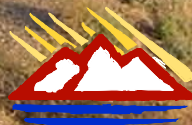


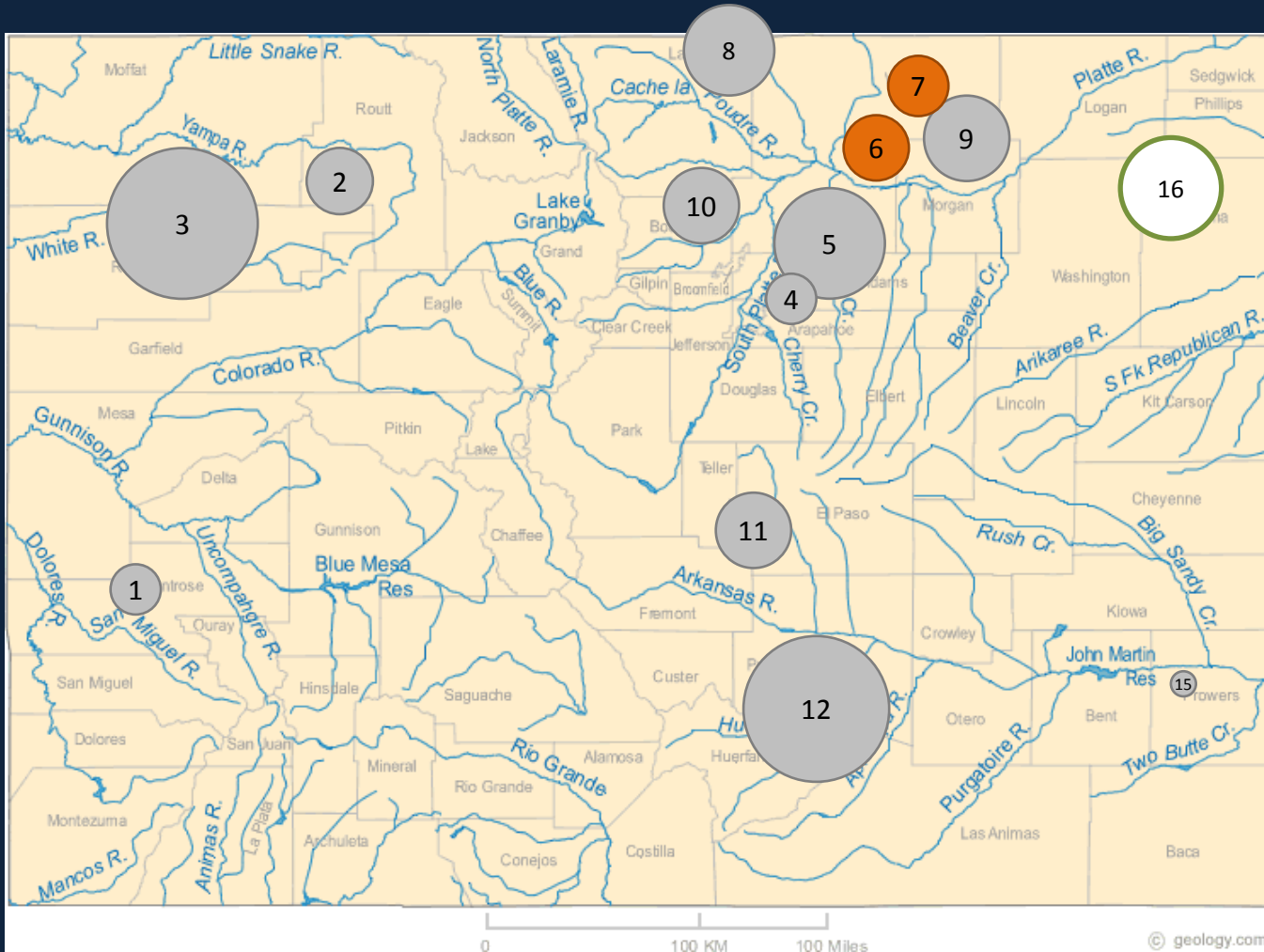
Managing Energy & Water – Solutions from the Interior West

Stacy Tellinghuisen



WESTERN RESOURCE
ADVOCATES

Colorado Power Plants



Plant		Water Use (Cons.) (AF/yr)
1	Nucla	1,600
2	Hayden	2,800
3	Craig	14,300
4	Arapahoe	1,700
5	Cherokee	7,800
6	Fort St. Vrain	2,700
7	Rocky Mtn. Energy Center	2,400
8	Rawhide	5,100
9	Pawnee	4,400
10	Valmont	3,700
11	Martin Drake	3,500
12	Comanche	13,100*
13	Nixon	2,800*
14	Front Range Power	800*
15	Lamar	500
16	Wind (distributed)	Est. 6,700 AF saved*



Circle sizes are based on water use.

