6-3-2009

SLIDES: Integrated Policy, Planning, and Management of Water Resources

Robert Wilkinson

Integrated Policy, Planning, and Management of Water Resources

Natural Resources Law Conference

Boulder, Colorado
June 3, 2009

Is the Energy Boom a Water Bane?

Points to Cover:

- Water Challenges
- Energy Challenges (+ security)
- Energy and Water
- The Climate Link
- Coupled Water/Energy/GHG Strategies

Stein’s Law

“Things that can't go on forever, don't.”

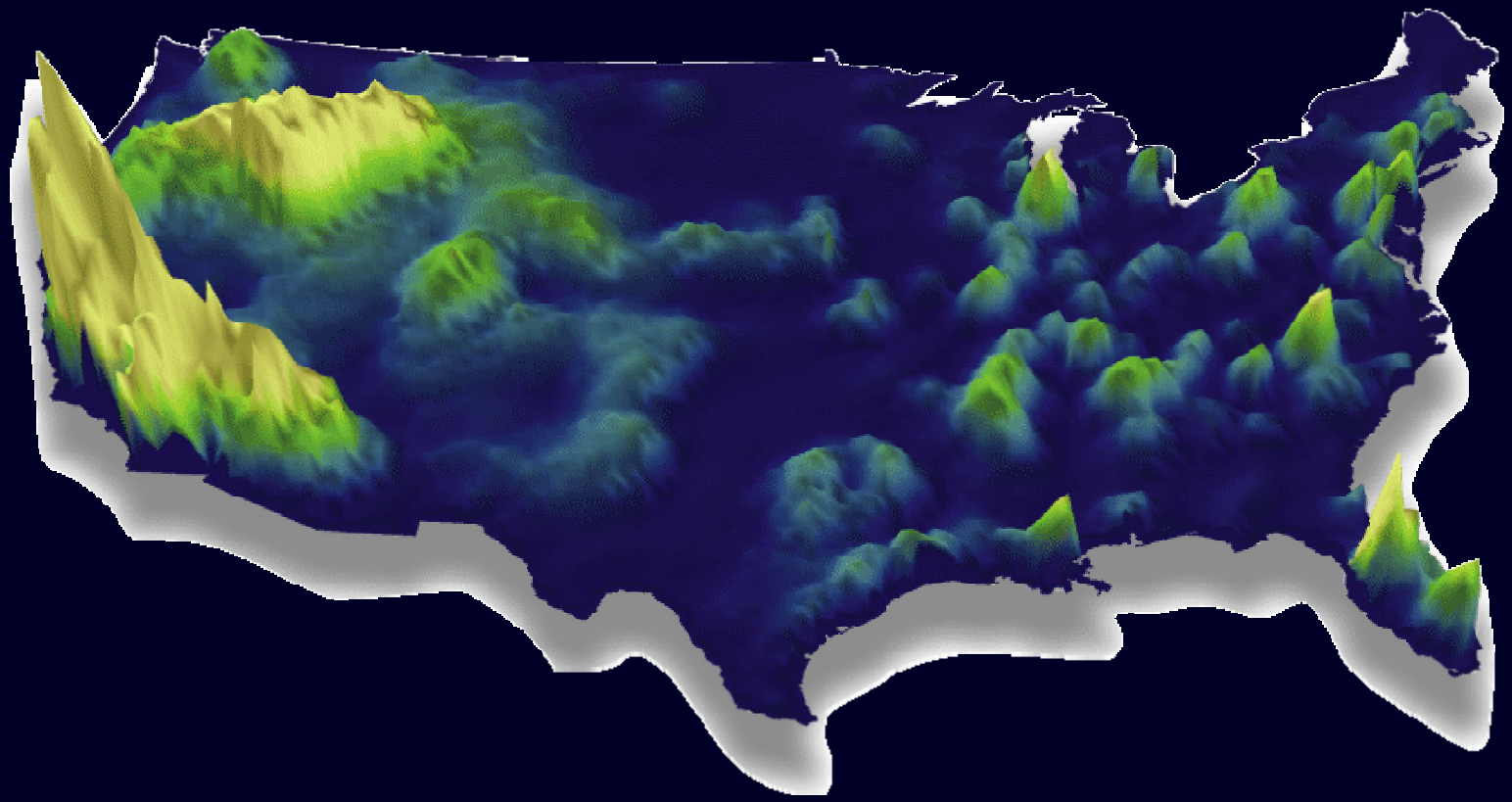
Herb Stein

Water Challenges

Water Supply

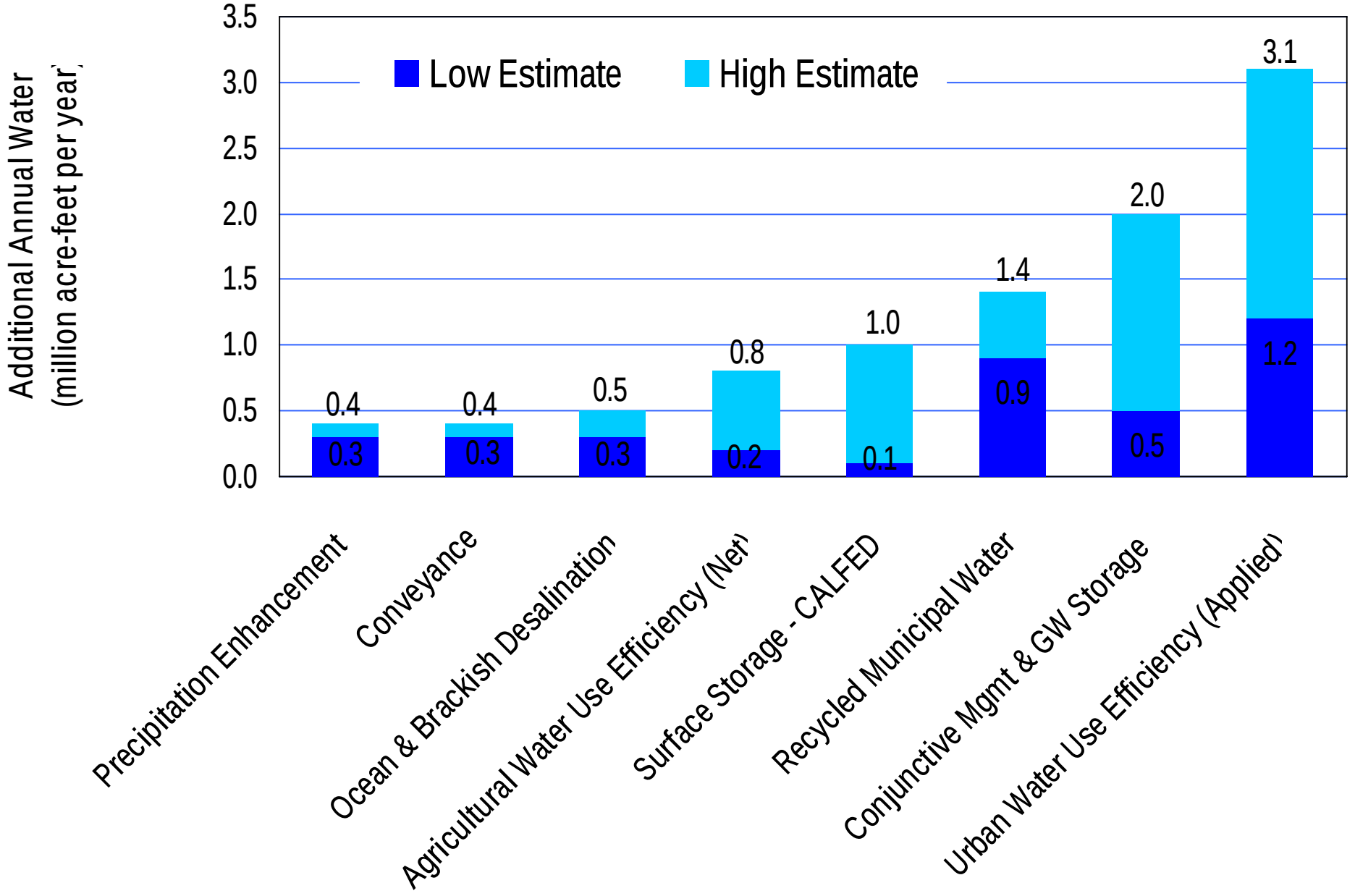
Every major water supply system in California (and many other places) is over-allocated.

