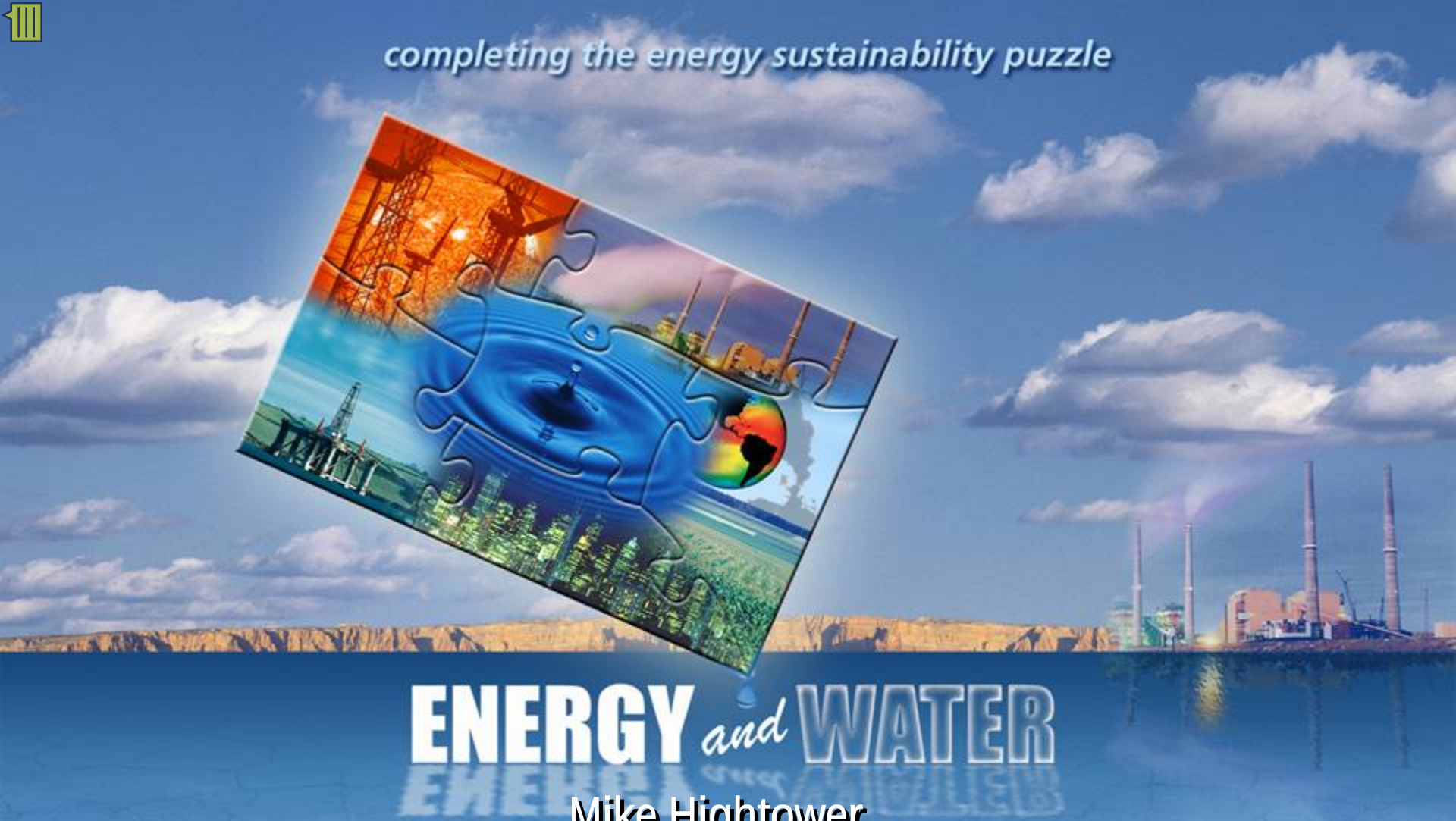


Mike Hightower

Sandia National Laboratories

Albuquerque, New Mexico

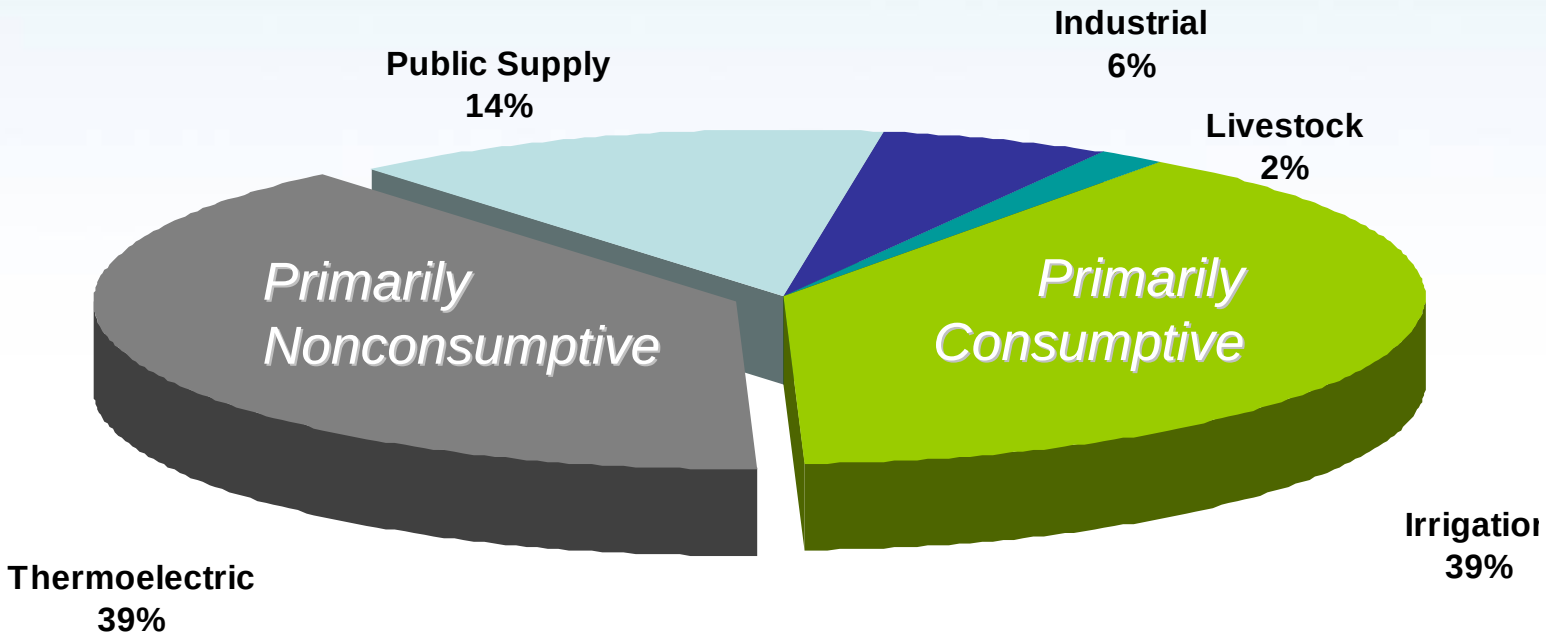
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000

Water Is a Critical Resource

- Fast growing demand for clean, fresh water
- Increased demand for environmental protection and enhancement
- Unknown impacts of climate variability/change
- All regions of US vulnerable to water shortages

Energy and agriculture withdraw the most water in the U.S.

