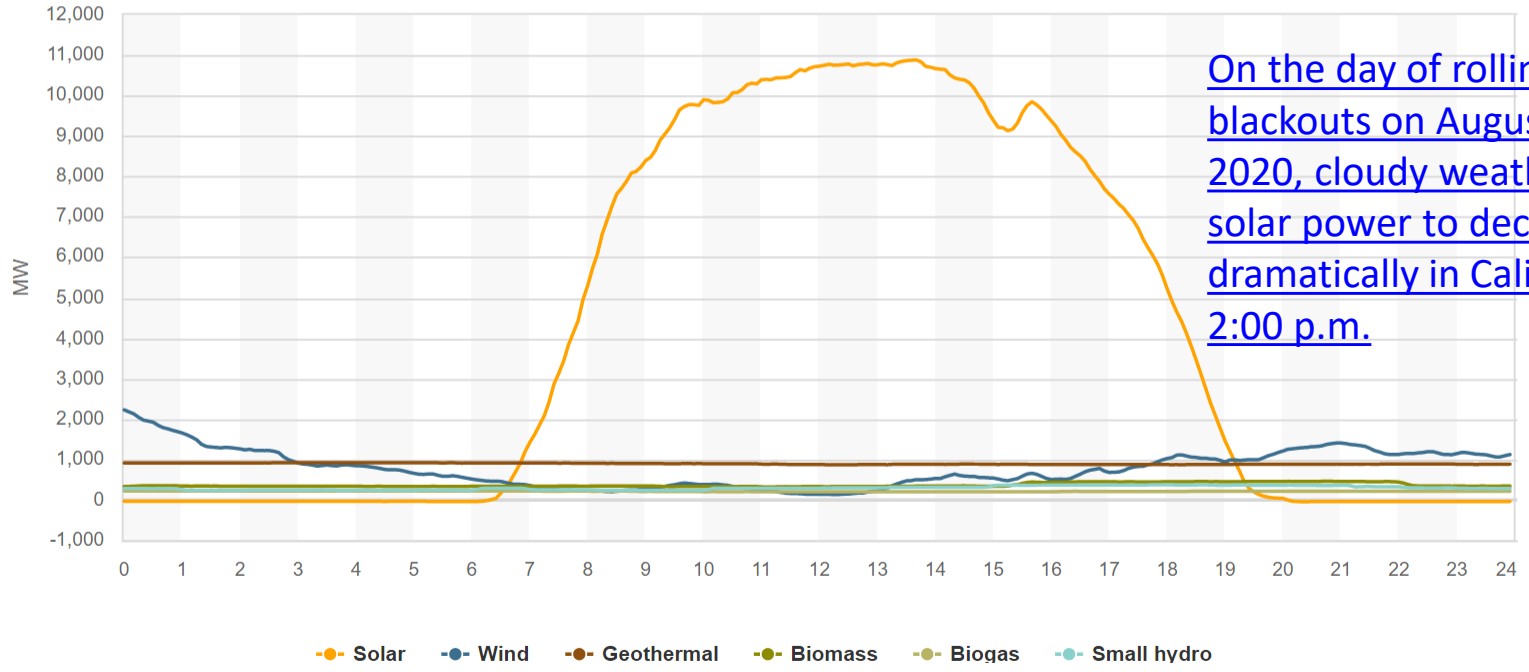


California ISO - Supply

Not secure | www.caiso.com/todaysoutlook/pages/supply.html

Today's Outlook | Demand | Supply | Emissions | Prices | 23:20 09/15/2020

08/14/2020 | Renewables trend | Data



On the day of rolling blackouts on August 14 2020, cloudy weather led solar power to decline dramatically in California by 2:00 p.m.

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Water & Wastewater Utilities Can Contribute to Energy Reliability and Markets through Demand Response

Stage 3 Emergency Declared; rotating power outages have been initiated to maintain grid stability

The California Independent System Operator (ISO) is declaring a Stage 3 Electrical Emergency due to high heat and increased electricity demand. The emergency initiates rotating outages throughout the state.

A Stage 3 Emergency is declared when demand outpaces available supply. Rotating power interruptions have been initiated to maintain stability of the electric grid.

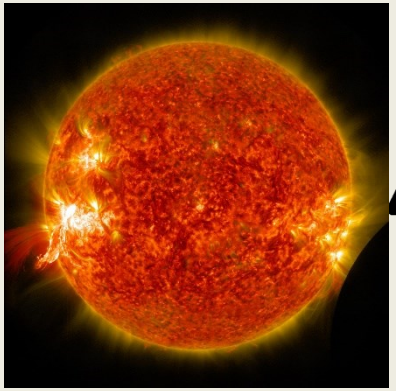
The Stage 3 Emergency declaration was called after extreme heat drove up electricity demand across California, causing the ISO to dip into its operating reserves for supply to cover demand.