Total Water Withdrawals



USGS Circular 1268, 15 figures, 14 tables (released March 2004 and revised April and May 2004) Available at: http://water.usgs.gov/pubs/circ/2004/circ1268/index.html

California Water Supply Options



Energy Challenges

Military Advisory Board

"America's approach to energy has placed the nation in a dangerous and untenable position."

"Given the national security threats of America's current energy posture, a major shift in energy policy and practice is required."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board Reports

National Security and the Threat of Climate Change

2007 SecurityAndClimate.cna.org

Powering America's Defense: Energy and the Risks to National Security

2009 PoweringAmericasDefense.org

Military Advisory Board

"This report identifies a series of current risks created by America's energy policies and practices that constitute a serious and urgent threat to national security —militarily, diplomatically, and economically."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board

"U.S. dependence on oil weakens international leverage, undermines foreign policy objectives, and entangles America with unstable or hostile regimes."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board

"U.S. dependence on fossil fuels undermines economic stability, which is critical to national security."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board

"The U.S.'s outdated, fragile, and overtaxed national electrical grid is a dangerously weak link in the national security infrastructure."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board

The grid is:

- vulnerable to intentional or natural disruptions
- energy and water supplies are at risk because of the grid's condition

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board

"A business as usual approach to energy security poses an unacceptably high threat level from a series of converging risks."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

From a National Security Perspective:

- Improve Energy Efficiency
- Reduce Dependence on Oil Quickly
- Shift from Fossil Fuels to Renewable Sources of Energy
- Reduce Reliance on a Fragile Grid

