

# When the Turbines Stop Turning: Examining the Impacts of Drought on Power Production at Hoover Dam and Its Consequences for Entities in Arizona

By

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SUSTAINABILITY

# U.S. Droughts Will Be the Worst in 1,000 Years

The Southwest and central Great Plains will dry out even more than previously thought

Image credit- Scientific American By Mark Fischetti on February 12, 2015  23





National

# Western drought steals clean energy along with fresh water at power plants



Save for Later



Reading List



The white band of calcium along the canyon walls of the Hoover Dam shows how far the water level has fallen. (Bonnie Jo Mount/Washington Post)

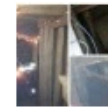
By **Todd C. Frankel** April 26, 2015 Follow @tcfrankel

## Most Read

**1** Octopus slips out of aquarium tank, crawls across floor, escapes down pipe to ocean



**2** Police discover massive backyard tunnel filled with stolen guns, golf clubs and electronics



**3** \$250 million, 300 scientists and 40 labs: Sean Parker's revolutionary project to 'solve' cancer



**4** CDC confirms Zika virus causes microcephaly, other birth defects



**5** Secretive Harvard club breaks silence to say that admitting women could increase sexual misconduct





# Aim of the Study

1. Review the potential impact of drought on power production at Hoover
2. Map the regulatory framework governing Hoover power allocation



3. Examine the consequences of power reduction at Hoover Dam for Arizona focusing on:
  - how power cuts will be instituted in the state
  - the entities/sectors that will be most at risk and the associated impacts of the same at a state-level

# Structure of the Presentation

- Brief Background on Hoover Dam
- Drought and Hoover Power Production
- Regulatory Overview of Hoover Power Allocation
- Findings on the Implications of Hoover Power Reduction
- Way forward

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# Background on Hoover Dam

- Power Marketed by Western Area Power Administration State-level power allocation:
  - California: 56%
  - Nevada: 25%
  - **Arizona: 19%**



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# Drought and Hoover Power

- Lake Mead Elevation
  - 1999 → 1221 feet
  - September 2016 → 1075.23 feet
- **Every Foot Drop in Lake Mead**
  - **Reduction of roughly 5.7MW of Power Generation Capacity**
  - **This number will be higher as Lake elevation drops**
- Hoover Currently Operating at 1560 MW → 25% reduction in capacity so far

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# Federal Regulations Governing Hoover Power Allocation

- **Boulder Canyon Project Act 1928**
  - Secretary of Interior Signed first set of contracts for 50 years
- **Federal Power Act 1920**
  - “preference power”
- **Hoover Power Plant Act 1984**
  - Schedule A: existing users
  - Schedule B: users of power generated through uprating
  - Schedule C: excess power → Arizona preference
- **Hoover Power Allocation Act 2011**
  - Governs power allocation Post 2017
  - Created Schedule D power: 5% of the total power generation capacity → 5% cut to Schedule A and B users

# Federal Regulations Governing Hoover Power Allocation: Implications for Users

- Pre 2017

- **Power Cuts: “the ratio that the sum of the quantities of firm energy to which each contactor is entitled pursuant to said schedules bears to 4527.001 million kilowatthours”**

- Post 2017

- **In case of non-availability of water: power cuts proportional to existing allotment**



# State Regulations Governing Hoover Power Allocation

- **Title 30- Power**

- Section 30-124: Authorizes payment of surcharge for payment of structures on Colorado
- Section 30-125: Preference to districts and city/municipal uses in case of power deficit

- **Title 45- Water**

- Section 45-1703 (C): recognizes the authority of APA to allocate the power generated through the uprating program at Hoover Dam

