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Electric Power-Water Sustainability

2008 National Salinity Summit

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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

Consequences of Growing Electric Power and Water Demands

SUPPLY

DEMAND

- Pressure on electric power sector to use less water
- More intensive management of water resources
- Greater integration between water and energy planning
- Emphasis on watershed/regional planning
- Demand for new science and technology to support planning and management needs

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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

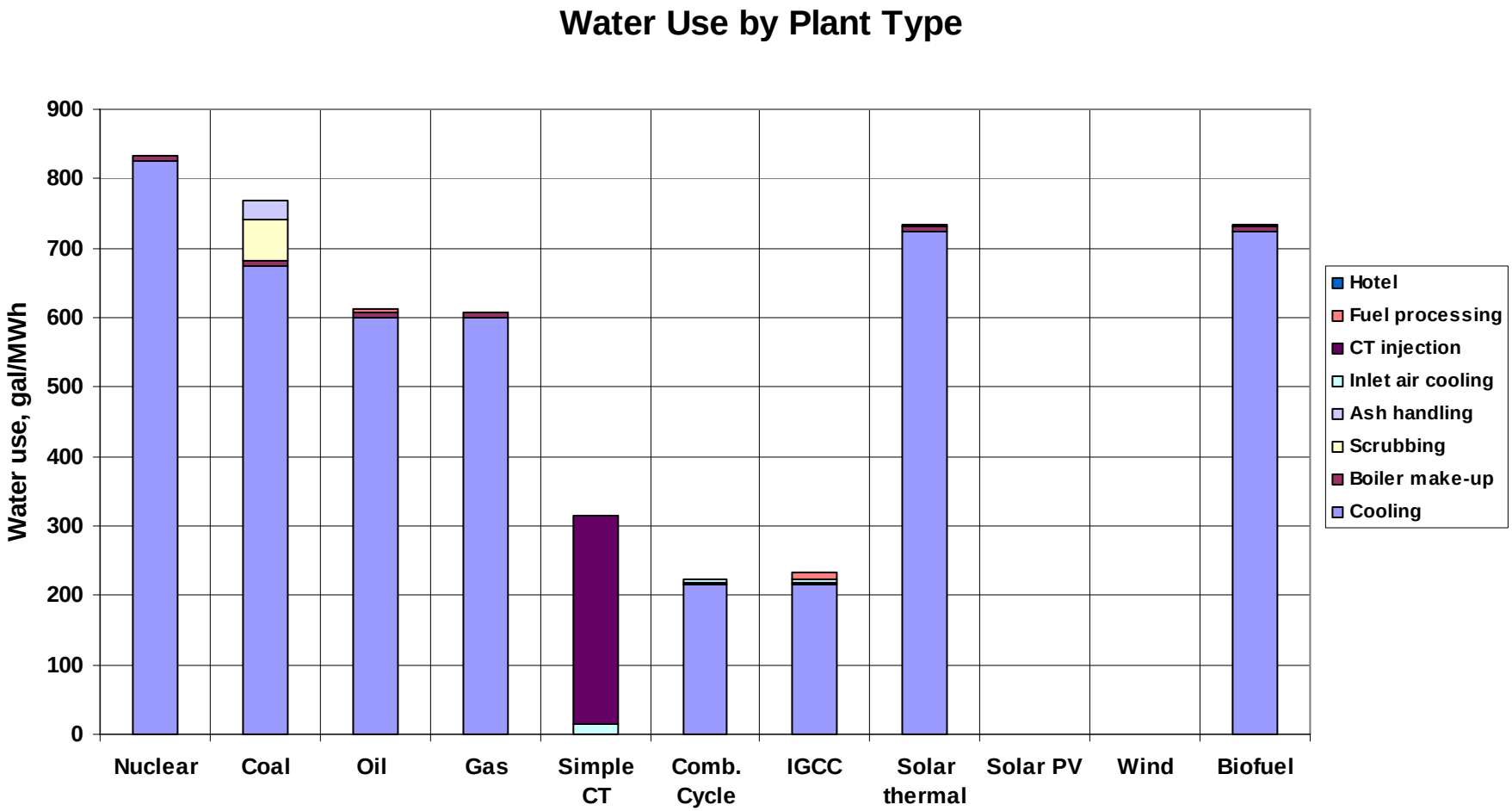
Normal conditions in August

August 27, 2003

Strategies to increase water use efficiency and reduce overall freshwater use