Water / Energy Nexus

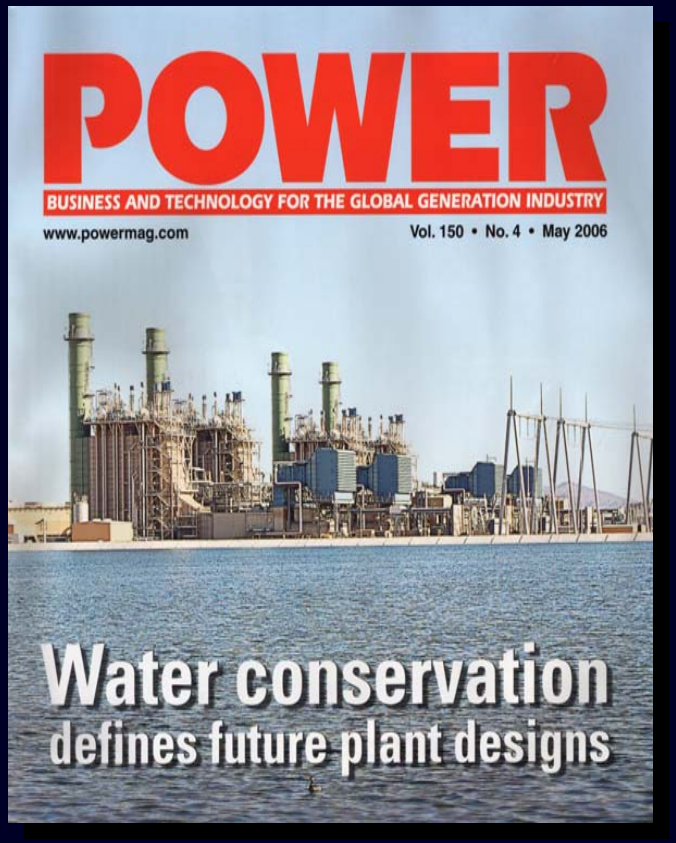
Water Intensity of Energy

Water Intensity of Energy

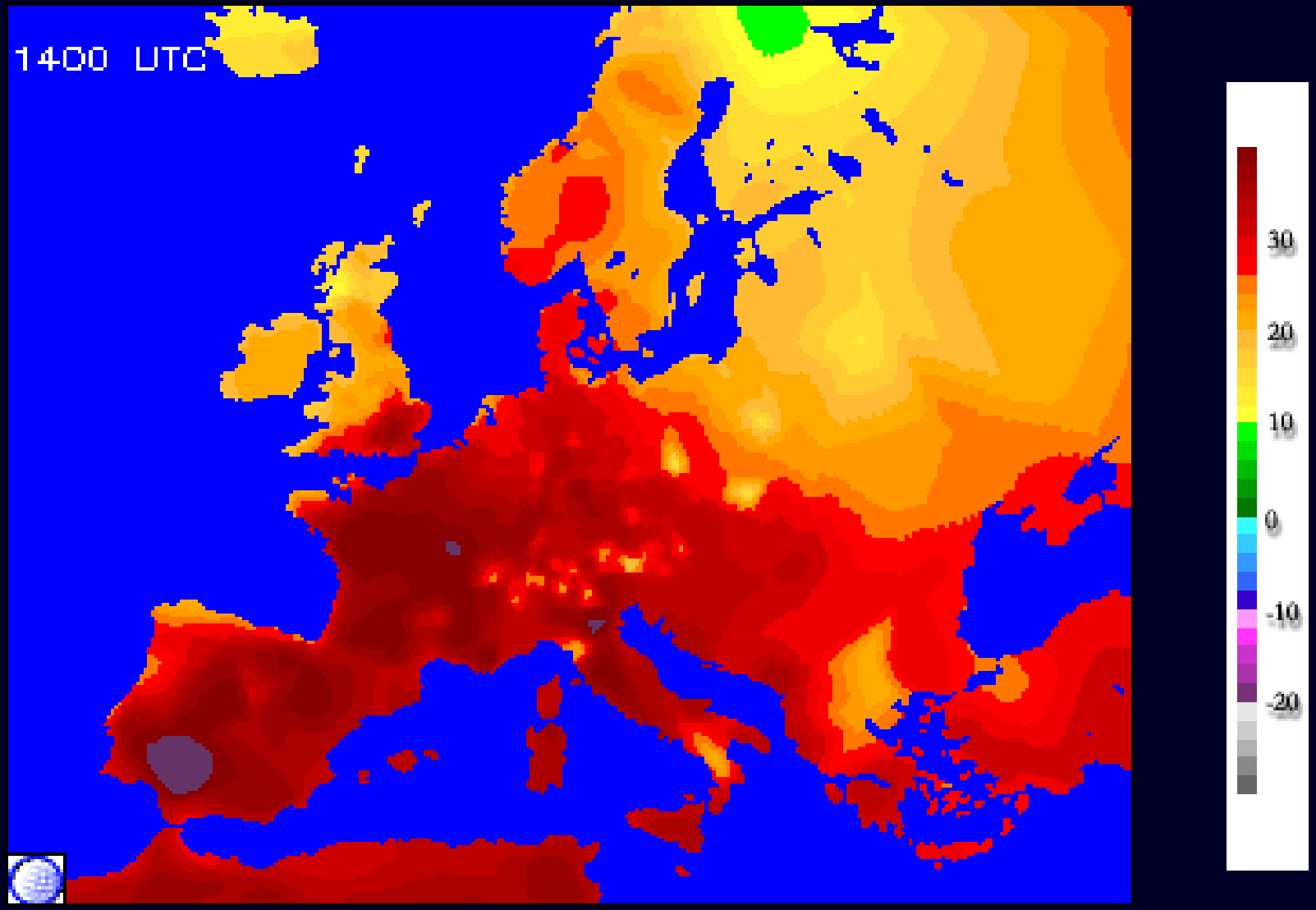
Thermoelectric power generation accounts for about 38% of U.S. freshwater withdrawls, and about 3% of water consumption.

USGS Circular 1268, (released March 2004 and revised April and May 2004)
Available at: http://water.usgs.gov/pubs/circ/2004/circ1268/index.html

Water for Power Production



Maximum Temperature August 10, 2003



Vulnerabilities

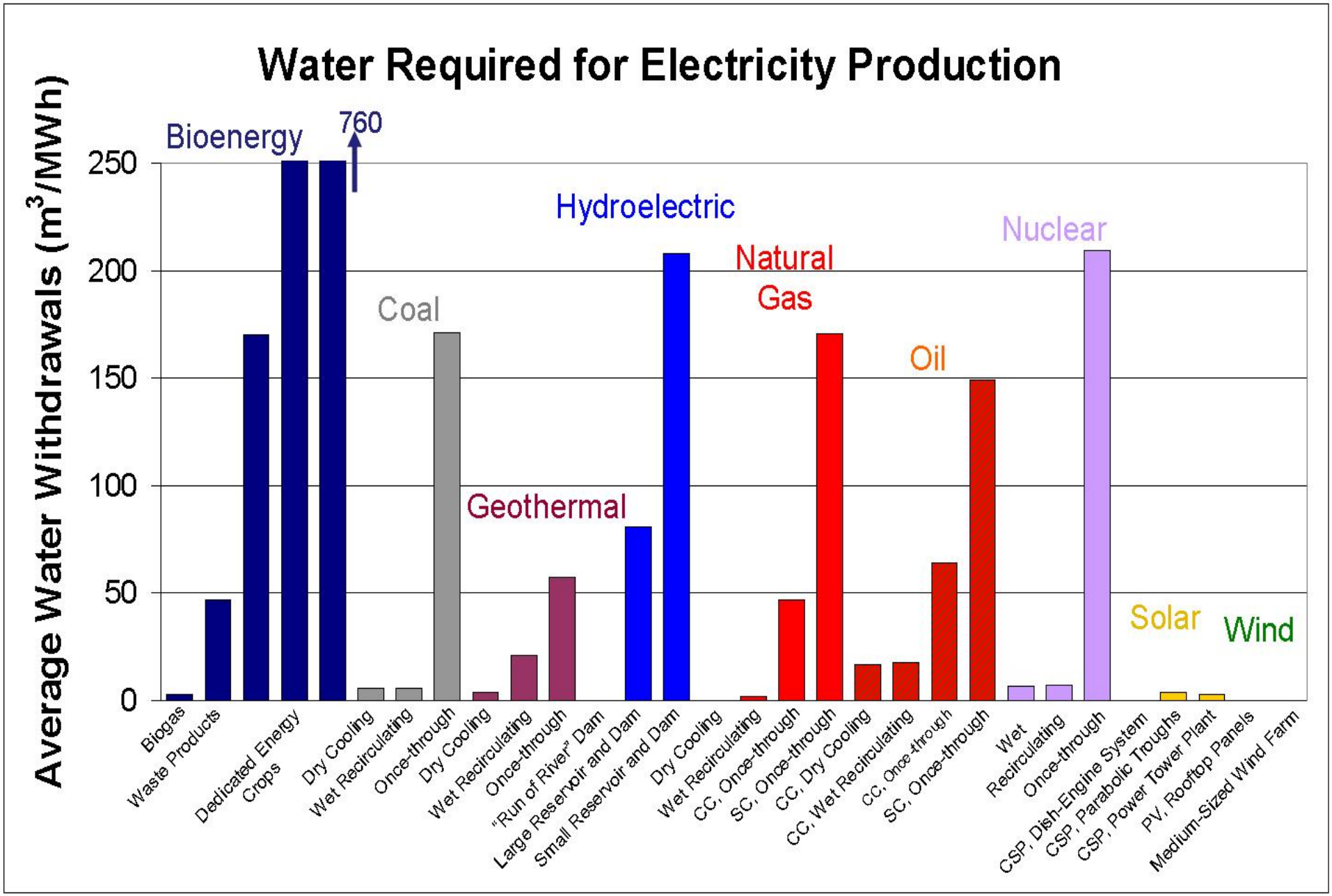
2003:

France shut down a quarter of its nuclear plants due to water constraints even after environmental regulations were removed.

Vulnerabilities

2007:

TVA had to reduce output from Browns Ferry due to water levels and temperature.