*Water use is estimated.

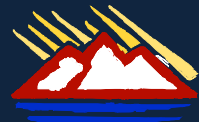
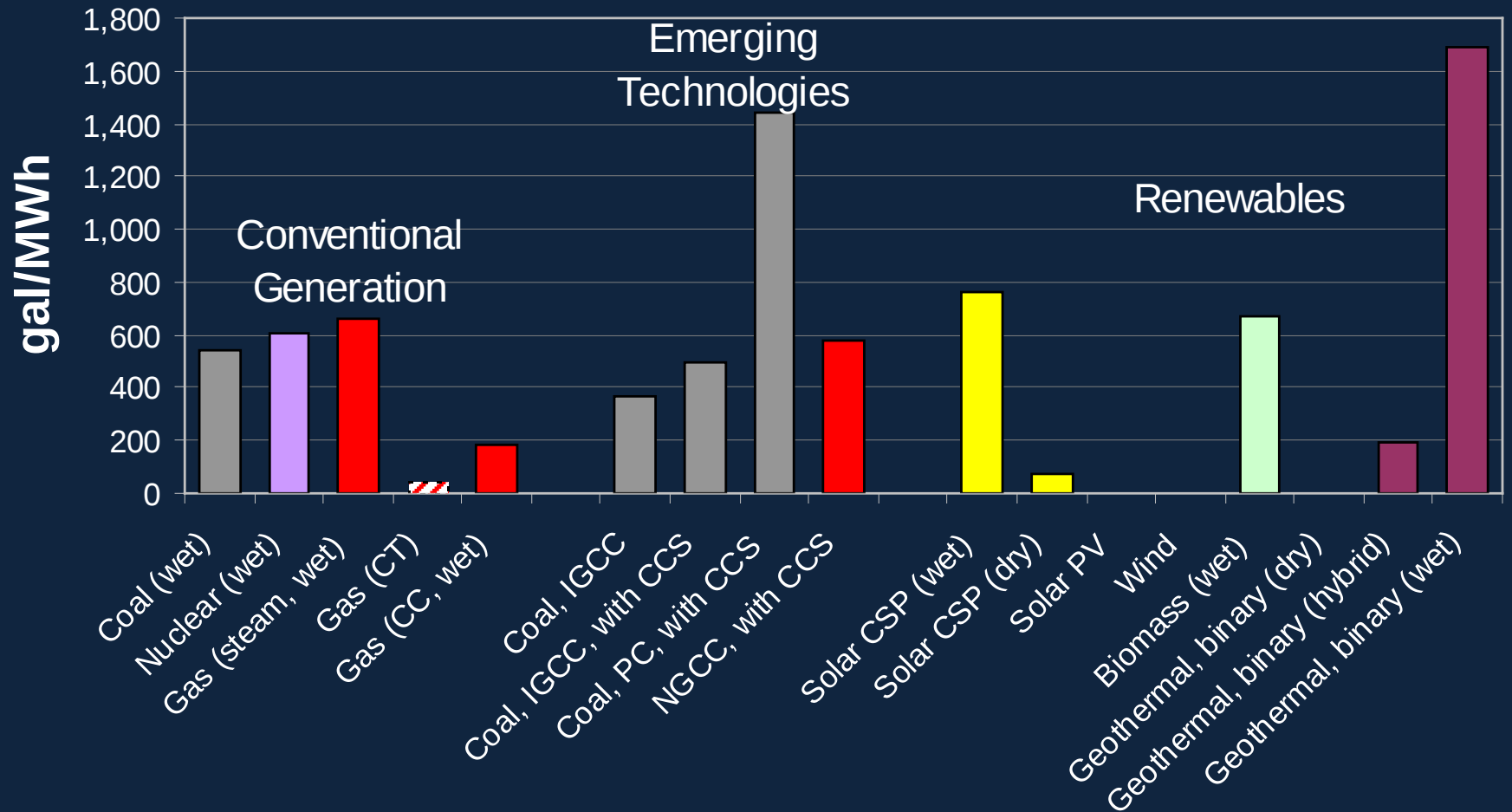
Water savings attributed to wind are based on average water intensity of CO electricity.