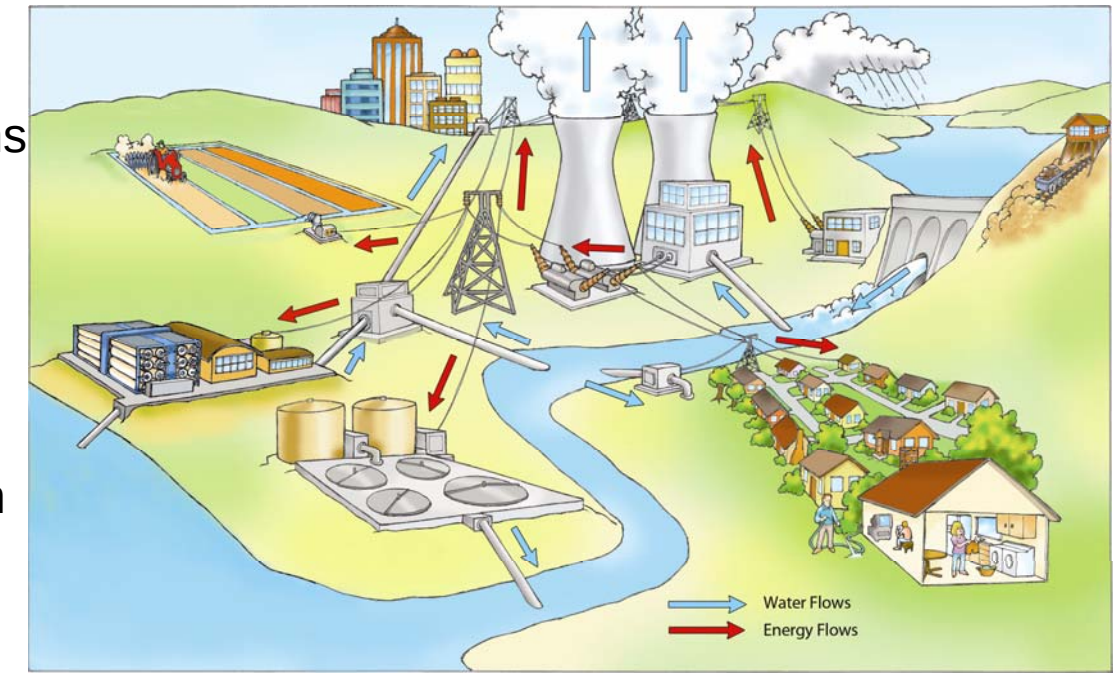
- Dry/hybrid cooling
- Recycle water within plant
  - Increase closed cooling cycles
  - Treat blowdown and reuse
  - Capture vapor produced in wet cooling tower
- Use degraded/reclaimed waters
- Increase thermal conversion efficiency

Water Use Efficiency
(Steam Cycles Using Wet Re-circulating Cooling)



Electric Power Industry Research Program for Energy/Water Sustainability (EPRI 1015371)

- Based on
  - Interviews with key industry decision makers and planners
  - Workshops, peer interactions and literature
- Elements
  - Engineering and economic analysis
  - Improving dry and hybrid cooling
  - Reduction of water losses in cooling towers
  - Use of degraded water sources
  - Water resource management and forecasting
- Ten year duration
- $37.5M