Water Required for Electricity Production
Average Water Withdrawals (m3/MWh)
0
50
100
150
200
250
760
Bioenergy
Coal
Geothermal
Hydroelectric
Natural Gas
Oil
Nuclear
Solar
Wind
Biogas
Waste Products
Dedicated Energy Crops
Dry Cooling
Wet Recirculating
Once-through
Dry Cooling
Wet Recirculating
Once-through
"Run of River" Dam
Large Reservoir and Dam
Small Reservoir and Dam
Dry Cooling
Wet Recirculating
CC, Once-through
SC, Once-through
CC, Dry Cooling
CC, Wet Recirculating
CC, Once-through
SC, Once-through
Wet Recirculating
Once-through
CSP, Dish-Engine System
CSP, Parabolic Troughs
CSP, Power Tower Plant
PV, Rooftop Panels
Medium-Sized Wind Farm

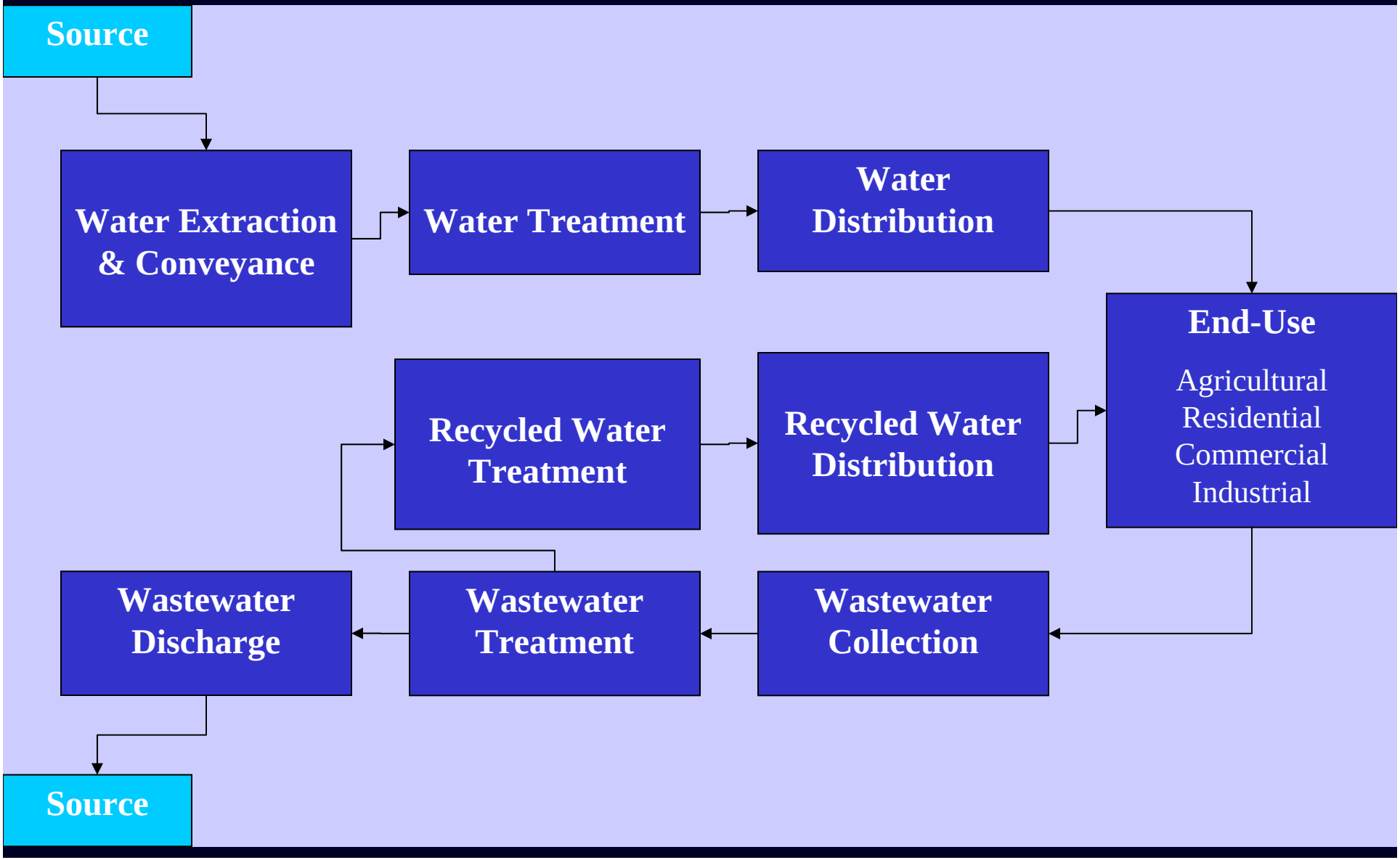
Energy Intensity of Water

California:

19% electricity

33% natural gas (non-power plant)