● Coal

● Natural Gas

○ Wind – *water savings*

Water Intensity of Electricity



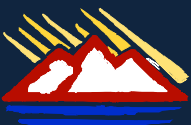
Coal
 Nuclear
 Natural Gas
 Solar
 Wind
 Biomass
 Geothermal

Effects of Drought

1. Changes in plant operation



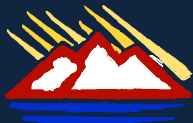
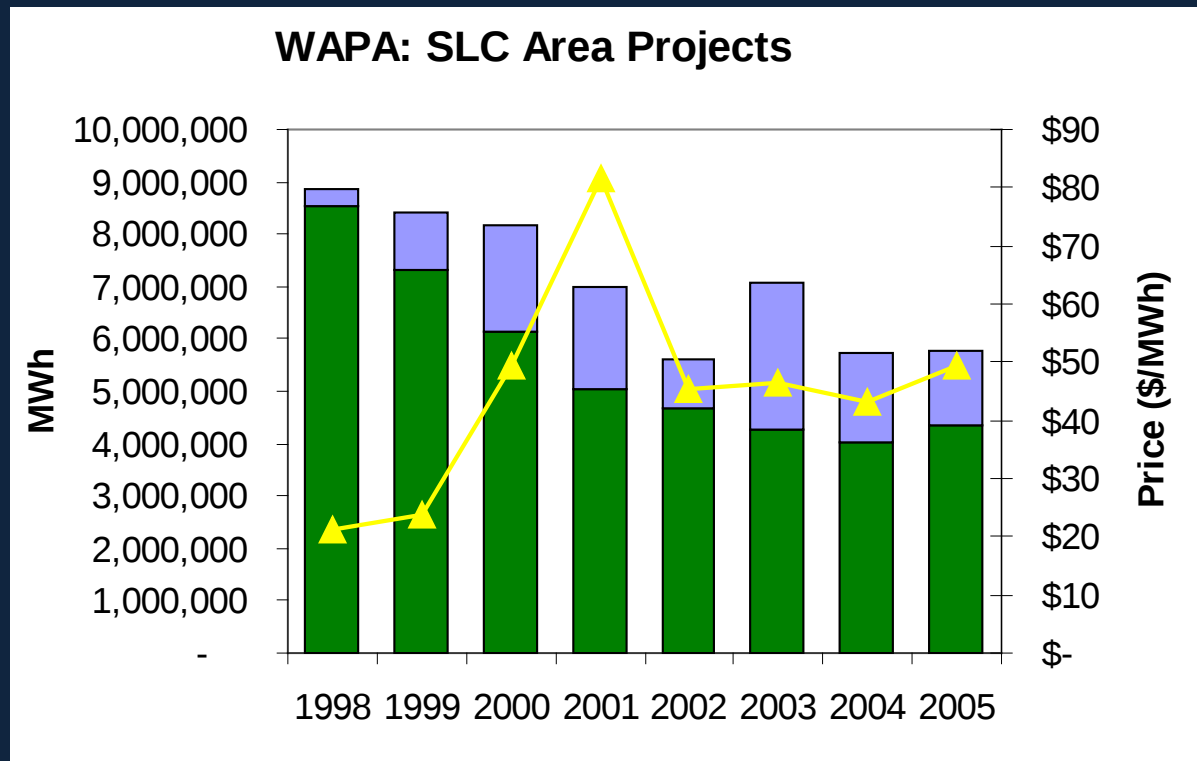
- *Actual impacts depends on water rights and other factors.*
- *Technology choices can act as a hedge against drought*



Effects of Drought

2. Reduced hydroelectric generation.

- May lead to more power purchases, with potentially higher costs for market purchases and greenhouse gas emissions.



Net generation WAPA Purchases Purchased Power Price

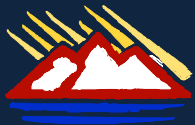
Effects of Drought

3. Power plants purchase/lease water from other users.

- Ex: Laramie River Station, Wyoming
- Cooling reservoir at ~10% in January, 2008
- Basin Electric actions: purchased agricultural water and conveyed via 17 mile pipeline; agricultural water required additional treatment



Photo: [nytimes.com](https://www.nytimes.com)



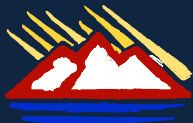
Effects of Drought - Texas

"If we don't get any rain between now and next summer, there's potentially several thousand megawatts of generation that wouldn't be available and would be affected."