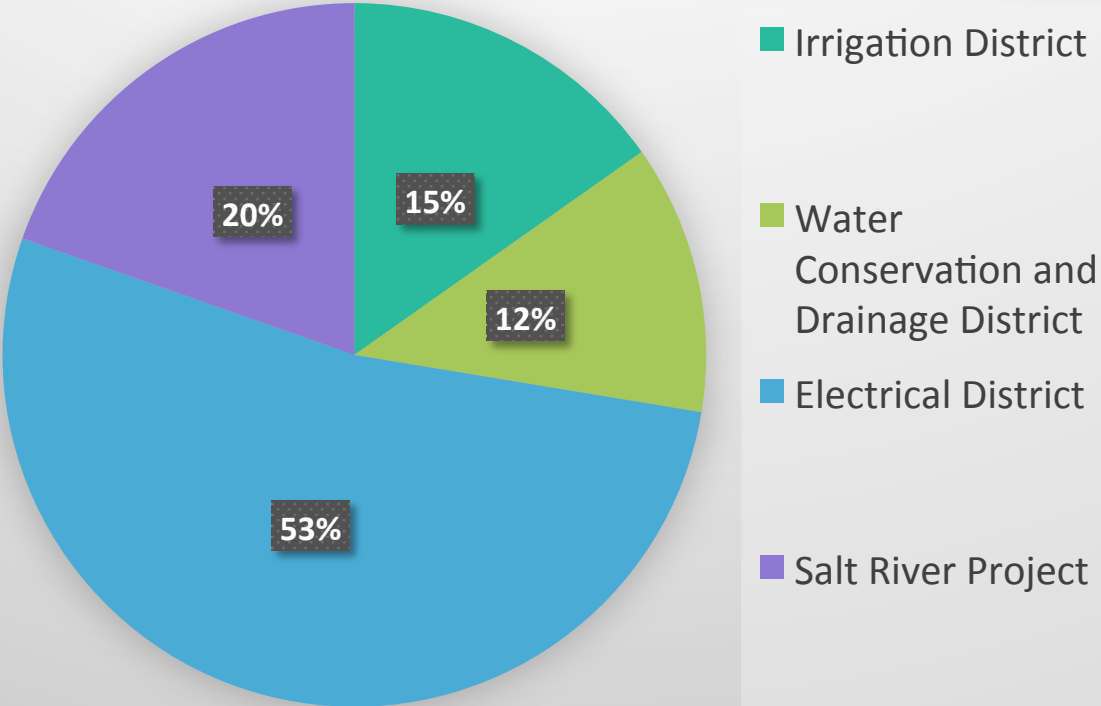
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## Broader Impacts

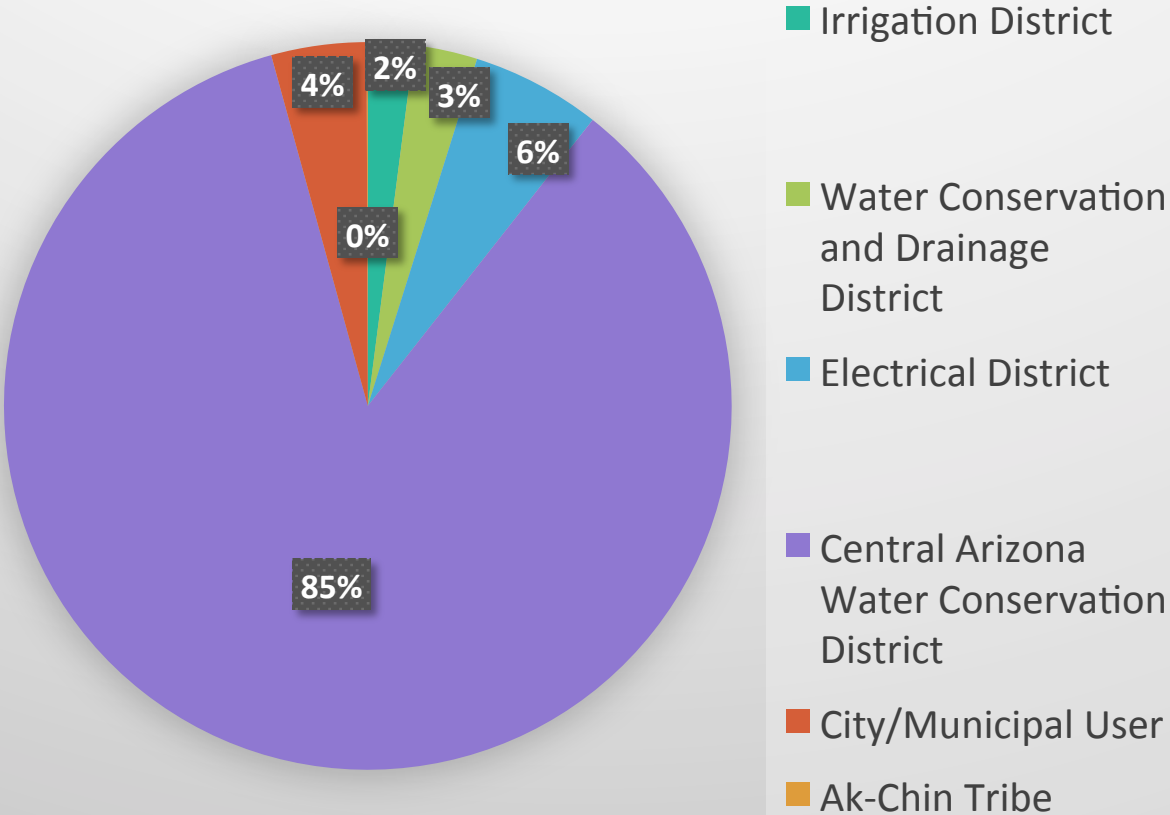
- Cost of hydropower is extremely low → revenues only have to cover the operating costs of Hoover Dam and Power plant
- Power users have to pay O&M costs regardless of power received
- With lower lake elevations cost of power will increase

