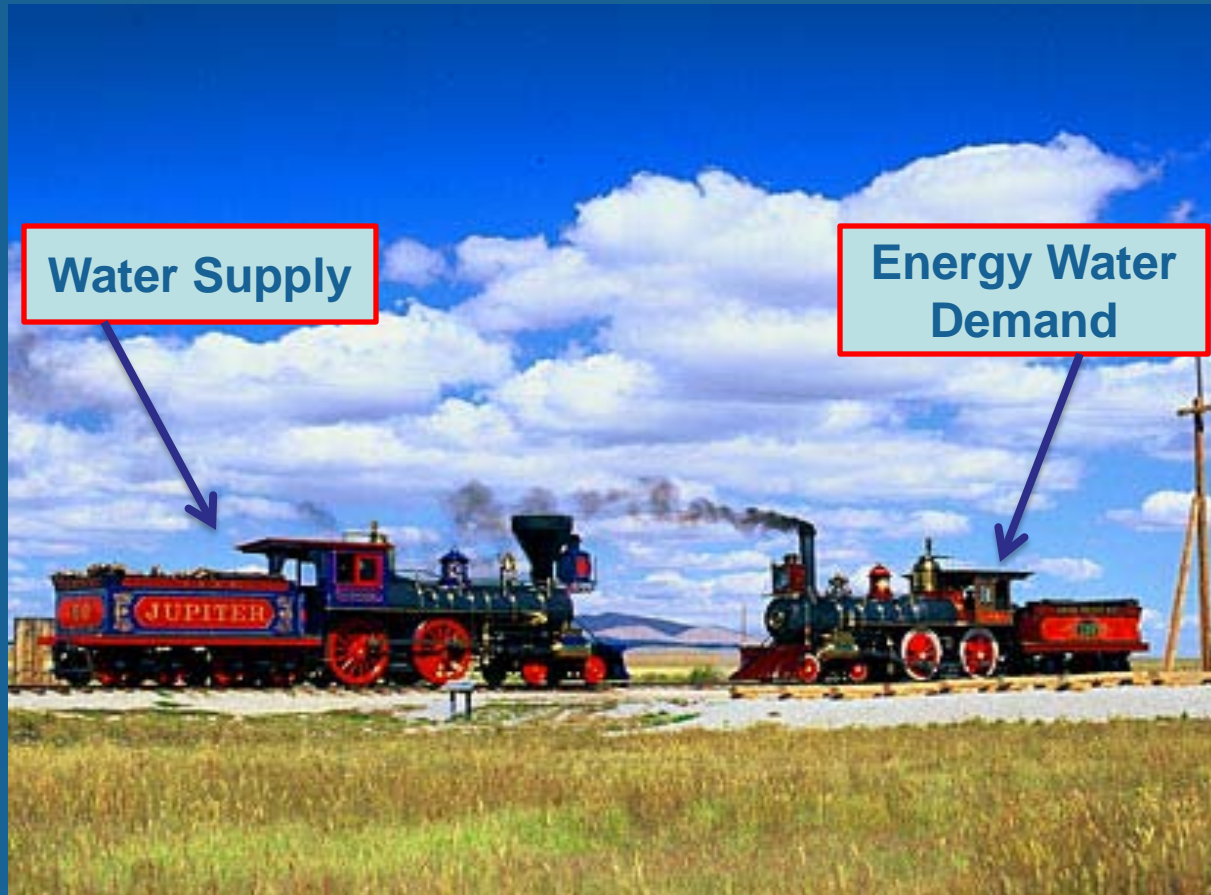




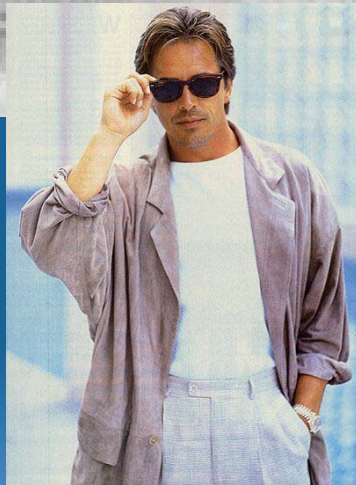
Beyond the Energy/Water Nexus
*Developing Sustainable Solutions for
the Electric Power Industry*

James M. Oliver, R.G.
Schlumberger Water Services
September 28, 2010

World's Slowest Train Wreck?



Imminent Danger of Running Out of Water



Still Waiting Energy – Water Nexus +20 Years

- Desalinization
- Private water supply
- Inter-basin transfer
- Toilet to Tap



Why No Disaster?