Kent Saathoff, ERCOT (The Texas Tribune, September 16, 2011. "Drought Could Pose Problems for Texas Power Plants")

- Increased temperatures → record electricity demands
- Reduced water levels
 - Plants curtailed: 24 MW
 - Record low water levels: 11,000 MW
 - At risk: 3,000 MW
- Mothballed plants
- Water rights
- Electricity prices
- Mitigating factors?

Texas Severe Drought
Help
Conserve Energy



Effects of Drought – Australia

- Drought: 2000 – 2010
- Hydro & thermal plants affected
 - 2,343 MW of coal power plants were curtailed
 - Coal mine production and jobs cut
- Prices soared
- Invested in recycled water pipeline

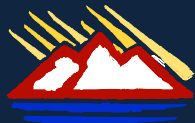
How do we manage water-related risks?



1. Information
2. Value water (and other externalities)
3. Recognize the risk of drought, and the value of water-efficient resources as a hedge

Managing Risk - Information

- Arizona
 - APS - began reporting water use and water intensity in 2009
 - Developing a methodology for valuing externalities, including water
 - Water has played a role in past siting decisions
- Colorado
 - Utilities must report water use and water intensity (2011)
 - Water (and value of water) was a factor in the 2010 Clean Air-Clean Jobs hearings at the PUC



Managing Risk - Valuing Water

Depends on:

- *Use*
- *Location*
- *Scarcity*

Municipal Tap Fees

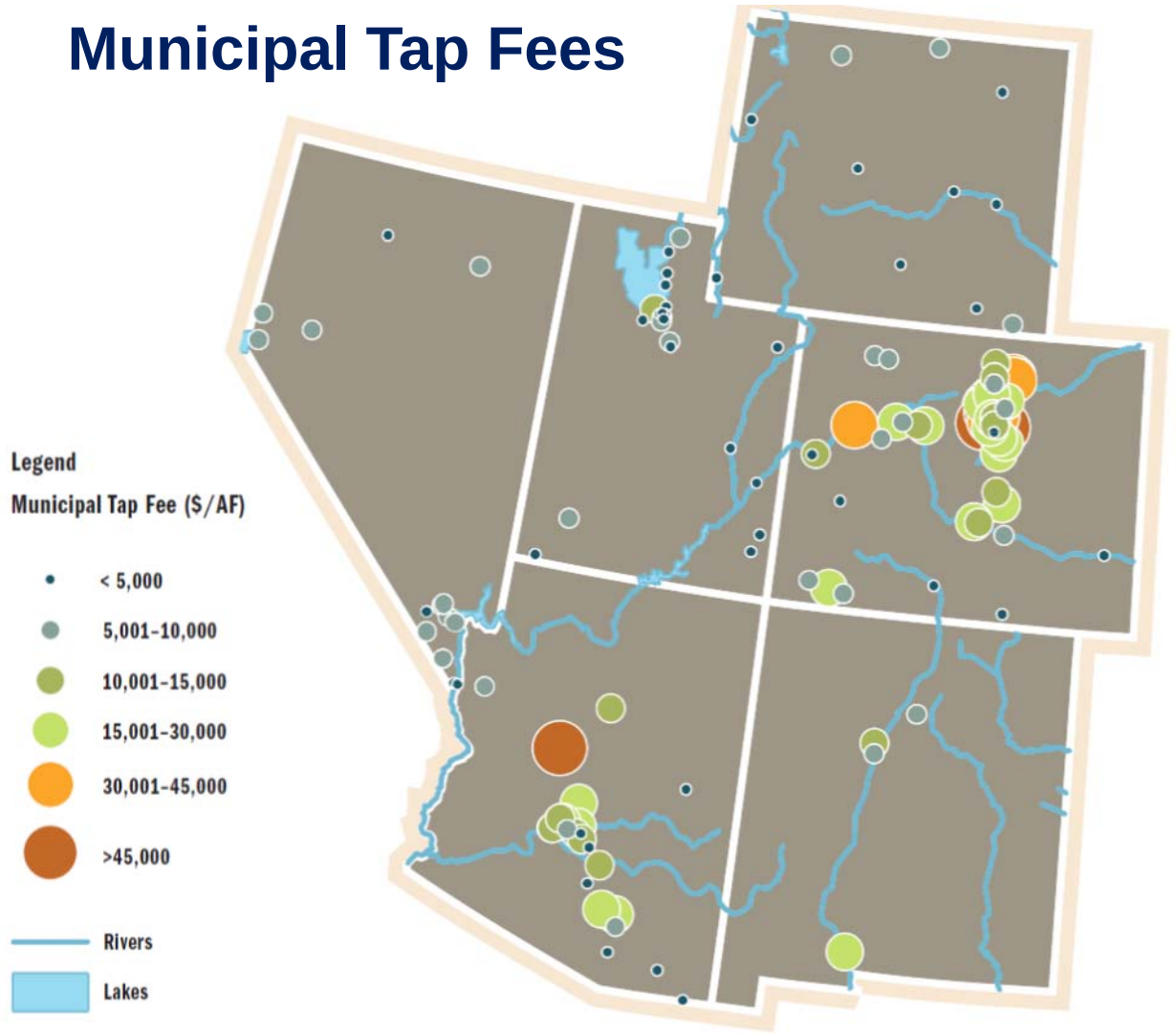
Legend

Municipal Tap Fee (\$/AF)

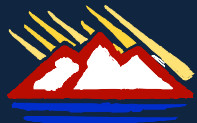
- < 5,000
- 5,001-10,000
- 10,001-15,000
- 15,001-30,000
- 30,001-45,000
- >45,000

— Rivers

— Lakes



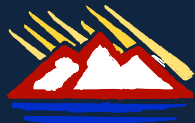
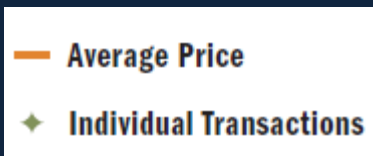
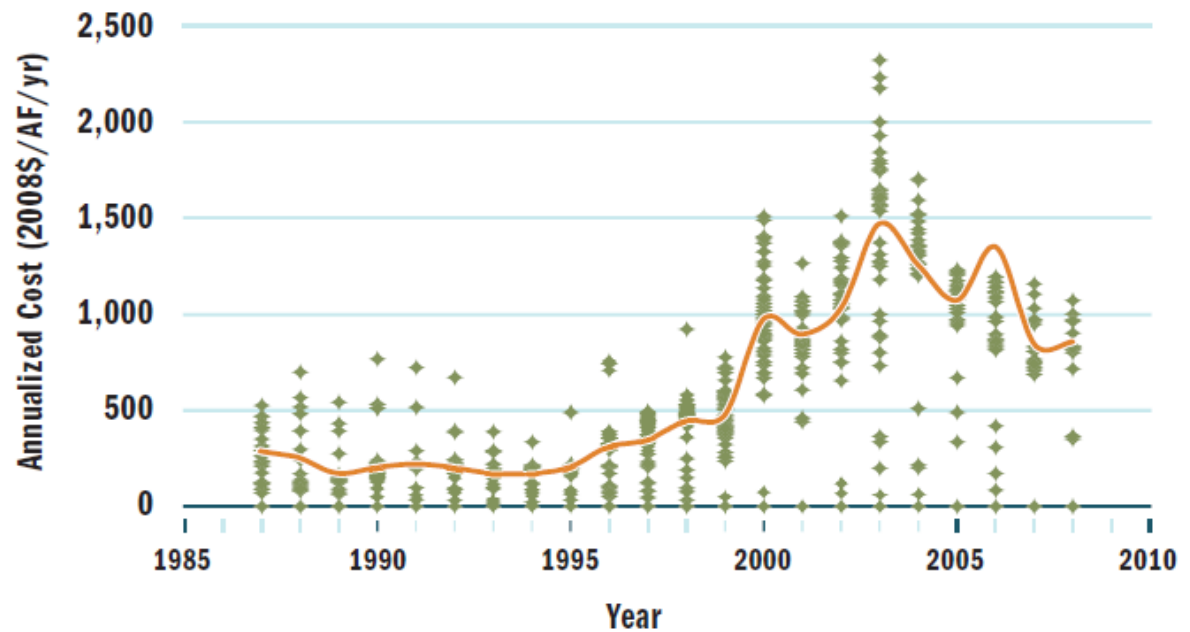
Costs are not annualized, but are adjusted to a common metric (\$/AF)



Managing Risk - Valuing Water

- *Value/price changes with time*

FIGURE ES 2 WATER SALES TO MUNICIPALITIES: COLORADO



Managing Risk – Next Steps

- How do water-efficient energy supplies act as a hedge against drought?

“Impacts from drought manifest themselves most often economically, in terms of increased costs that can significantly impact local economies,” while power shortages are rare.



- Harto et al., 2011. Analysis of Drought Impacts on Electricity Production in the Western and Texas Interconnections of the United States.

How do we manage water-related risks?



1. Information
2. Value water (and other externalities)
3. Recognize the risk of drought, and the value of water-efficient resources as a hedge

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