Estimated Freshwater Withdrawals by Sector, 2000



Source: USGS Circular 1268, March, 2004

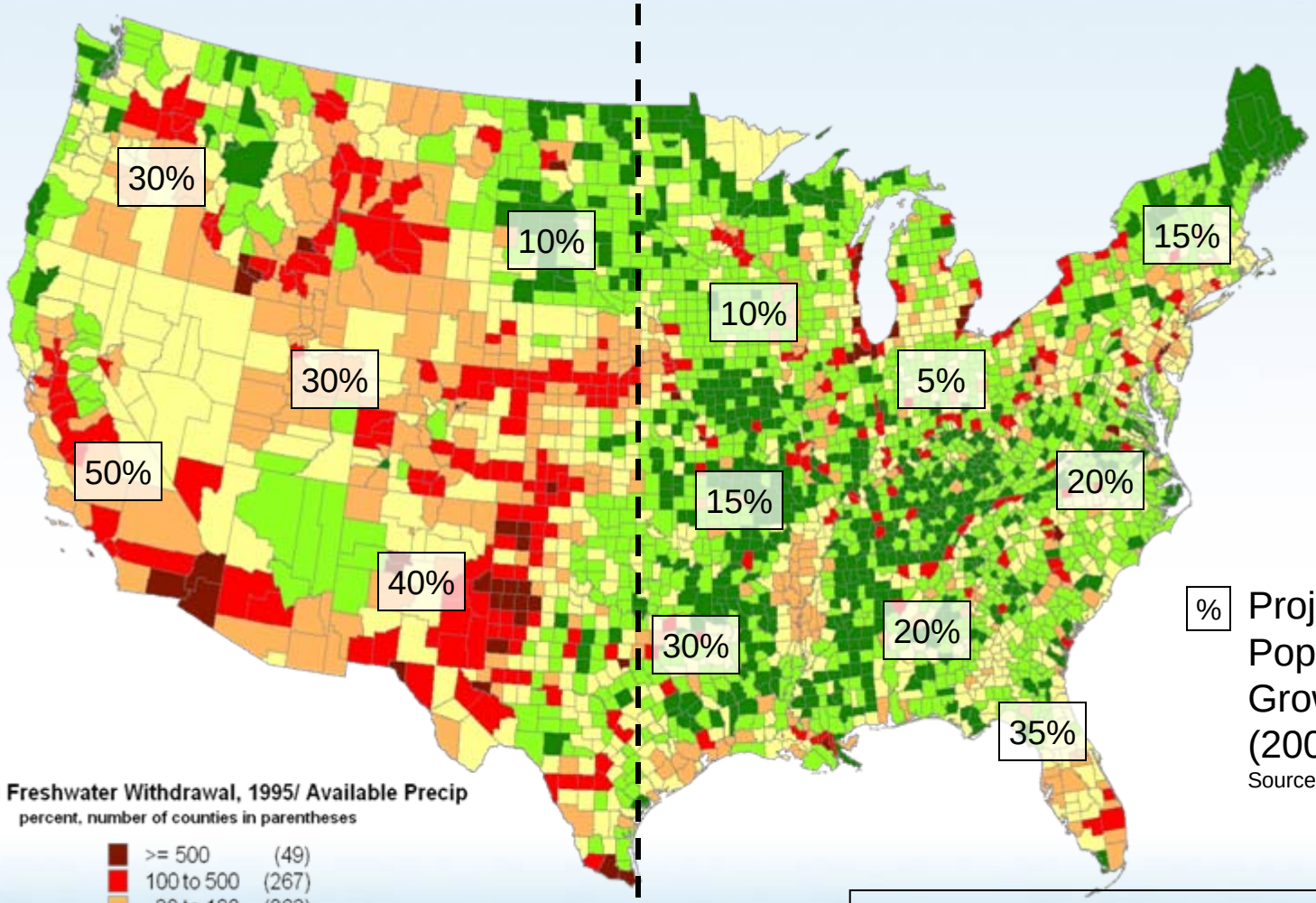
Note: Hydropower uses are not included here!

ENERGY and WATER

US Energy Sustainability

ENERGY and WATER

Water challenges are nationwide



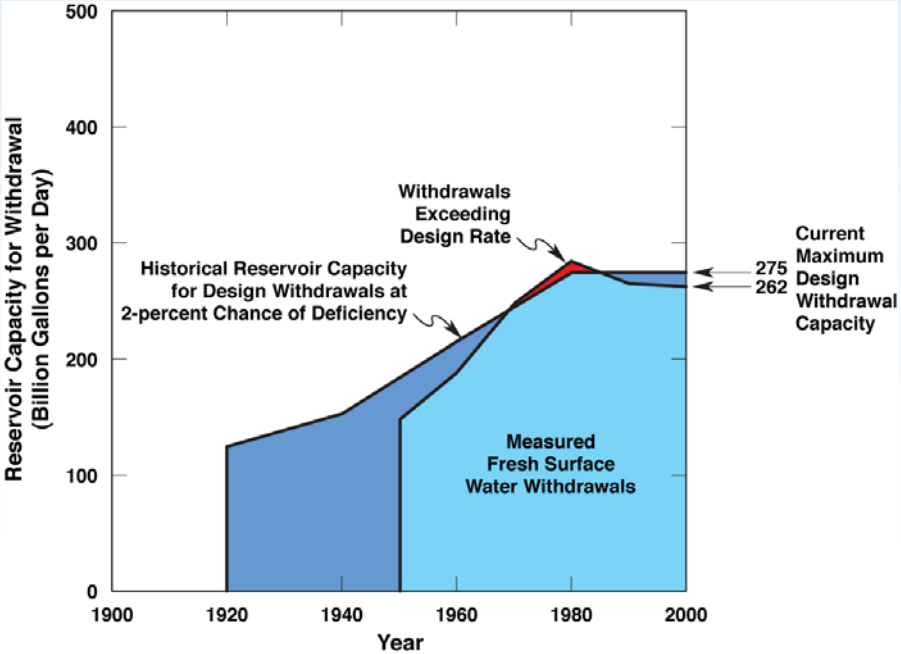
% Projected Population Growth (2000-2020)
Source: NETL (2002)