- Process moves slowly
- Strong legal framework
- Market value of resource
- Deal making



Relevant Water Issues

- Supply
- Distribution
- Salinity
- Redistribution

Concentrated Solar Water Use in Perspective

- Western Governors' Association goal of 8 GW of Solar in Southwest by 2015
- 8 GW at Capacity Factor of 25% and 800 gal/MW hr – 40,150 Ac-Ft/year CSP water
- Equivalent to 8,600 acres of Cotton
- 4.7% of 185,000 acres cotton to be planted in AZ in 2010



Total Cost and Sustainable Supply

Total Water Cost

- Water Rights
- Pumping Costs
- Power load
- Treatment Costs
- Disposal Costs
- Capital versus Operational Costs

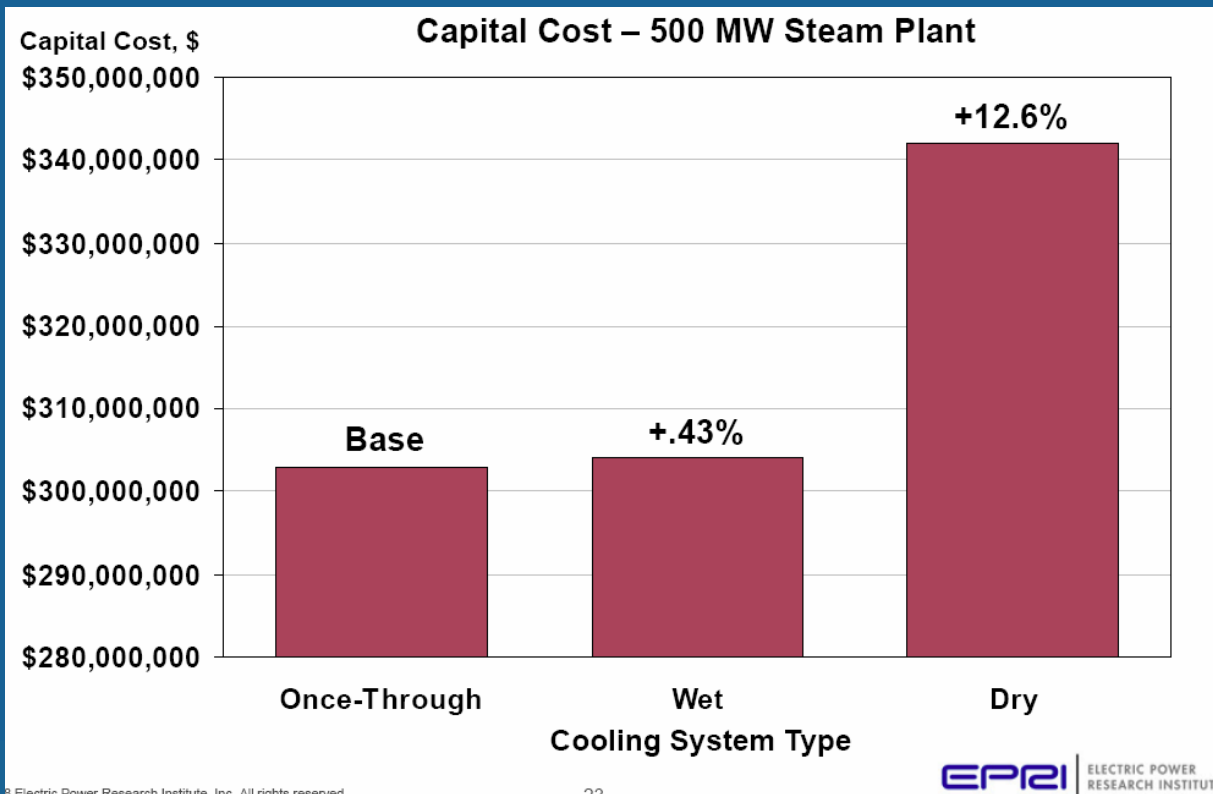
Sustainable

- Volume of Water
- Time Water Needed
- Water Quality over Time
- Potential for Undesirable Impacts

Which is Energy Project is Greener?

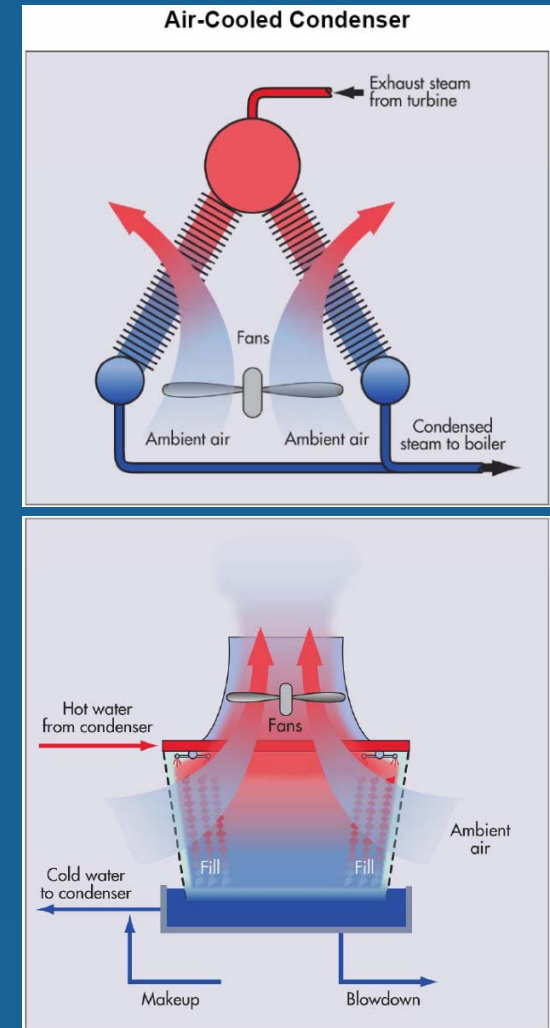


Is Dry Cooling the Answer?