The California ISO is working closely with California utilities and neighboring power systems to manage strain on the grid and to restore the power grid to full capacity. As portions of the grid are restored, local utilities will restore power in a coordinated fashion.

Although a Stage Emergency is a significant inconvenience to those affected by rotating power interruptions, it is preferable to manage an emergency with controlled measures rather than let it cause widespread and more prolonged disruption.

Click here to learn more about System Alerts, Warnings, and Emergencies.

On the day of California Independent System Operator initiated rolling blackouts on August 14 2020, cloudy weather led solar power to decline dramatically in California by 2:00 p.m.



On California's Blackout Days in August 2020:

Major Natural Gas Plants Tripped Offline

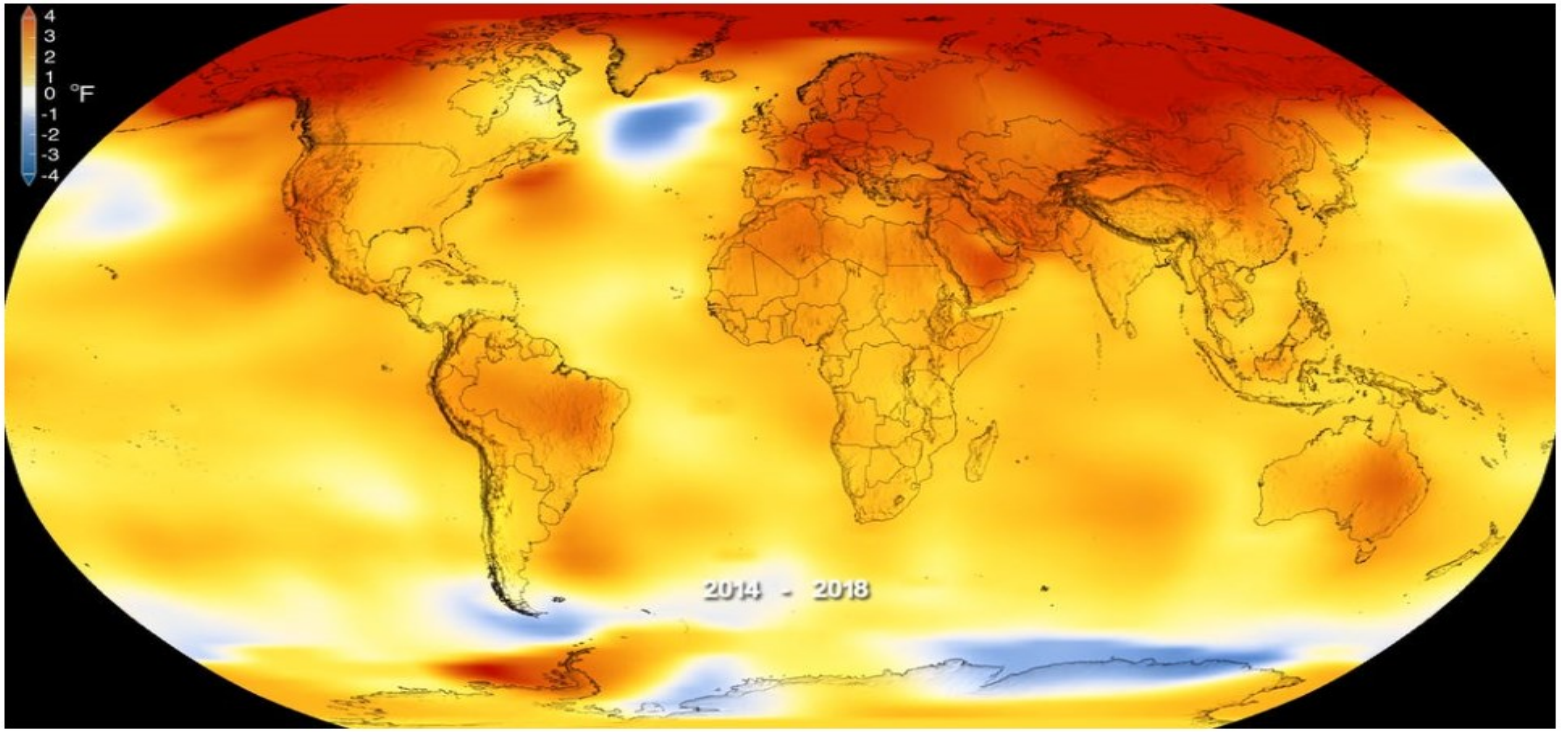
High Heat led to High Demand

Demand Response Programs were not well-coordinated. *Conservations calls were not initiated in time to prevent blackouts*