Energy Inputs to Water Systems



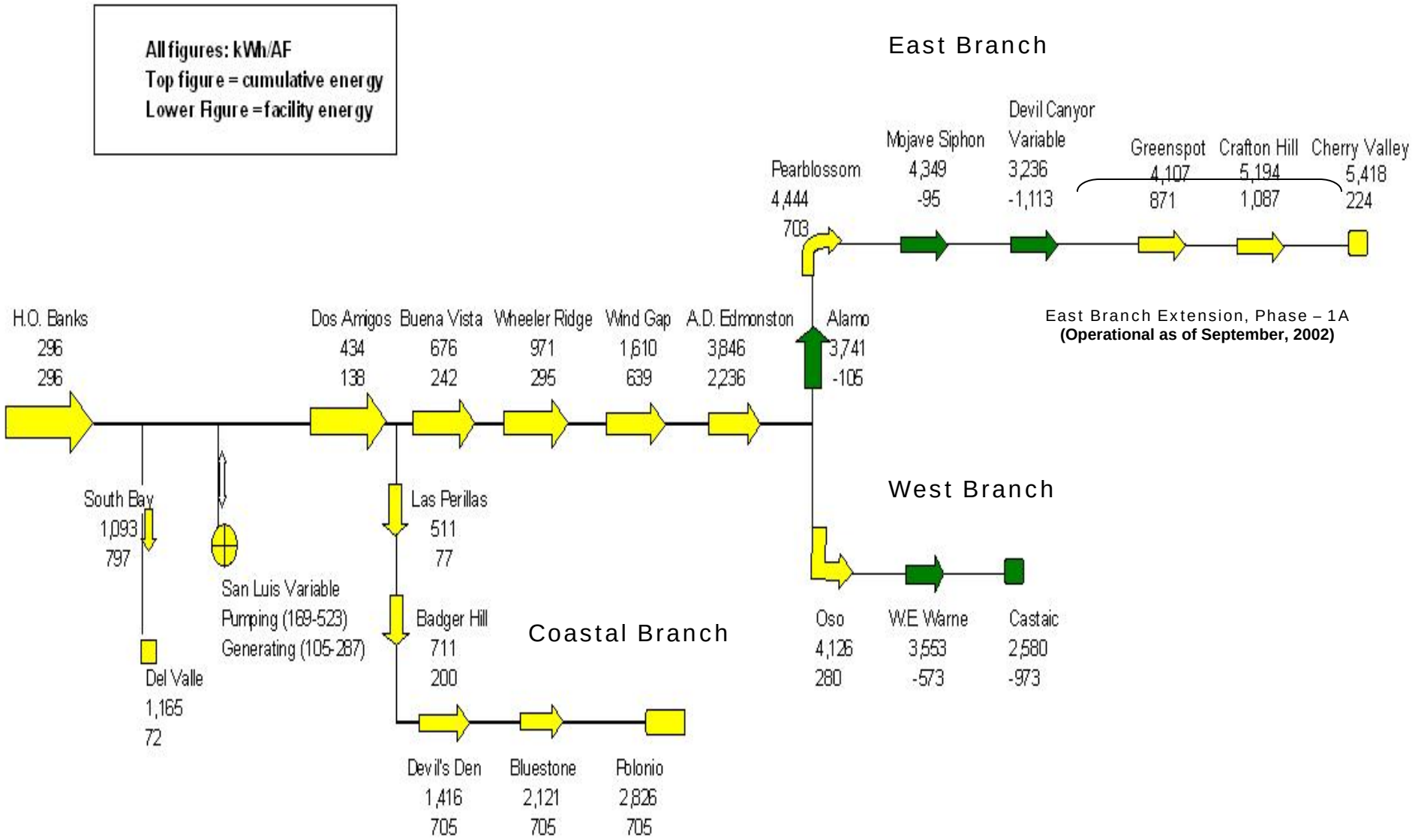
State Water Project

Edmonston Pumping Plant

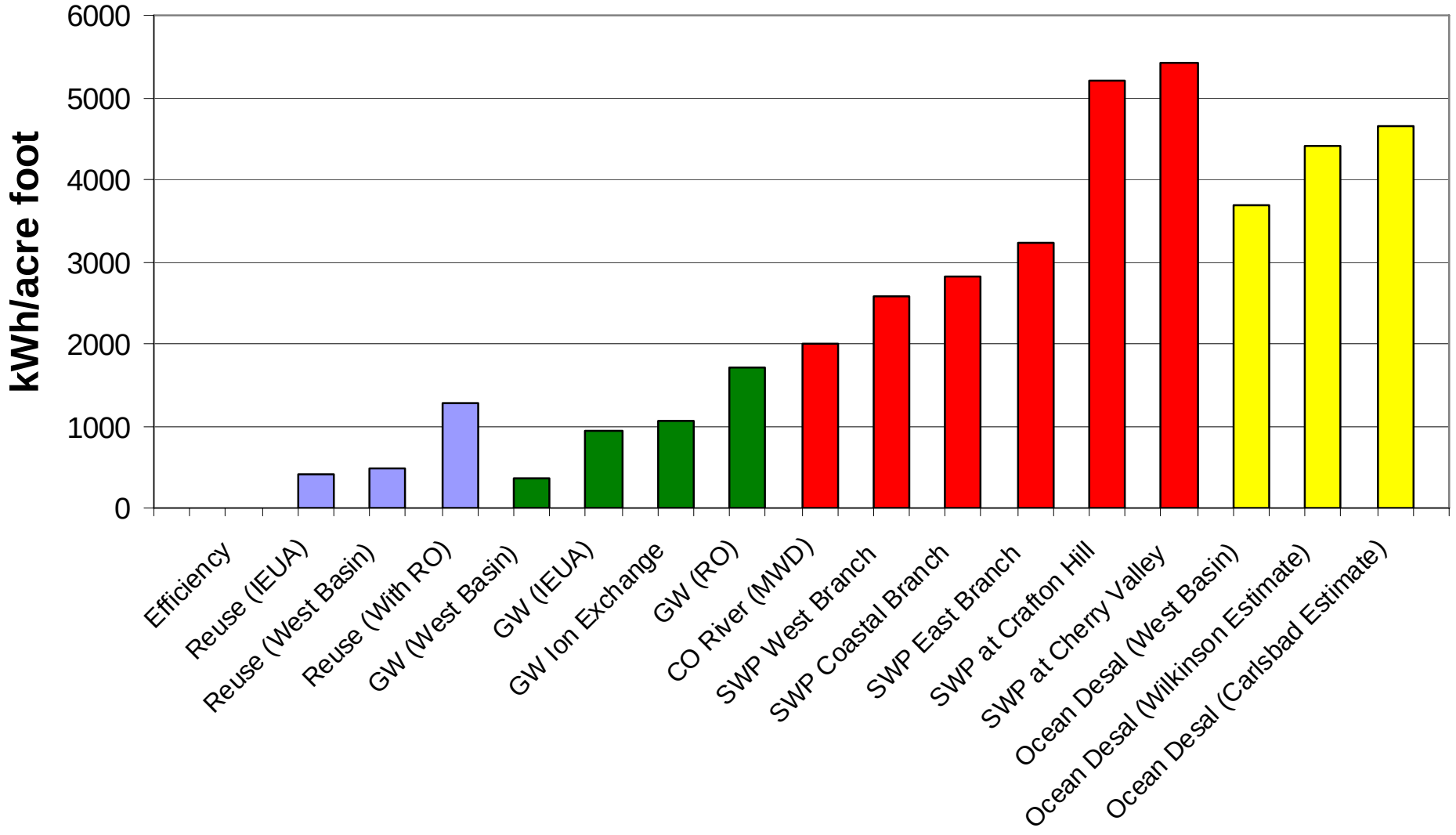
SWP Pumping Facilities

SWP Pumping Facilities

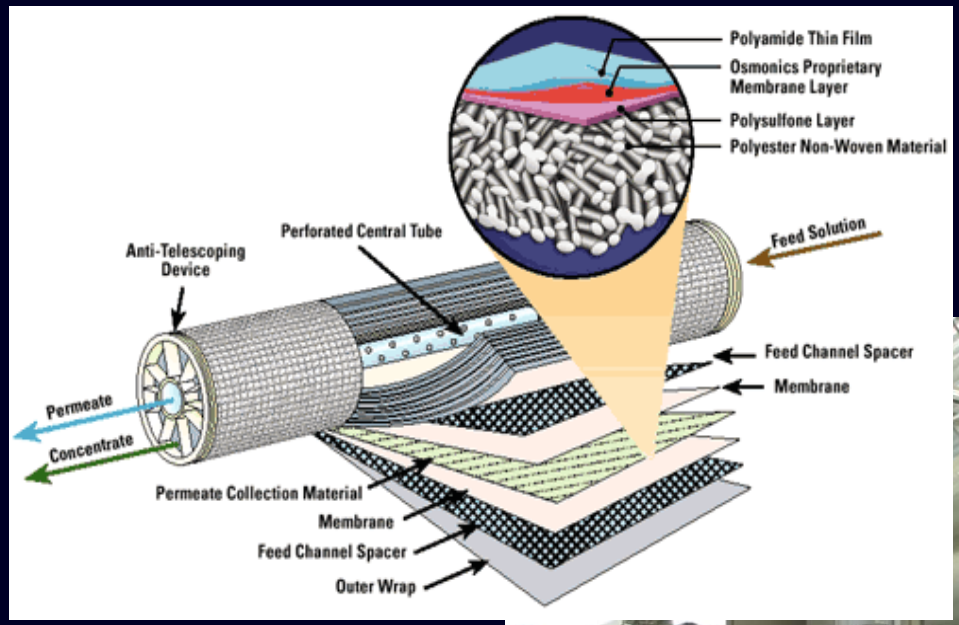
Incremental and Cumulative Energy Inputs and Generation



Energy Intensity of Selected Water Supply Sources in Southern California



Advanced Water Treatment



The Climate Challenge

“Dangerous Anthropogenic Interference”

“The world is already experiencing ‘dangerous anthropogenic interference in the climate system’.

