DESALINATION TASK FORCE

U.S. Army Corps of Engineers
Bay Model Building

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Comparative Energy and Cost Implications of Desalination

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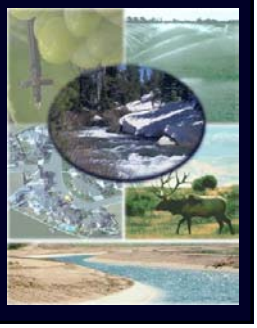
Points to Cover

1. Energy and Cost Implications of Desal in the Context of State Water Planning
2. Comparison to other California Water Supply Systems
3. Desal Technology and Energy Issues
4. Whole Systems Planning

DEPARTMENT ◆ OF ◆ WATER ◆ RESOURCES
CALIFORNIA WATER PLAN
◆ UPDATE 2003 ◆



http://www.waterplan.water.ca.gov/b160/indexb160.html

Water Costs

New water supplies
do not tend to be cheap.

A “Portfolio” Approach

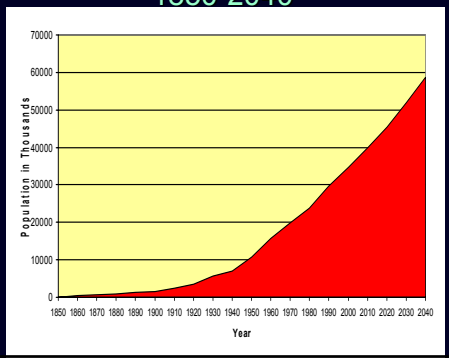
A portfolio strategy to water management implies building whole-system performance, and resilience, by looking for a number of cost-effective options to meet our needs.

Gross Product Ranking of G-7 Countries and California

(in billions of U. S. dollars: 2001)

United States	$9,927
Japan	$4,611
Germany	$1,873
United Kingdom	$1,416
CALIFORNIA	**$1,350**
France	$1,291
Italy	$1,074
Canada	$ 688

Population Growth in California 1850-2040

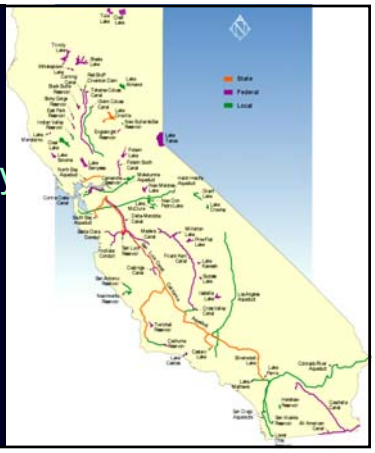


Water Supply

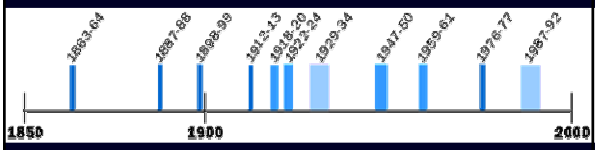
Every major water supply system in California is over-allocated.

The "Traditional" Solution: Interbasin Transfers

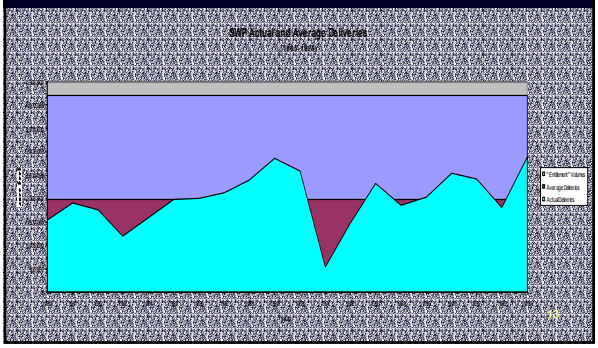
California's Major Interbasin Water Supply Projects



California's Multi-Year Historical Dry Periods (1850-present)



State Water Project Deliveries



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A new Focus and Legal Priority for Local Water Supply Sources

California law requires that the state examine ways to "*minimize the need to import water from other hydrologic regions*" and report on these approaches in the official State Water Plan.

SB 672, Machado, 2001. California Water Plan: Urban Water Management Plans. (The

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Local Water Sources in Southern California

Nearly half (46%) of the water used in the service area of the Metropolitan Water District of Southern California (Ventura to Mexico) is in fact secured from *local* sources, and the percentage of total supplies provided by local sources is growing steadily.

Metropolitan Water District of Southern California, 2000. *The Regional Urban Water Management Plan for the Metropolitan Water District of Southern California*, p.2-3.

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Energy Intensity of Water

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"Energy Intensity"

Energy intensity is the total amount of energy, calculated on a whole-system basis, required for the use of a given amount of water in a specific location.

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Water and Energy

Water systems in California, including extraction of supplies from natural sources, conveyance, storage, treatment and distribution, end-uses, and wastewater treatment, account for one of the largest electricity uses in the state.

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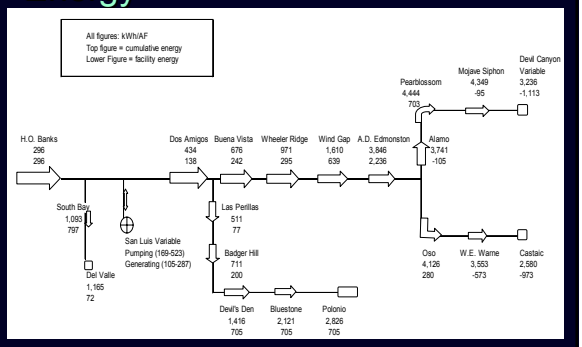
State Water Project Pumping Facilities

State Water Project Pumping Energy



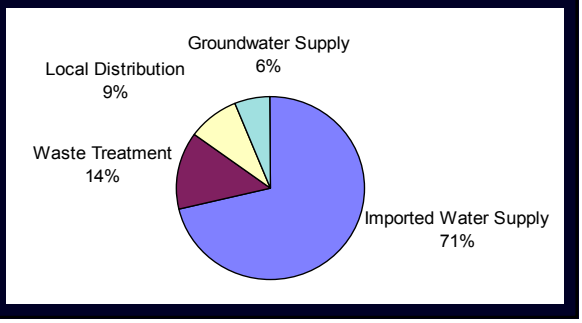
(Includes Energy Recovery and Transmission Losses)

Energy Intensity of Marginal Water Supplies in Southern California

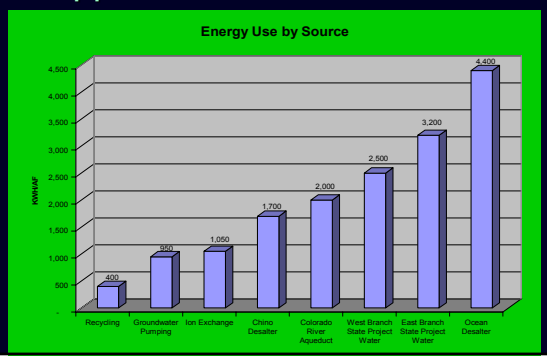
Total average energy requirements for marginal supplies of water in Southern California is 3,519 kWh/acre-foot

(0.01 kWh/gallon).

Electricity Use for Water System Components in Southern California



Energy Intensity of Water Supplies for IEUA



Desalting Technologies

- Thermal Processes
  - Multi-Stage Flash Distillation
  - Multiple Effect Distillation
  - Vapor Compression Distillation
- Membrane Processes
  - Electrodialysis
  - Reverse Osmosis (RO)
- Other Processes
  - Freezing
  - Membrane Distillation
  - Solar Humidification

Cost Factors for Desal, and for Other Water Supply Options

Basic Cost Factors

1. energy
2. other O&M
3. capital

Other Considerations in Valuing Water Supply Options

1. reliability
2. quality
3. environmental impacts (or benefits)
4. avoided cost

Basic Energy Factors

1. sources of supply
2. location of supply and end-uses
3. distribution systems
4. environmental impacts
5. total energy system cost

Basic Water Factors

1. limits of systems
2. sources and location of supply
3. end-uses
4. distribution and storage systems
5. environmental impacts
6. total system costs

Conclusions

Desalination technologies are proven. A number of different approaches work well and produce high quality water.

Conclusions

Desalination is energy intensive and costly.

Few new water supply options are cheap. (Efficiency improvements are often an exception.)

Conclusions

Both desalination and some "traditional" water supply sources, including major interbasin water transfers, tend to be energy intensive.

Conclusions

Technology development is rapidly changing the economics, and the cost-effective viability, of desalination to compete with "traditional" water supply sources.

Conclusions

We need to consider how to properly value the role of water supplies provided from desalination as compared to other water supply sources.

Conclusions

Whole-system analysis of full costs and benefits for *all* water supply sources will help provide a basis for informed policy decisions.