Energy Users Such as Water Plants can Shift Some Energy Use, With Notice, Provide Self-Generation, and Export Some Power

Climate Change Creates New Water/Energy Nexus Challenges & Opportunities

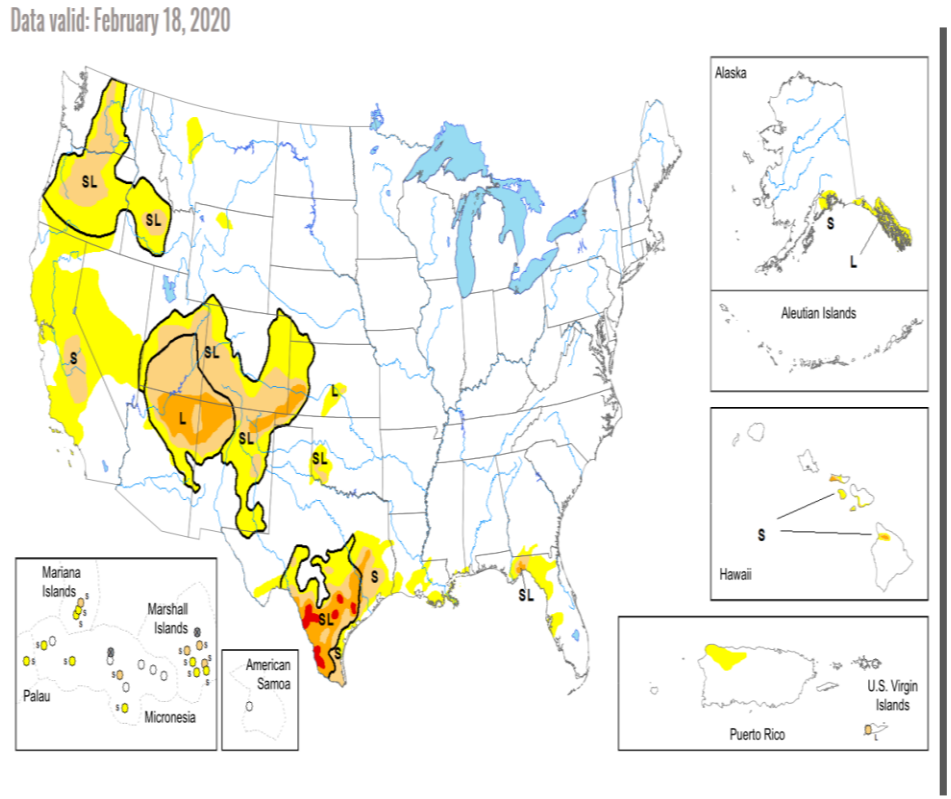
Temperatures are Projected to Rise in Many Areas of the United States

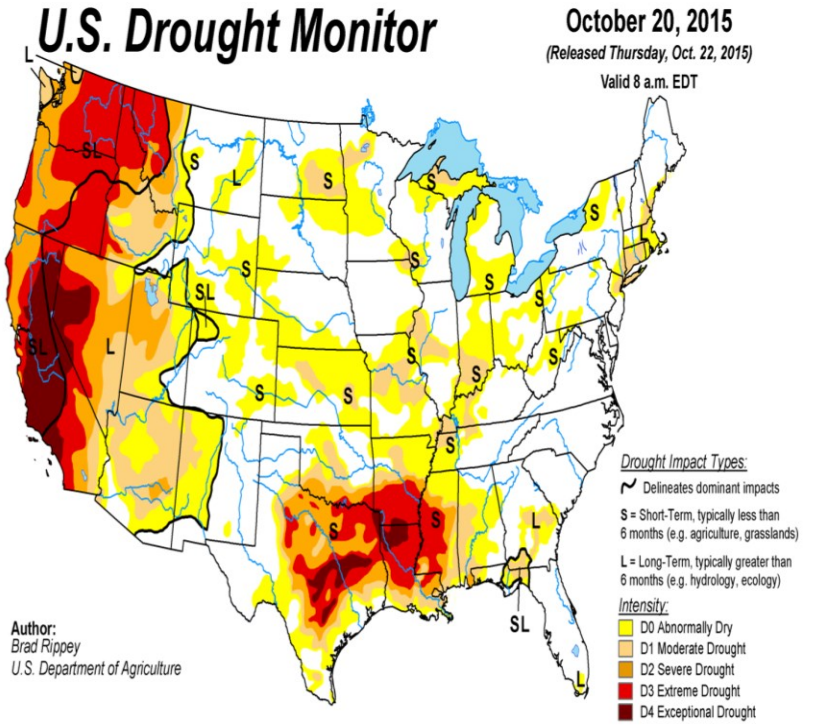


This map shows Earth's average global temperature from 2014 to 2018, as compared to a baseline average from 1951 to 1980, according to a NASA analysis. Yellows, oranges, and reds show regions warmer than the baseline. NASA's Goddard Space Flight Center