Source: USGS Circular 1200 (Year 1995), EPRI 2003

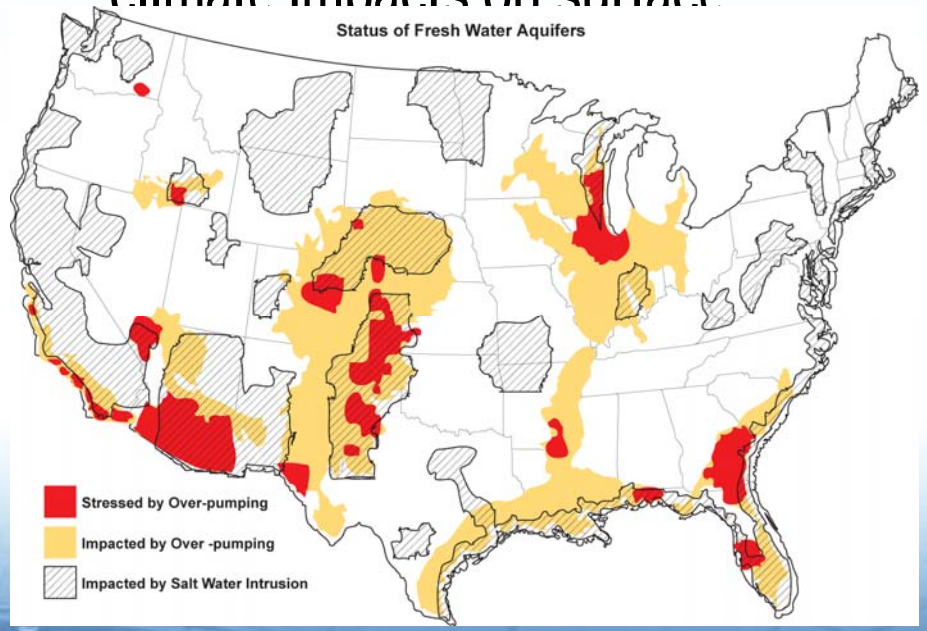
Heavy reliance on irrigation in agriculture

ENERGY and WATER

Growing Limitations on Fresh Water Availability



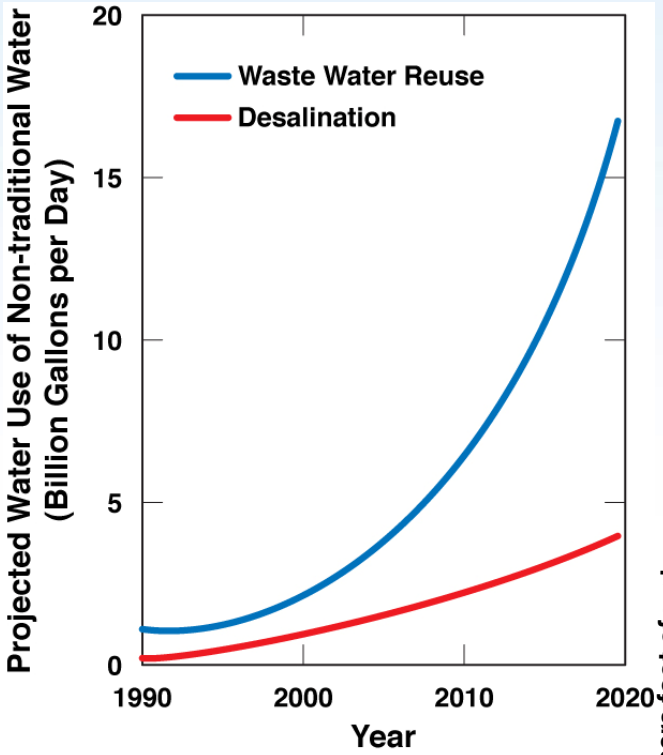
- Little increase in surface water storage capacity since 1980
- Emerging concerns over climate impacts on surface

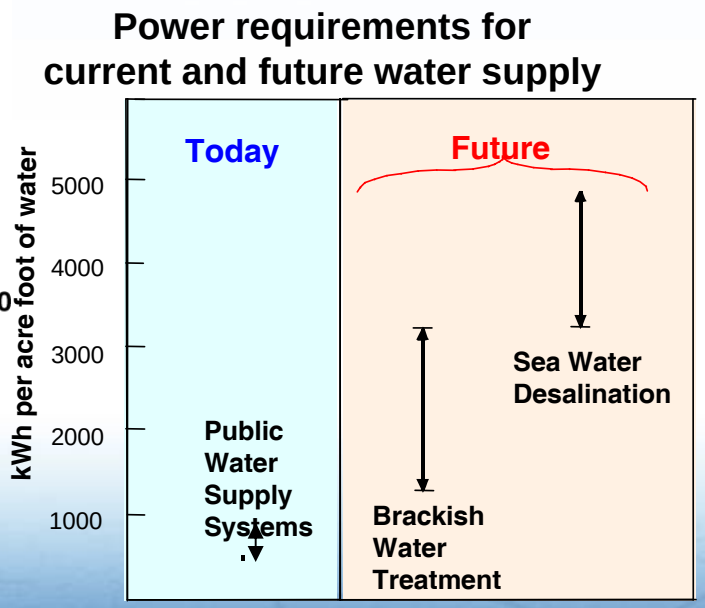


- Many major aquifers seeing reductions in water quality, yield and availability
- This is forcing reductions in ground water pumping