Air Cooling Issues

Pilot Spray Enhancement Testing Crockett Cogeneration Station

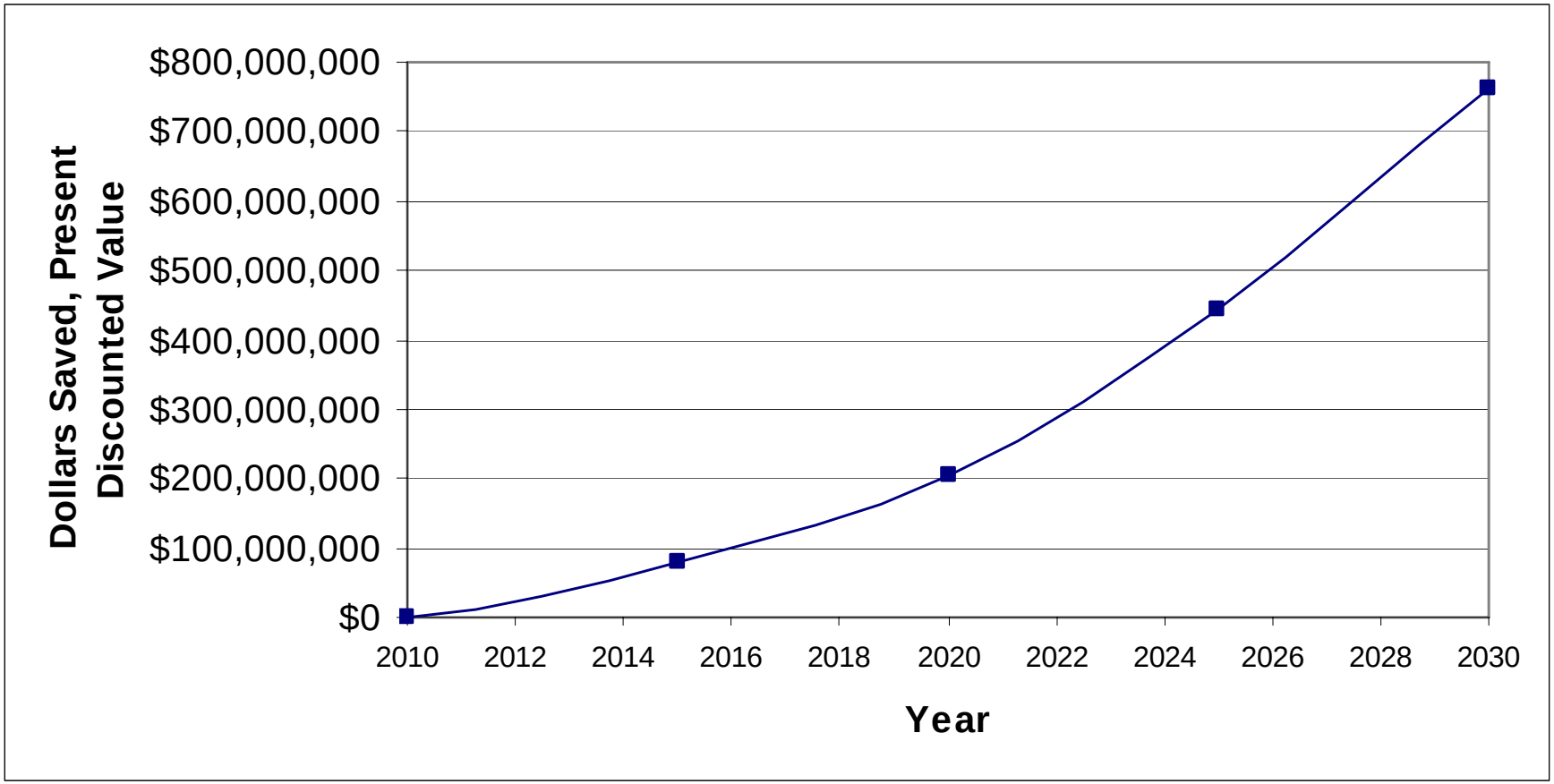
- Cost
- Hot weather penalty
- Wind effects
- Nuclear plants