The question now is whether we can avoid catastrophic interference.”

John Holdren NCSE Meeting,

Washington, D.C. January 2008

Climate Impacts

"This is a real economic disaster in the making for our children."

United States
Energy Secretary
Steven Chu

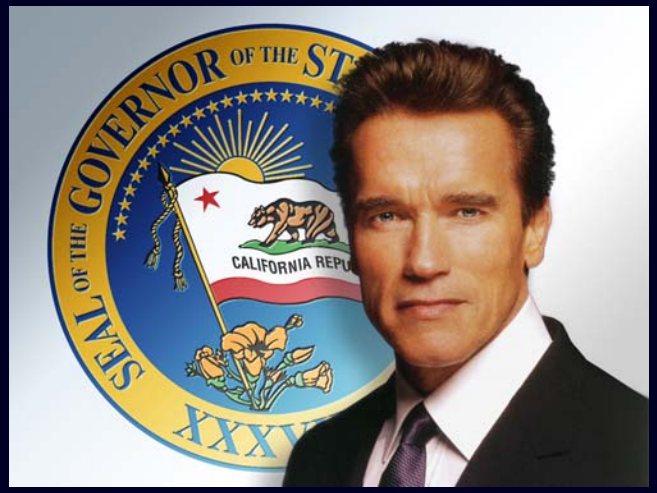
Military Advisory Board: Findings

"Projected climate change poses a serious threat to America's national security."

National Security and the Threat of Climate Change, 2007
SecurityAndClimate.cna.org

Military Advisory Board: Recommendation

The U.S. should commit to a stronger national and international role to help stabilize climate change at levels that will avoid significant disruption to global security and stability.



"I say the debate is over. We know the science. We see the threat. And we know the time for action is now."

Governor Arnold Schwarzenegger, United Nations World Environment Day Conference, June 1,2005, San Francisco

AB 32

"Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California."

AB32, California Global Warming Solutions Act of 2006, Section 38501 (a).