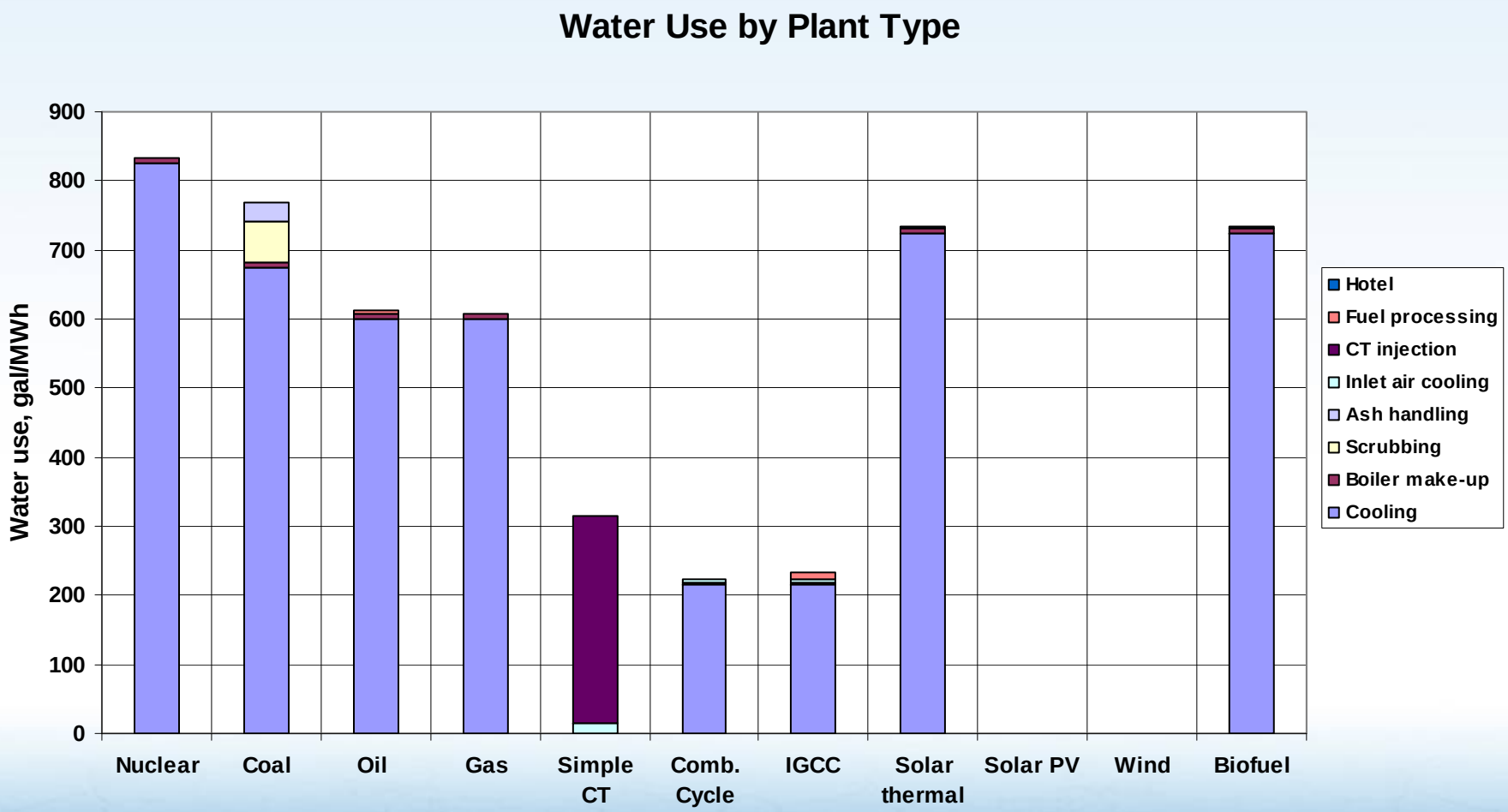
Growing Use of Non-traditional Water Resources

- Desal growing at 10% per year
- Waste water reuse growing at 15% per year
- Reuse not identified in fresh water withdrawal or consumption data
- Non-traditional water use is