Estimated Annual Savings for 350MW Coal Plant

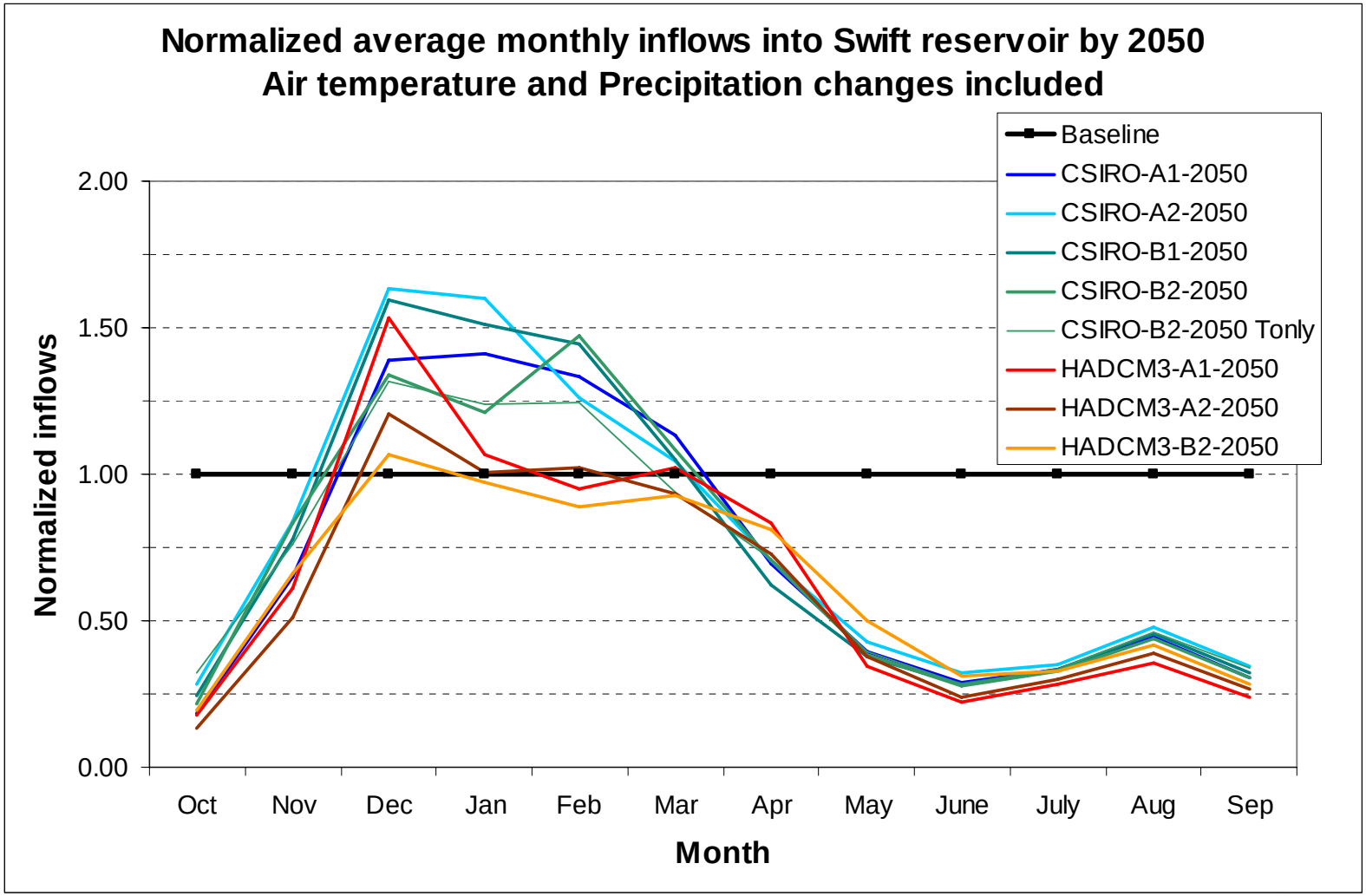
Technology Research Area	Savings
Capture Evaporation	$870,000
Reduce Blow Down	$860,000
Dry Scrubbing	$220,000
Use of Degraded Waters	$740,000
Air Cooling	$750,000