Policy Responses

Water Use in the US

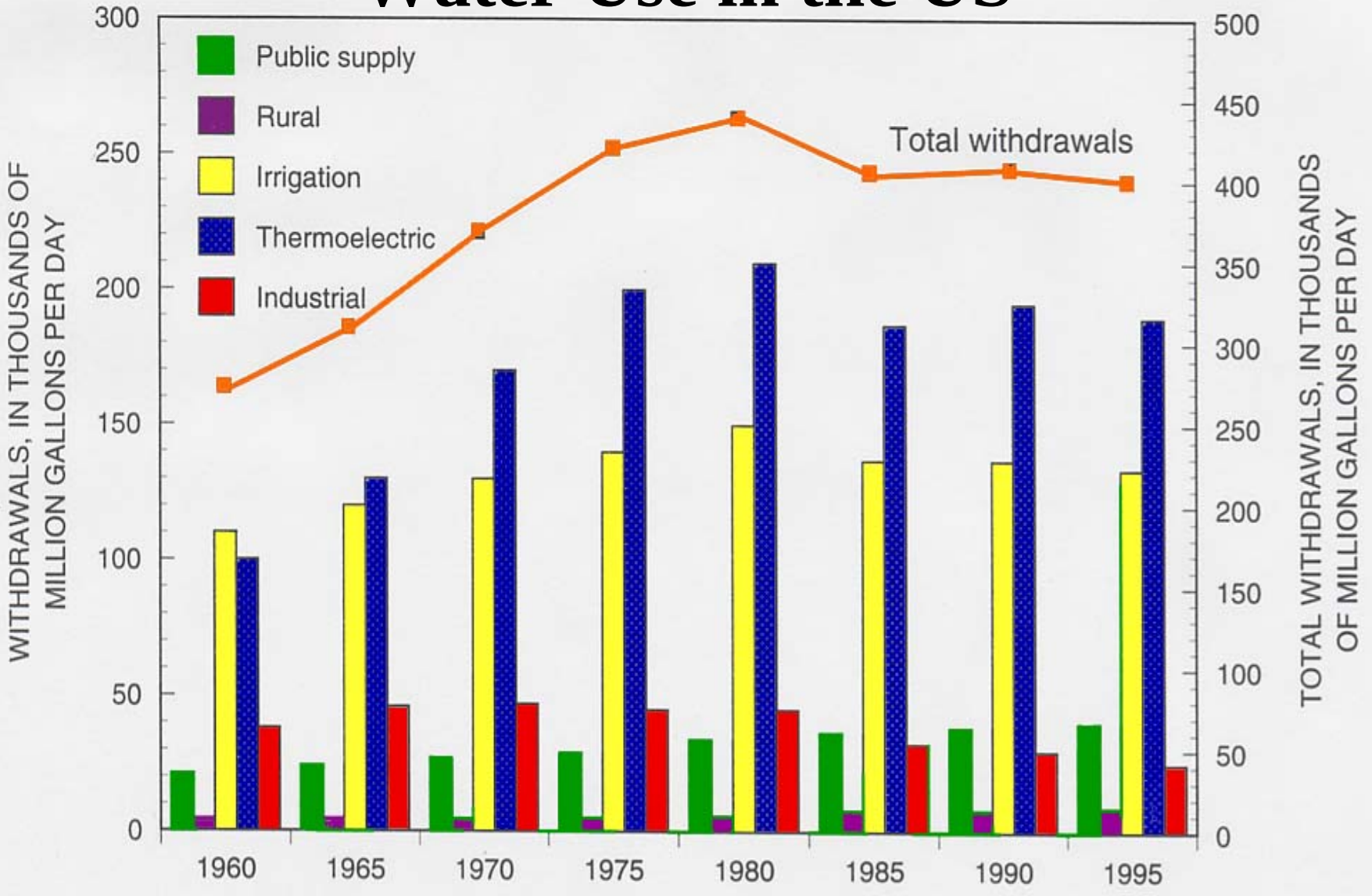
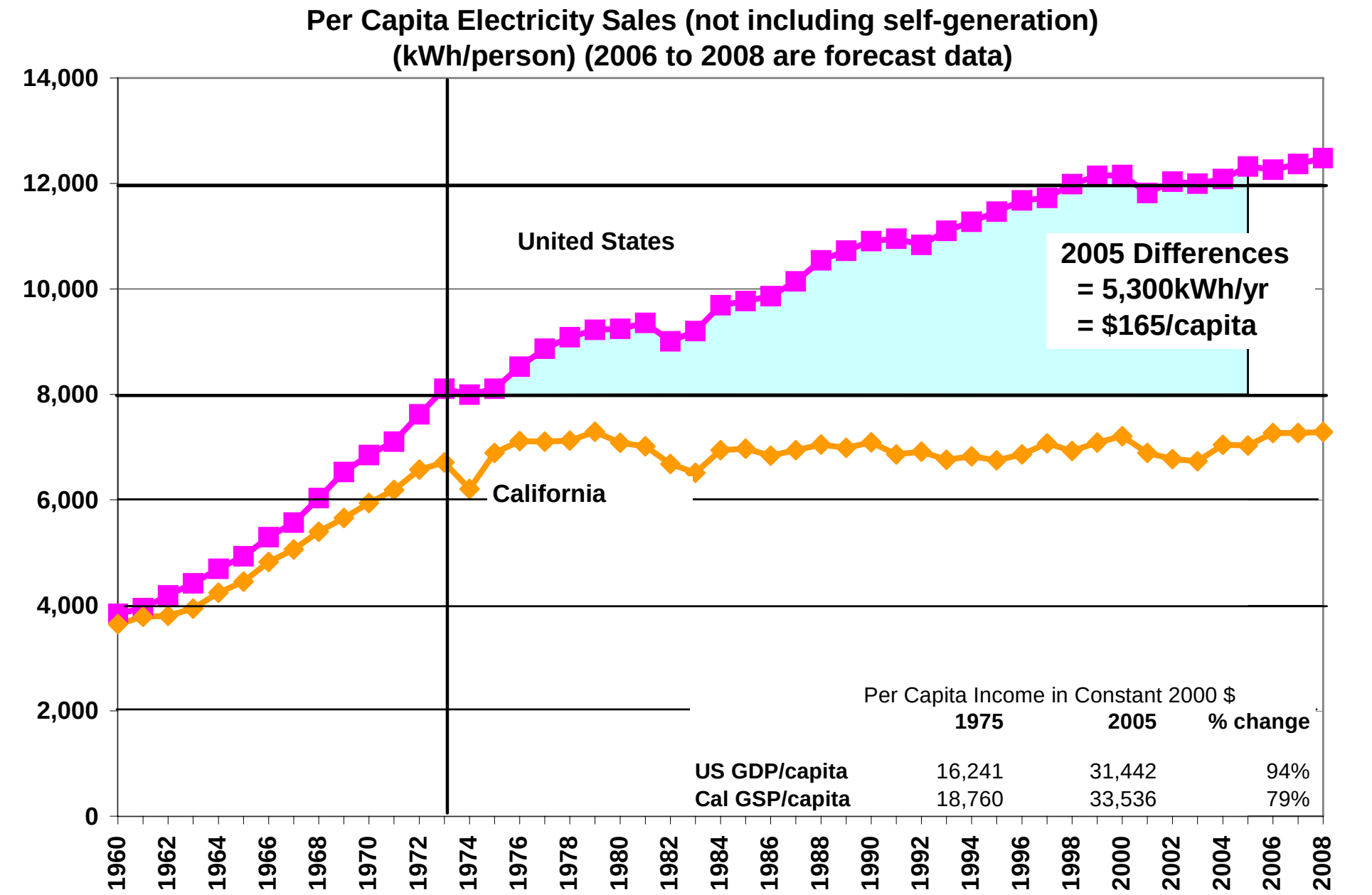
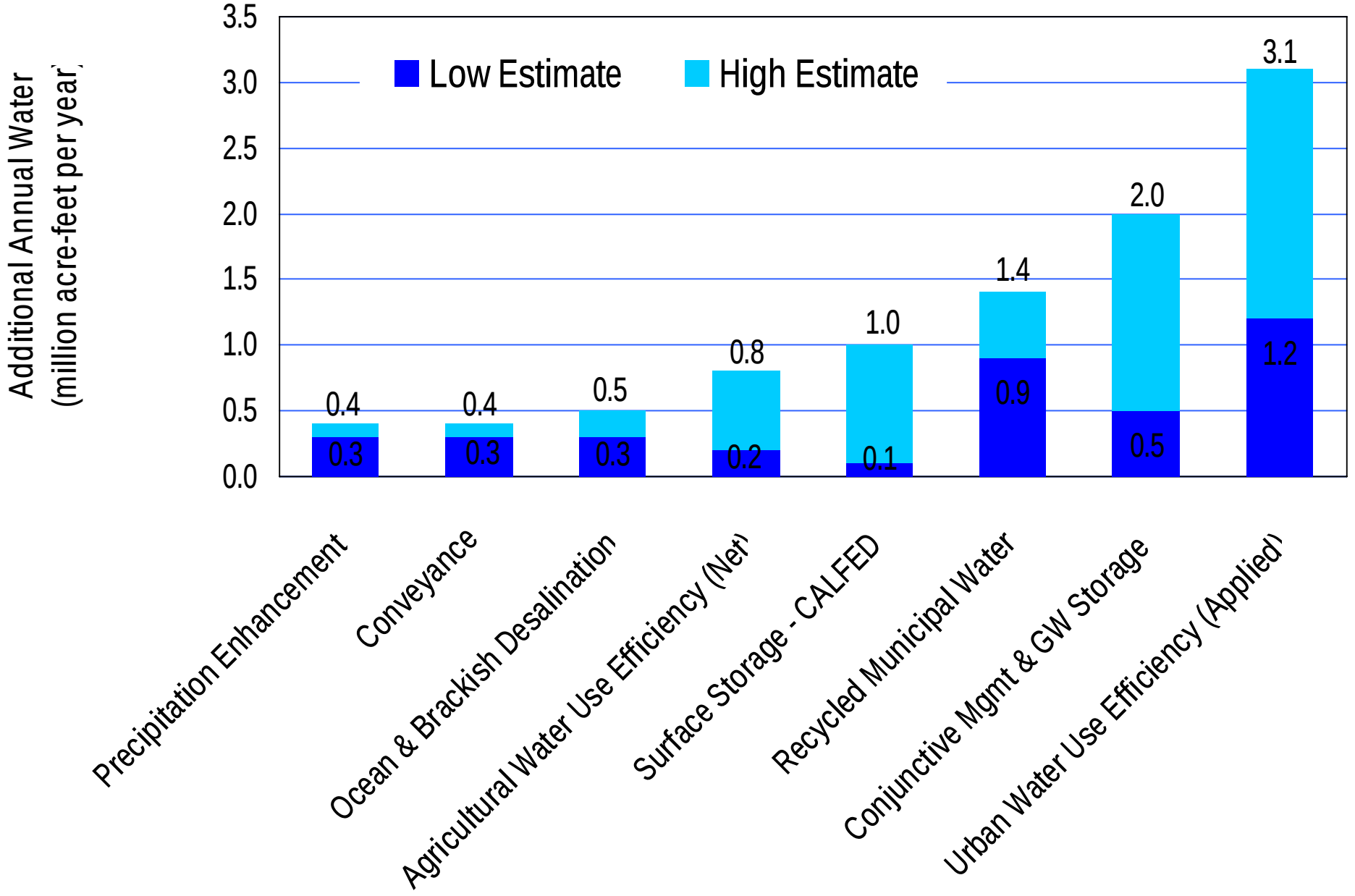


Figure 34. Trends in water withdrawals (fresh and saline) by water-use category and total (fresh and saline) withdrawals, 1960-95.