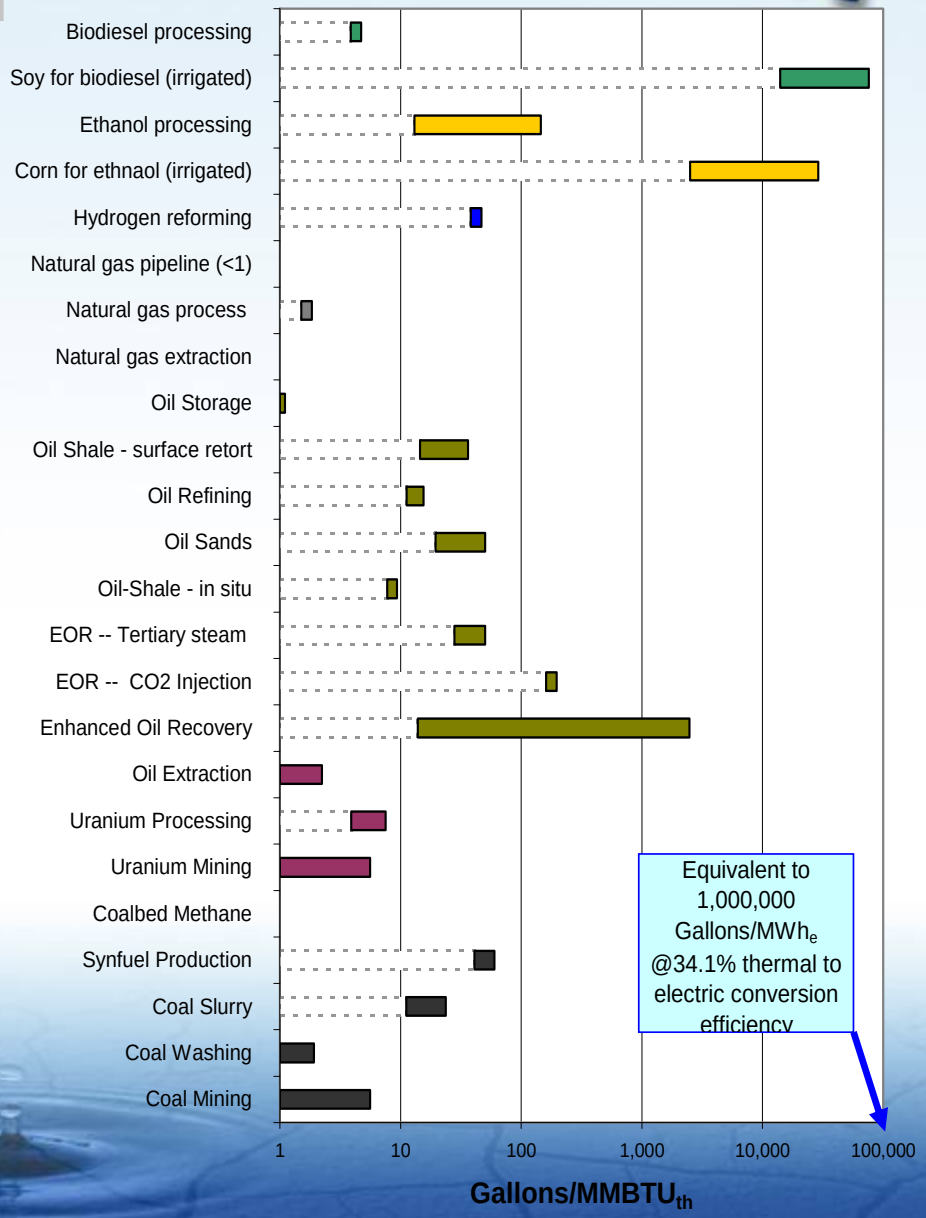


Water Use Efficiency for Different Generation Types

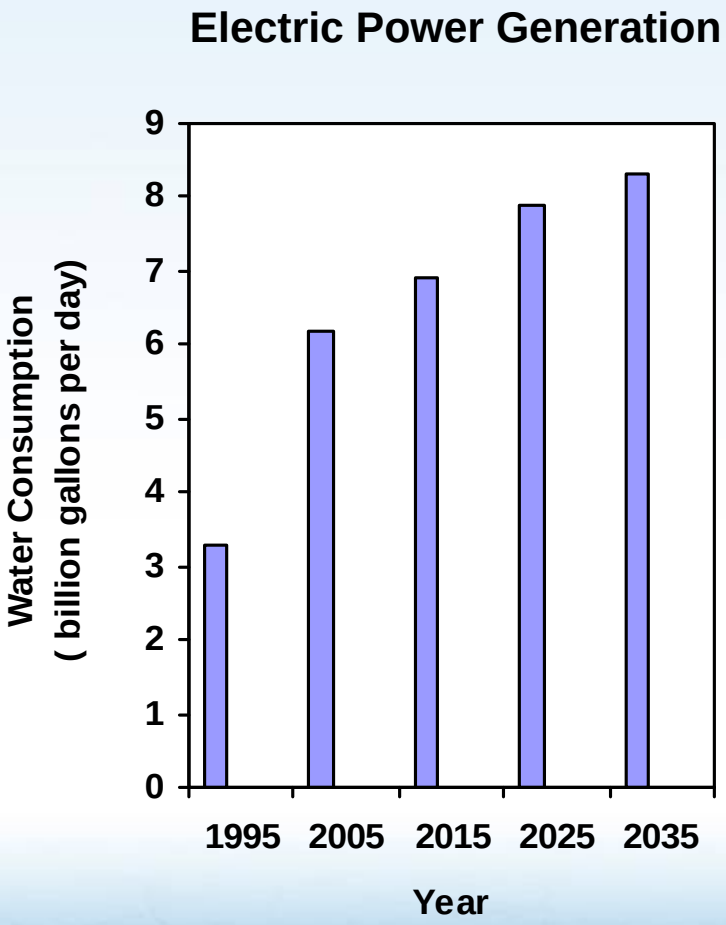


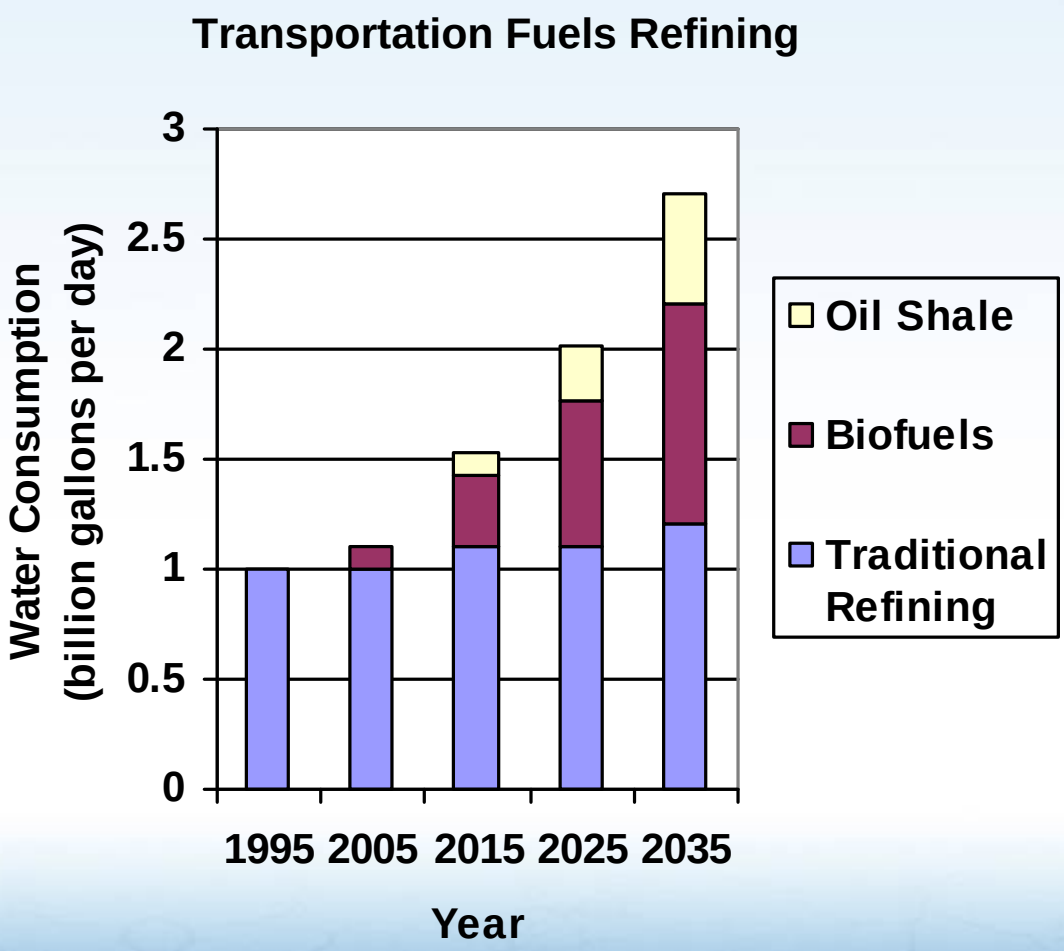
Future energy development will put new demands on water

- Many newer technologies will be more water intensive
- Biofuels and hydrogen economy would require significantly more water than fossil transportation fuels
- Constraints will grow for power plant siting because of water for cooling needs, advanced scrubbing, and CO_2 removal



Emerging Water Demands for Future Energy Development





2003 Heat Wave Impact on French Generation System

- Loss of 7 to 15% of nuclear generation capacity for 5 weeks
- Loss of 20% of hydro generation capacity
- Purchase of large amount of electricity on wholesale power market
- Large-scale load shedding and shut off transmission to Italy
- Sharp increase in spot-market prices: 1000 to 1500 $/MWh for most critical days