# Broader Impacts

### Schedule A



### Schedule B



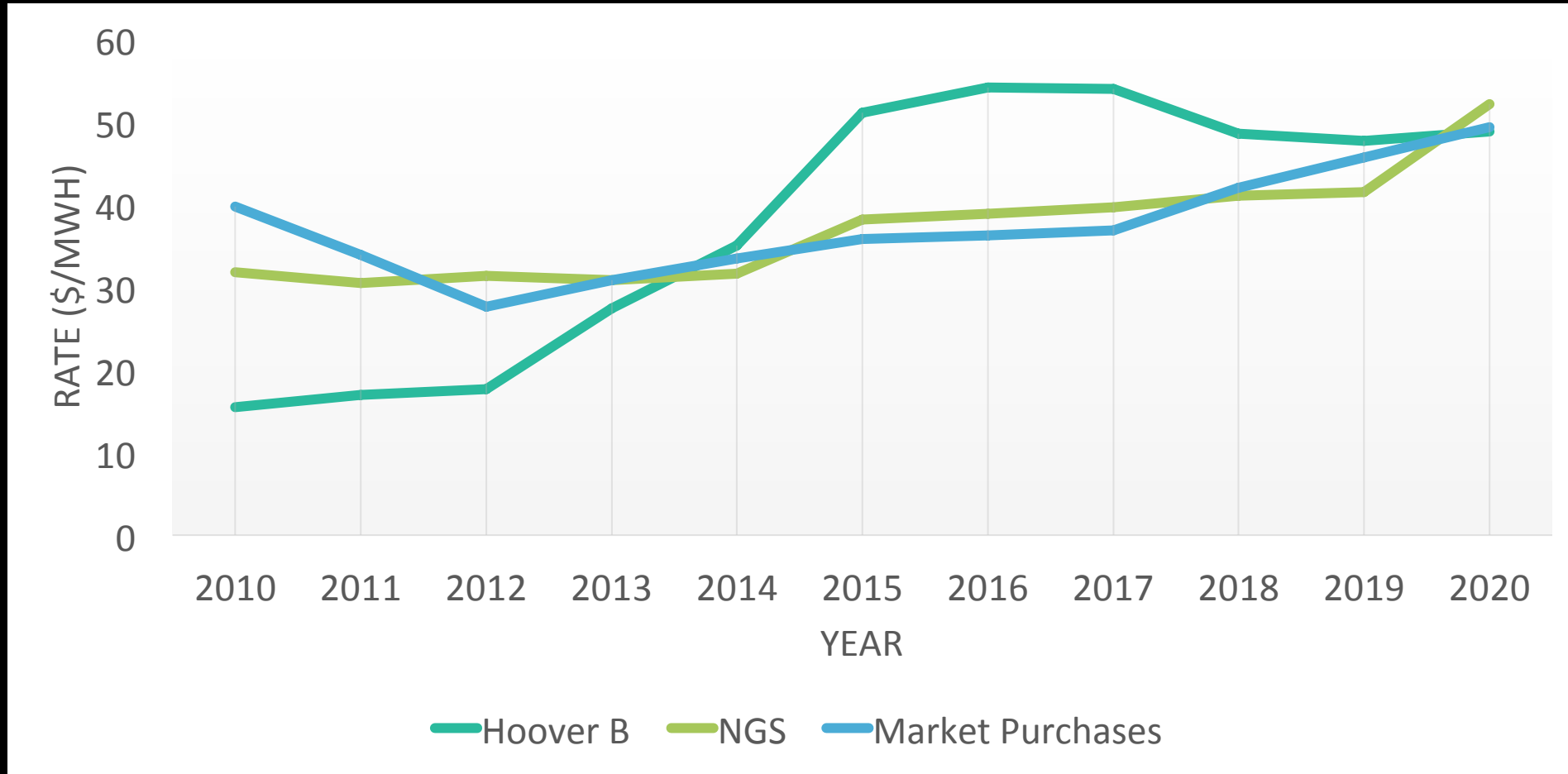
Source-Arizona Power Authority, 2015



# Impacts on the Central Arizona Project

- Main use of Hoover Power for CAP → match the load generation requirement at CAP's pumping stations on demand
- Losing inexpensive power will increase price of water → **even a 1 cent per kWh increase in CAP's electricity costs would increase the cost of each AF of water by 3.5%**
- Additional purchases will be necessary on the spot market

# Historical and Projected Power Purchase Costs



Source- Galardi Rothstein Group , 2016 “Bond Feasibility Study  
Water Delivery Operation and Maintenance, Revenue Bonds, Series 2016 for CAWCD”

# Loss of Revenue for Central Arizona Project

- 3 Key Sources of Revenue for Central Arizona Water Conservation District:
  - surplus revenues in the Lower Colorado River Basin Development Fund
  - ad valorem taxes
  - M&I capital charges
- Section 102 (c) of the Hoover Power Act 1984 → stipulated the addition of 4.5 mills per kilowatthour in the rates charged to Hoover power users in Arizona
- 2015 Strategic Reserve deficit → \$ 54 million
- **Lower electricity/water use will add to CAP's structural deficit**

# Impacts on Irrigation Districts

- **Require purchasing power at higher market rates** → Specifically for Irrigation Districts that are not linked to Electrical Districts
- **Shift to groundwater pumping in Districts with lower profit margins** → Impact on groundwater
- **Potential fallowing/ non-production**



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# Way Forward

## **Policy Options**

- Creating flexibility in regulatory structures to manage power through a formal pool within the State
  - Southwest Public Power Agency Inc.
- Western Region Grid Integration
  - Western Interconnection Flexibility Assessment published in December 2015
  - Energy Imbalance Market → Arizona Public Service to Join in 2016
- Technical Upgrades

# Way Forward

## Research Directions

- Quantification of economic impacts due to changing water/energy costs for agriculture, municipal uses, etc.)
- Assessment of the effectiveness of peak-hour regulation (for water and energy)
- Examination of Hoover Power contracts to identify
  - potential barriers/openings to pooling power
  - potential barriers/openings to store water long term in Lake Mead
- Examination of how the Drought Contingency Plan will change the relationship of hydropower with other uses
- Examination of similar issues in the Upper Basin at Glen Canyon-Hydropower more severely impacted

# Acknowledgements

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Questions?

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