Business Insider, Nov. 22, 2019, https://www.businessinsider.com/climate-change-in-the-next-decade-2019-11#regardless-of-what-actions-we-take-there-are-a-few-changes-scientists-know-well-see-in-the-next-10-years-5

Many Areas of the United States Often Face Drought Affecting Water Resources and Energy; Proactive Planning Required





Declining Snowpack Reduces Water Resources

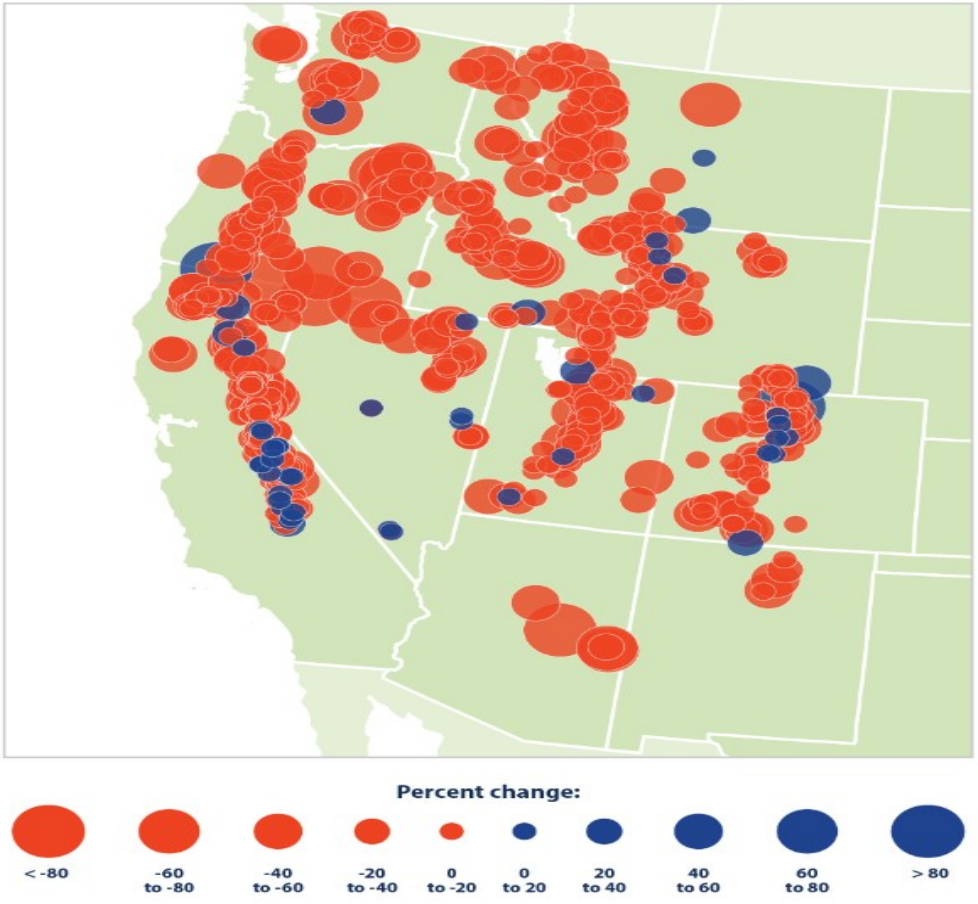
Diminishes Water Available for All Uses including Energy

U.S. EPA, Snowpack Changes, 1995-2016

Climate Change Indicators: Snowpack

This indicator measures trends in mountain snowpack in the western United States.

Figure 1. Trends in April Snowpack in the Western United States, 1955–2016



Regulatory, Academic, Community, and Business Leadership Can Address the Water/Energy Nexus

- State and federal regulators can initiate proceedings to examine and address the water/energy nexus
- Innovators and business can address the water/energy nexus through innovation, investment, business practices that recognize the nexus, reduce water and energy use, and support for proceedings and programs
- Need to examine opportunities for and barriers to Water & Wasterwater Renewable Energy Generation & Demand Response
- Community support is critical, *e.g.* smart water use and conservation, particularly during drought or times of high energy demand
- Climate change makes action imperative

Thank you!

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See Professor Sandoval's SCU Law Faculty Page for More Information about Her Recent Scholarship:

https://law.scu.edu/faculty/profile/sandoval-catherine/