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Past Experience in Air Cooing



Great in Germany, Not So Great in the Southwest



Keys to Water Supply Development for Power

- Avoid hype and make sound water decisions for your site
- Understand the long-term impact of water decisions
- Use good business principles
- Include potential for water supply contamination as a factor in water decisions

Factors to Optimize Energy Water Costs

- Spend the time to find the best water right option
- Include the total cost of water in the site selection process
- Do the math for poor quality water
- Disposal wells versus evaporation basins
- Evaluate hybrid dry-wet cool options
- Evaluate water banking options
- Be wary of Farmers offering water



Make Use of Uncounted Water

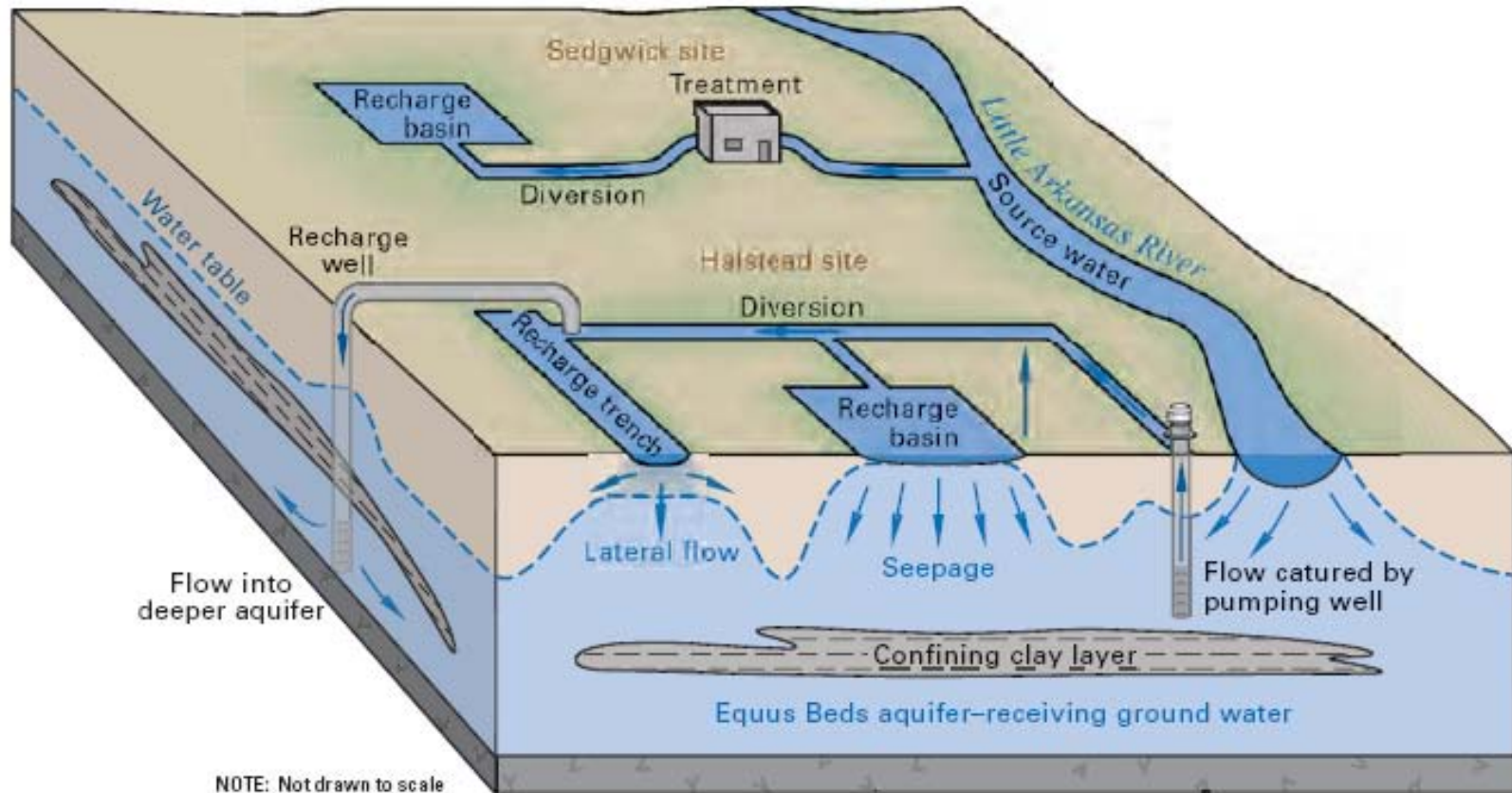
Base Flow



Flooding



Water Banking Alternative



Water Quality Fit for Purpose

- Match water quality for use (i.e., low quality for dust control)
- Reclaimed Use
- Slightly saline for cooling



Questions?