Per Capita Electricity Sales (not including self-generation)
(kWh/person) (2006 to 2008 are forecast data)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
United States
California
2005 Differences
= 5,300kWh/yr
= $165/capita
Per Capita Income in Constant 2000 $
1975
2005
% change
US GDP/capita 16,241 31,442 94%
Cal GSP/capita 18,760 33,536 79%
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008

California Water Supply Options



Waste = Opportunity

Efficiency Options

Irrigation Efficiency

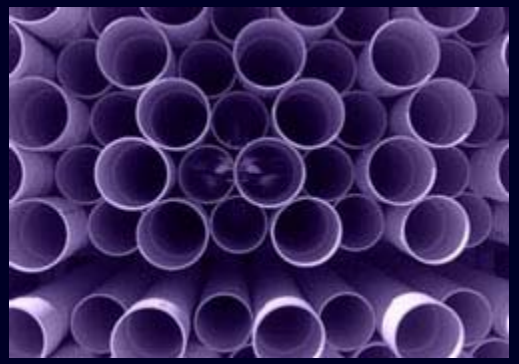
Stormwater Flows

Infiltration Islands

Courtesy of Bruce Ferguson

Rain Gardens

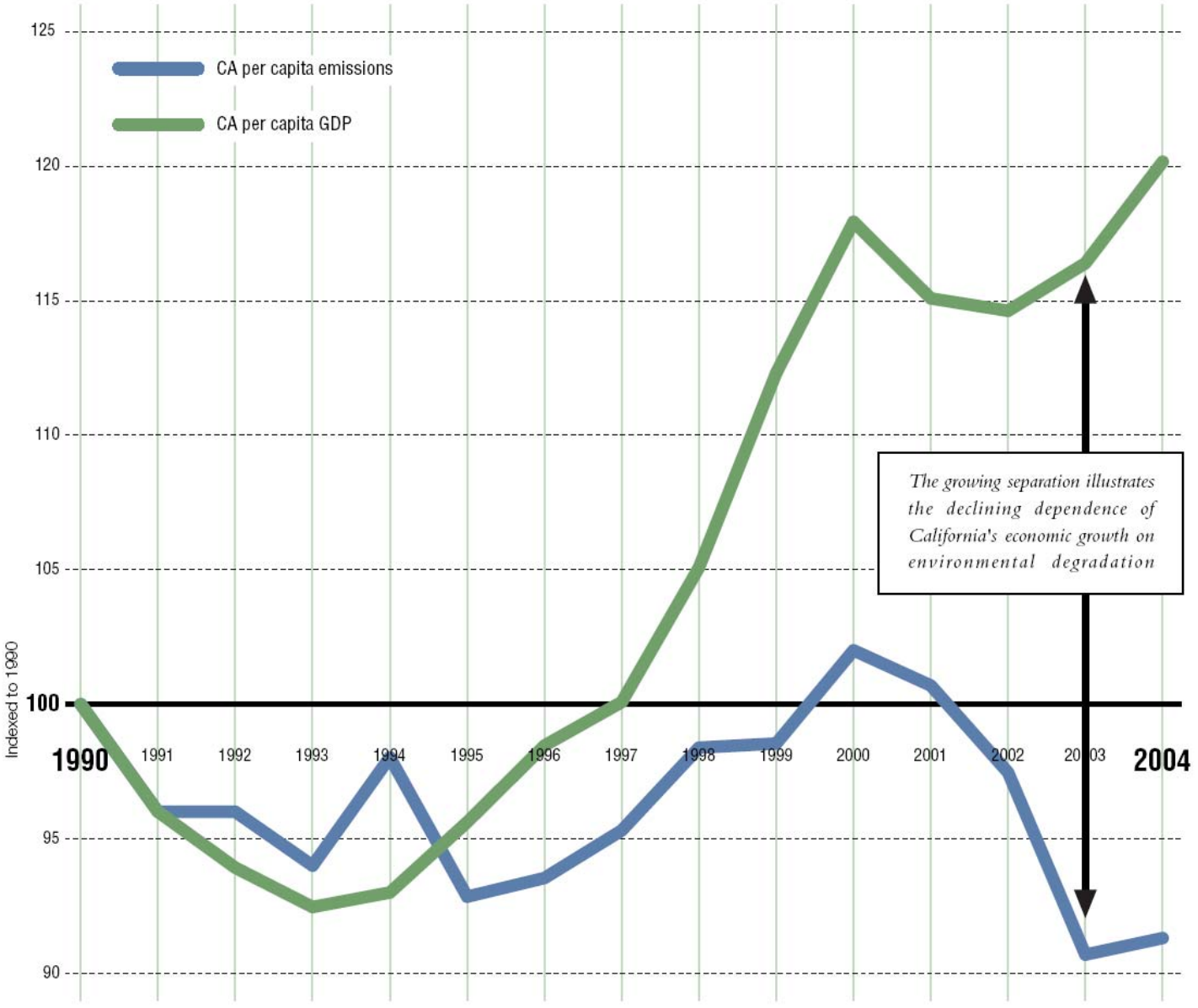
Recycled Water



Conclusion

3: California Emissions and Gross Domestic Product

Carbon emissions per million people - Inflation adjusted GDP dollars per million people
Relative trends since 1990



Source: Energy Information Administration; Population Division, U.S. Census Bureau; Bureau of Economic Analysis; U.S. Department of Commerce

Military Advisory Board

"Climate change, national security, and energy dependence are a related set of global challenges."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Military Advisory Board

"We can say, with certainty, that we need not exchange benefits in one dimension for harm in another; in fact, we have found that the best approaches to energy, climate change, and national security may be one and the same."

Powering America's Defense: Energy and the Risks to National Security, 2009
PoweringAmericasDefense.org

Design for Flexibility

"Governments at all levels should reevaluate legal, technical, and economic procedures for managing water resources in the light of climate changes that are highly likely."

Roger Revelle and Paul Waggoner

Climate Change and U.S. Water Resources, 1990

Strategies

We need to develop and implement *integrated, whole-system policy approaches* for energy, water, climate, and security.

Robert Wilkinson, Ph.D.

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Bren School of Environmental Science and Management
University of California, Santa Barbara

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