Cumulative Benefit of Water Saving Technologies

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



Climate Change Risks

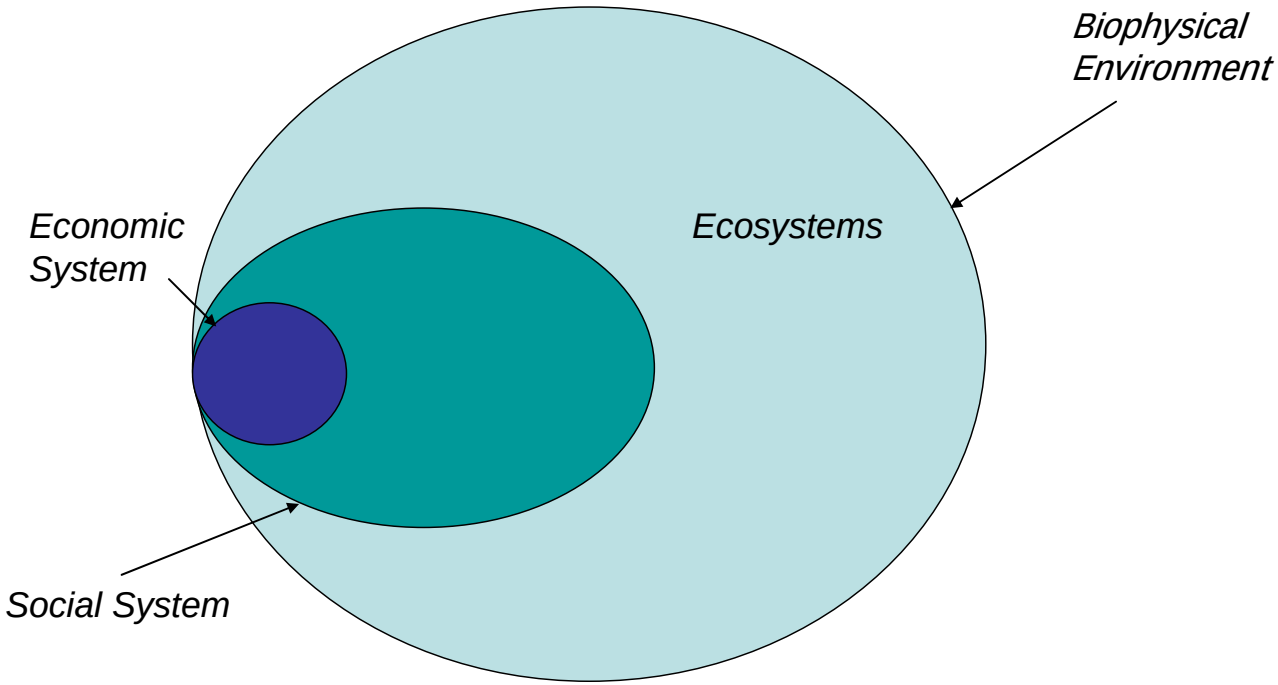


Concluding Thoughts

- Potential for increased water use efficiency and conservation
- Potential and cost savings can be enhanced through research
- Relative benefits of individual technologies and practices are site dependent
- Value to create tool box of technologies and practices
- Increased efficiency and conservation are necessary but not sufficient conditions for sustainability

A Scientist's View of Economics

Essential Relationships of Sustainability



Source: Sustainable Water Resources Roundtable