

completing the energy sustainability puzzle



ENERGY *and* WATER

Emerging Climate and Security Challenges

Defense, National Security, and Climate Change Workshop - June 2012

Mike Hightower

Sandia National Laboratories - Albuquerque, New Mexico USA

Energy and Water are ... Interdependent



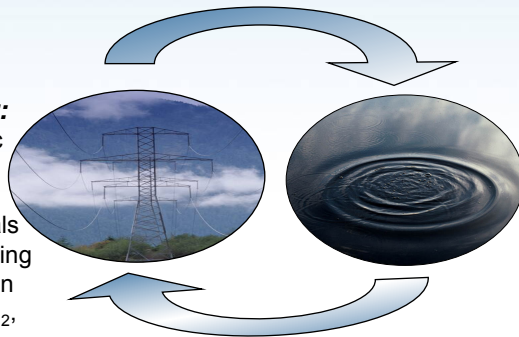
Water for Energy

and

Energy for Water

Energy and power production require water:

- Thermoelectric cooling
- Hydropower
- Energy minerals extraction/mining
- Fuel Production (fossil fuels, H₂, biofuels)
- Emission control



Water production, processing, distribution, and end-use require energy:

- Pumping
- Conveyance and Transport
- Treatment
- Use conditioning
- Surface and Ground water

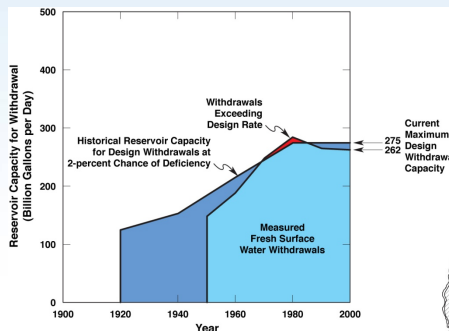
Energy-Water Connections



- **Energy sector accounts for 8% of worldwide fresh water withdrawals**
 - 40% of withdrawals in developed countries
 - 27% of non-agricultural fresh water consumption in the US – could triple by 2030 from electricity, biofuels, and gas shale demands
- **Energy sector contributes to water quality issues**
 - Oil and gas produced water; biofuels, oil sands, oil shales, gas shales, mine water drainage; power plant emissions and impact on surface water quality
- **Water and waste water sector energy use is expected to grow substantially**
 - Growth in water treatment, desalination, disinfection technologies, increased water transportation will increase energy intensity
 - Water and waste water sector energy use could triple by 2030

ENERGY and WATER
EWECA WATER

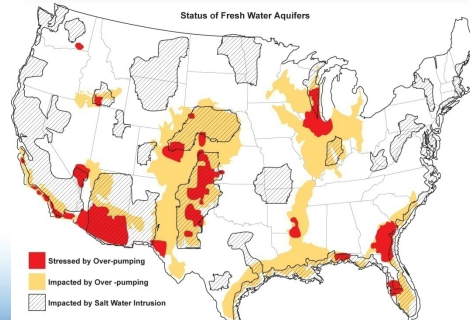
Growing Limitations on U.S. Fresh Surface and Ground Water Availability



(Based on USGS WSP-2250 1984 and Alley 2007)

- **Many major ground water aquifers seeing reductions in water quality and yield**

- **Little increase in surface water storage capacity since 1980**
- **Concerns over climate impacts on surface water supplies**



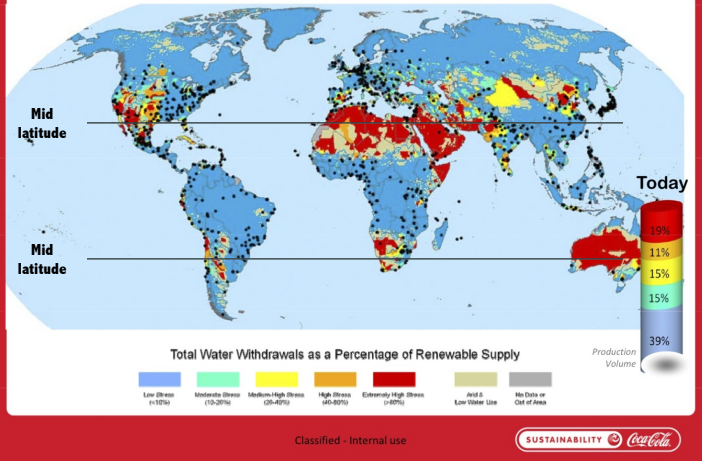
(Shannon 2007)

ENERGY and WATER
EWECA WATER

Regional Water Stress in Mid-latitudes will be Exacerbated by Climate Change



Assess: TCCC Global Water Stress: 2008 Update



Classified - Internal use



ENERGY and WATER
EWECA