Bort-les-Orgues Reservoir

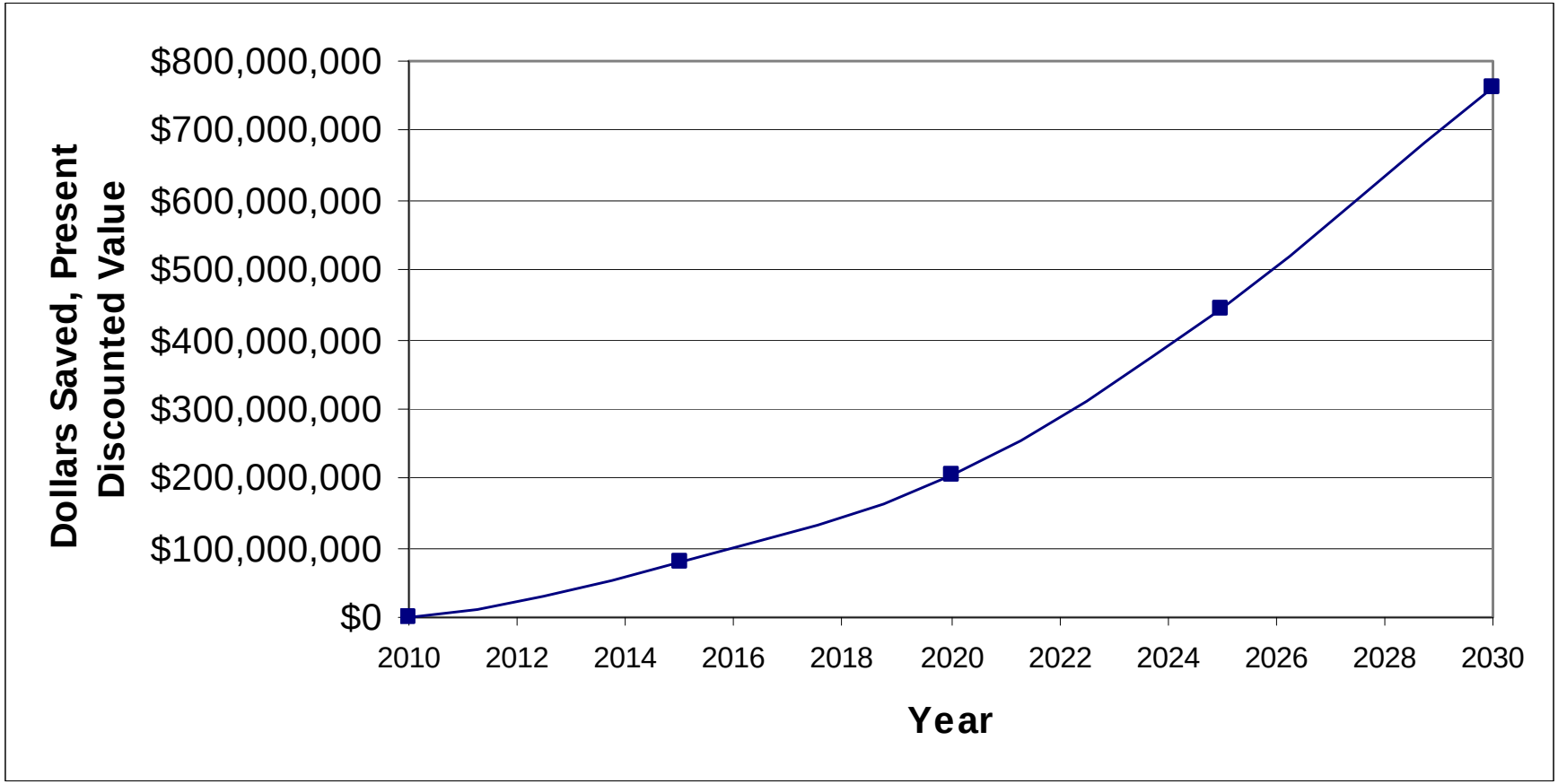
August 27, 2003

Energy and Water Interdependency Issues Are Appearing Now

ENERGY and WATER

Summary of Major National Needs and Issues Identified in Workshops

- Better resources planning and management
  - Integrated regional energy and water resource planning and decision support tools
  - Infrastructure and regulatory and policy changes for improved energy/water use efficiency
  - Improved water supply and demand characterization, monitoring, and modeling
- Improved water and energy use efficiency
  - Improved water efficiency in thermoelectric power generation
  - Improved biofuels/biomass water use efficiency
  - Reduced water intensity for emerging energy resources
- Development of alternative water resources and supplies
  - Oil and gas produced water treatment for use
  - Energy efficiency in the treatment and use of non-traditional water

Cumulative Benefit of Water Saving Technologies

- Adopted by 10% of new coal-fired plants: