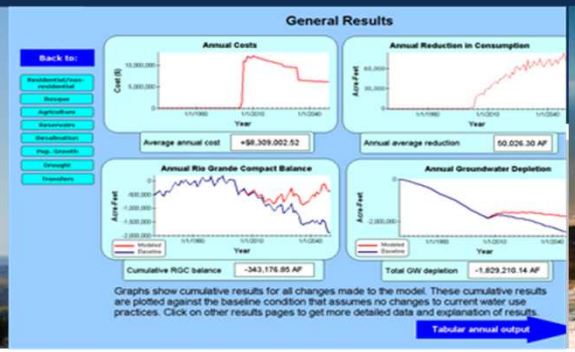
SAND2015-0571PE

Exceptional service in the national interest

Sandia National Laboratories



Energy and Water at Sandia National Laboratories

EWN National Laboratory Meeting

Golden, CO

January 14-15, 2015

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

SWaRMS Regional Focus

Sandia National Laboratories

Reduce the fresh water footprint of energy and the energy footprint of water

Themes:

- Adaptation planning: vulnerability and impacts assessment
- Non traditional waters: optimized utilization of brackish and produced waters
- Hybrid cooling technology
- Desalination technology
- Role of renewable energy sources in the EWN

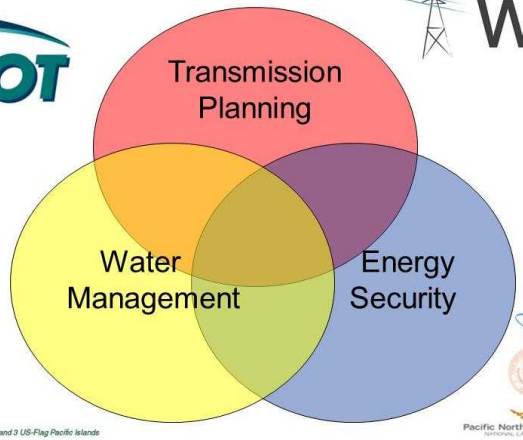
WETT Elements: DMA; Technology, Policy, and Stakeholder Outreach

Energy and Water in the West

Sandia National Laboratories

ERCOT

WECC



EPRI ELECTRIC POWER RESEARCH INSTITUTE

NREL National Renewable Energy Laboratory

INL Idaho National Laboratory

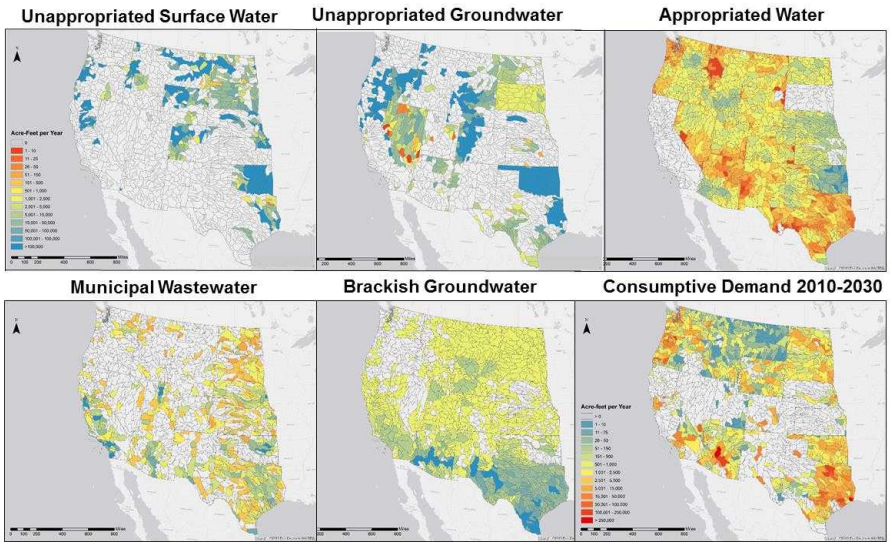
Argonne NATIONAL LABORATORY

Pacific Northwest NATIONAL LABORATORY

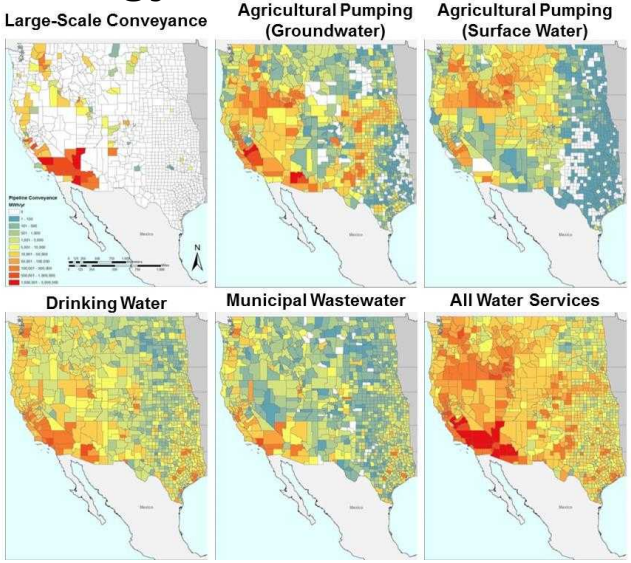
WESTERN GOVERNORS' ASSOCIATION
Serving the Governors of 19 States and 3 US-Flag Pacific Islands

WSWC Western States Water Council

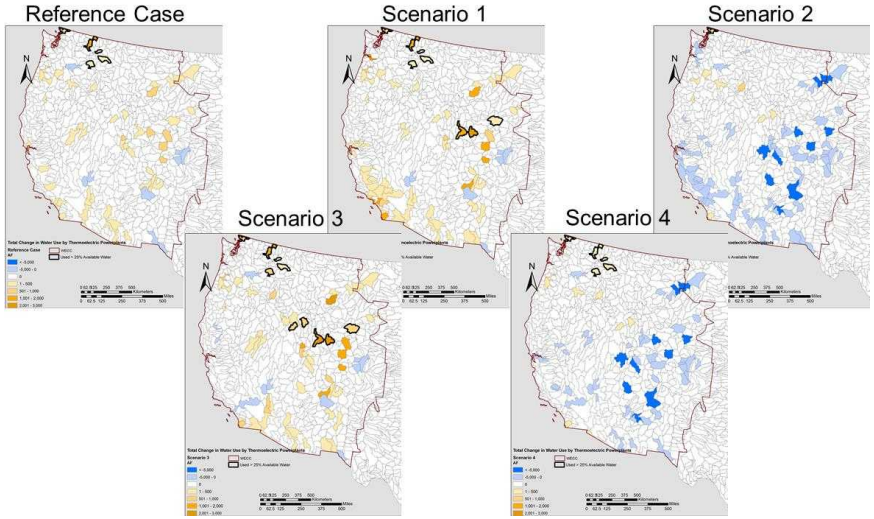
Water Availability, Cost and Future Use



Energy for Water Services



Transmission Planning



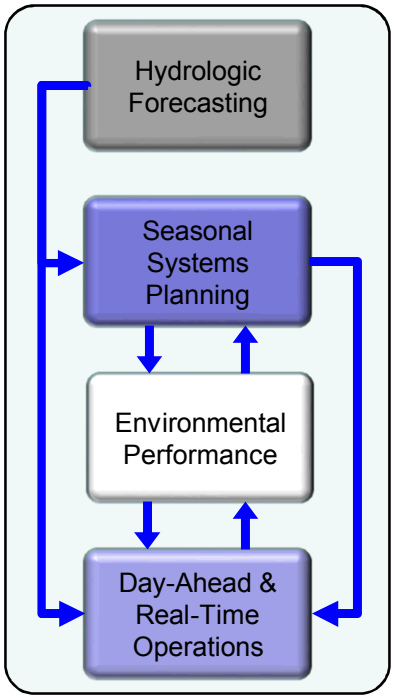
Modeling

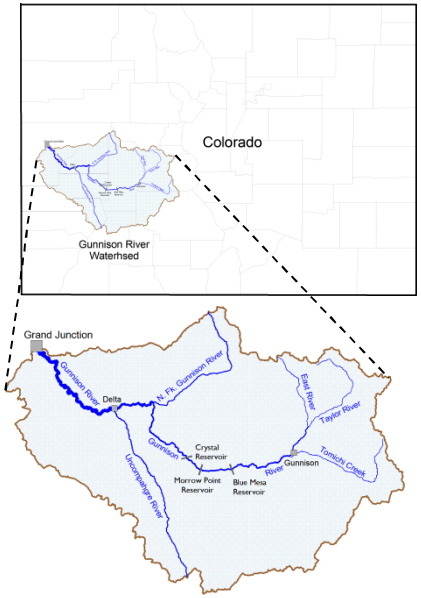
Hydropower and Source Optimization

Sandia National Laboratories

Modeling

Hydropower Optimization Toolset
Funding Source: DOE





Applied to 3 reservoir system of the Aspinall Cascade on the Gunnison River

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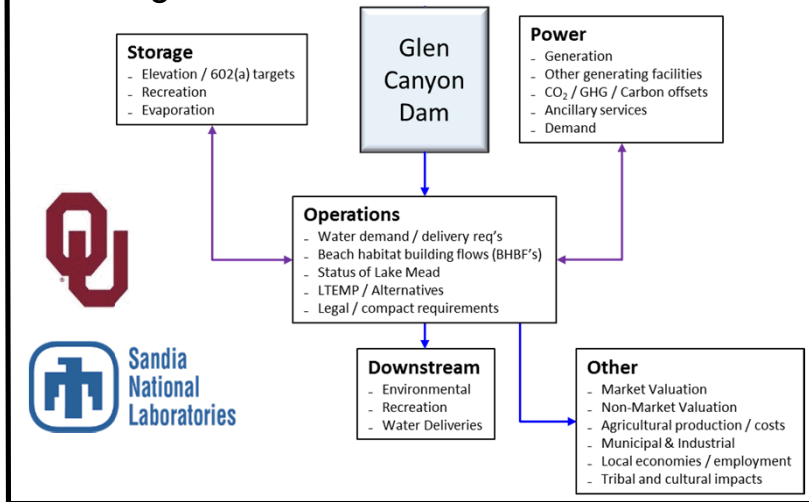
Argonne NATIONAL LABORATORY

Pacific Northwest NATIONAL LABORATORY

Non-Market Values for Hydropower and Water Storage
Funding Source: Western Area Power Administration



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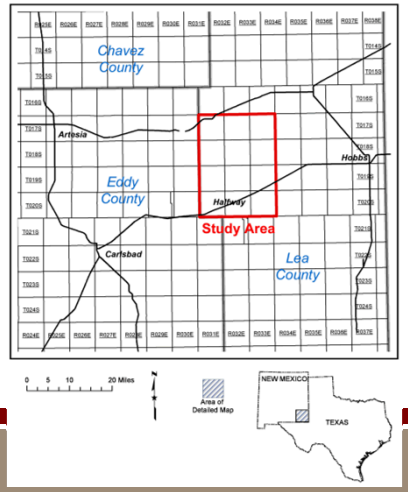
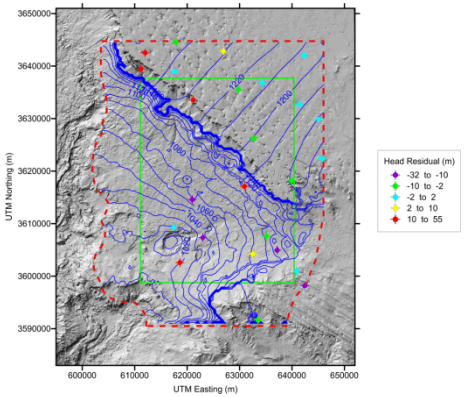
Hydrogeologic Assessment of the Dewey Lake and Santa Rosa Aquifers, SE New Mexico
Funding Source: B. of Land Management





The Water, Energy and Carbon Sequestration Simulation Model (WECSsim)

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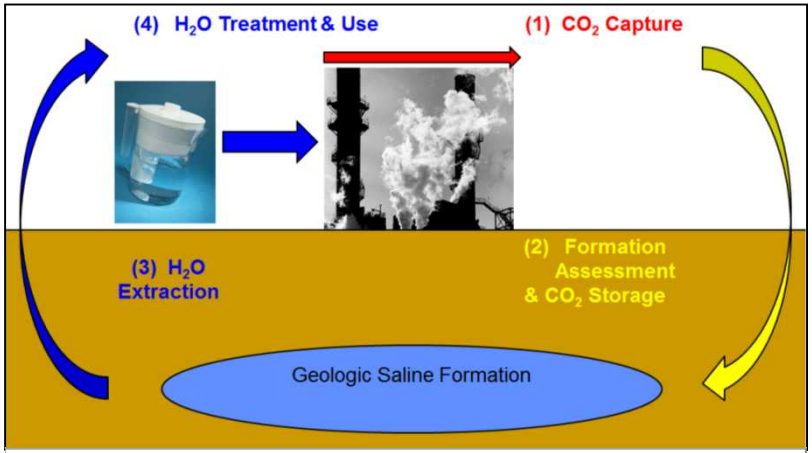
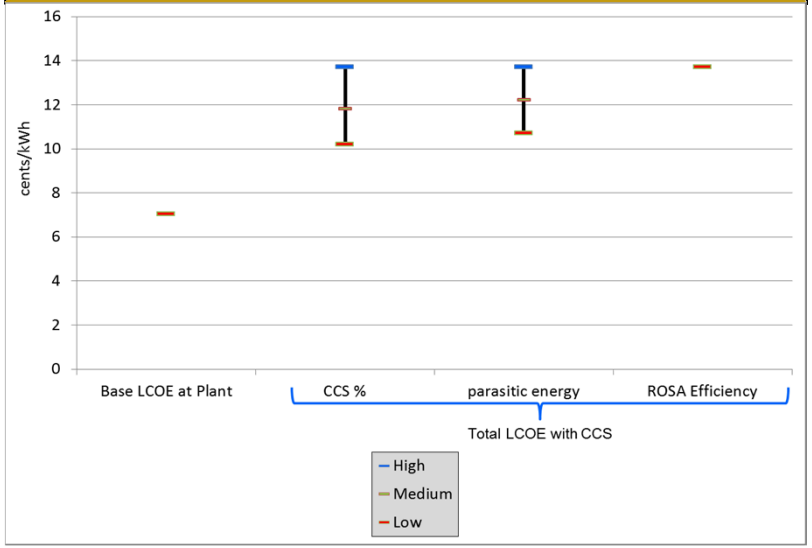
Modeling

- *Integrating Geoscience, Power Plants and CO_2 Sequestration Infrastructure in the U.S.*
- *A National-Level Systems Model To Calculate*
  - *CCS, Water Extraction and Treatment Costs*
  - *National CCS Infrastructure Development*
  - *CO_2 Geological Sinks Sizing and Power Plant Emissions Matching and Competition Algorithm*
- *Cost and Performance Drivers*
  - *Percent Capture, Fuel Type & Parasitic Energy Greatly Affect the LCOE and Water Requirements*
  - *Water Treatment Efficiency changes to the Full Systems' LCOE are Small For Reverse Osmosis Systems*





NETL

Integrated Water Resources Modeling

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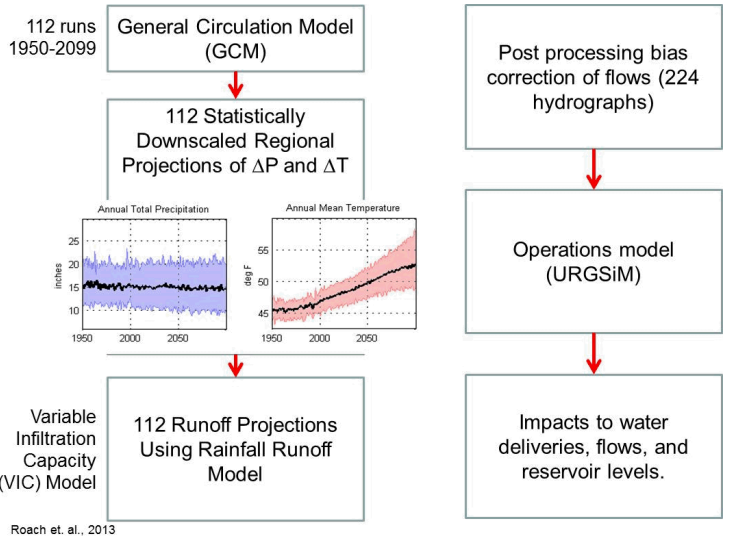
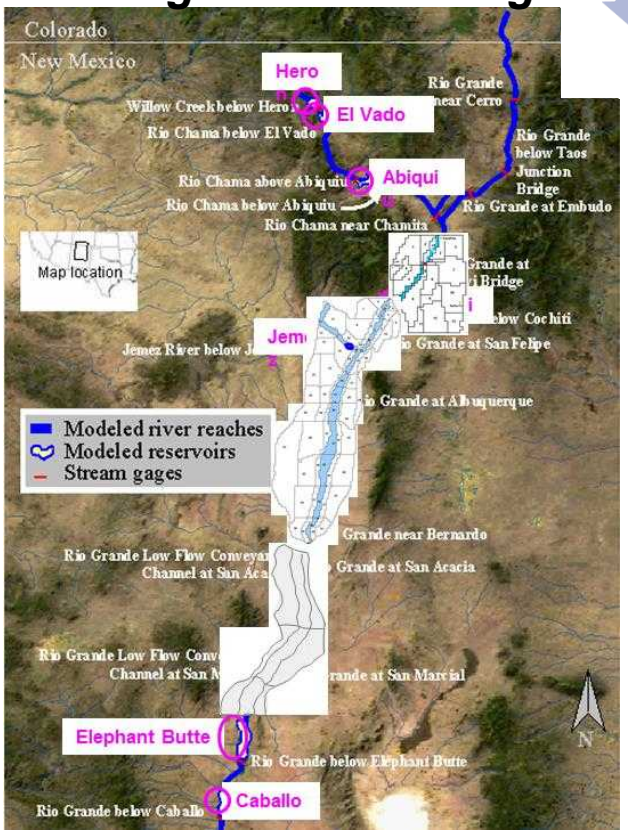
Upper Rio Grande Simulation Model

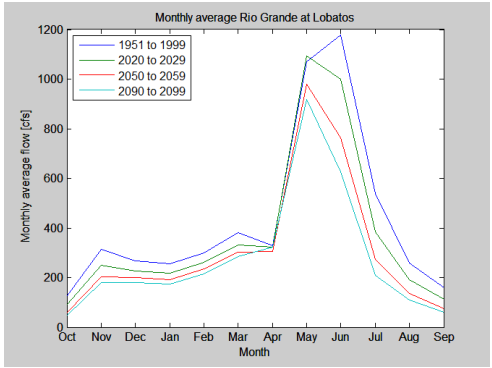
Stochastic Climate Analysis



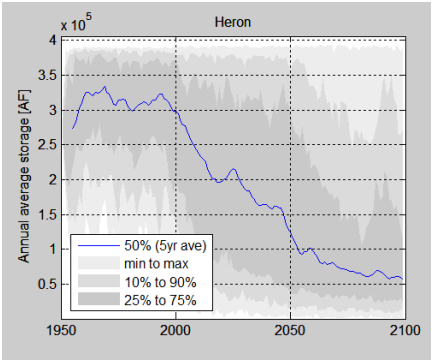
Roach et. al., 2013

Integrated Modeling





Hydrograph Change



Reservoir Storage

Modeling

Economic Evaluation of Hybrid Cooling

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- Key drivers – Reduce fresh water footprint of thermoelectric cooling
- Activities – Hybrid cooling economic evaluation for improved approaches and priorities
- Partners – EPRI, Arizona public Service, TriState Generation, PNM, and Excel Energy.
- Benefits - Hybrid cooling significantly reduces water use in hot climates with minimum parasitic loads to maintain high operational efficiency and reduced costs

aps

TRI-STATE Generation and Transmission Association, Inc.

A Touchstone Energy® Cooperative

PNM

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Cooling Systems

Nanofiltration Treatment of Side-Stream Cooling Tower Water for Reduced Water Usage

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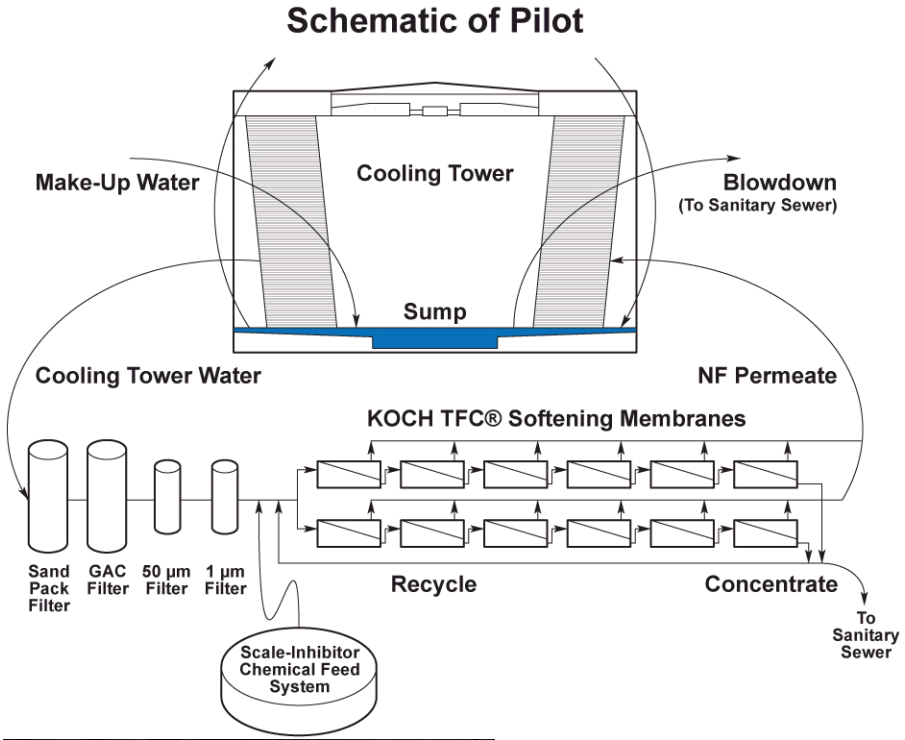
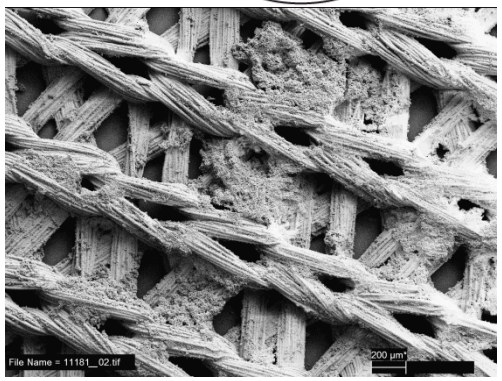
Cooling Systems





- Water savings observed
- Water savings can pay for electrical costs
- Scaling control is critical for economic operation

UTEP

Integrating Power Plant Cooling Systems with Membrane Distillation

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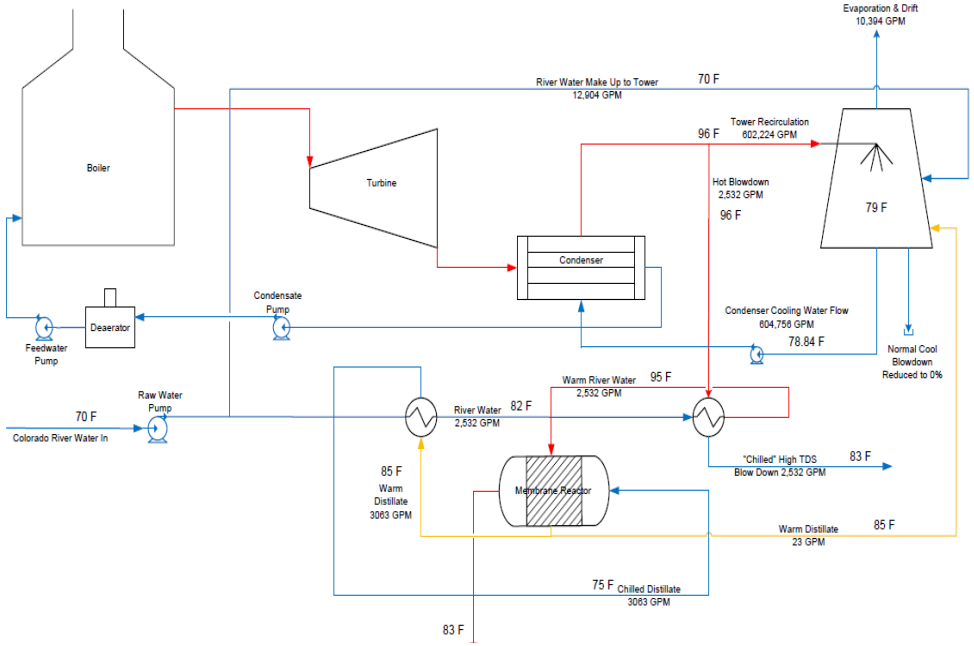
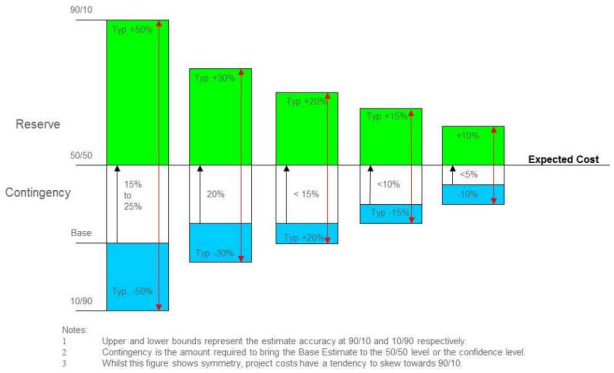
EPRI ELECTRIC POWER RESEARCH INSTITUTE

Desalination

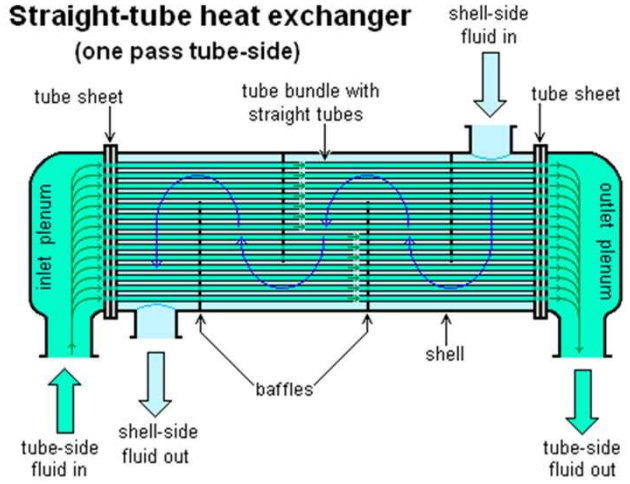
Heat Source: Condenser vs. Flue Gas

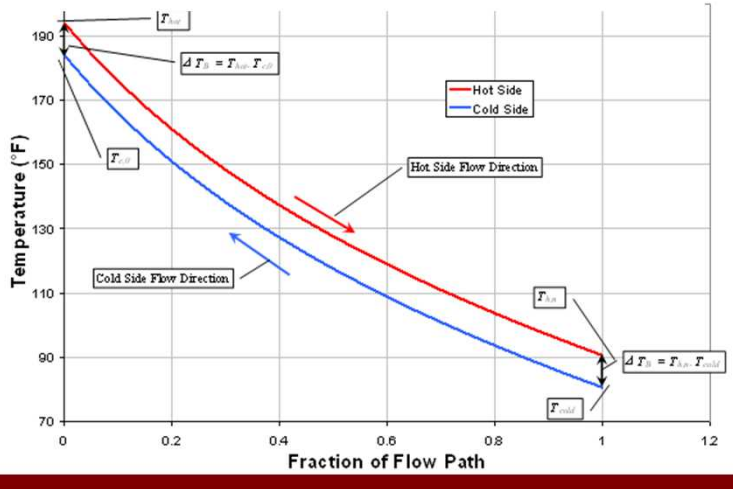


Economic Analysis



Membrane Modeling





Bureau of Reclamation's Regional Brackish Groundwater and Produced Water Research Facility

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- Key drivers – Reduce energy footprint of brackish water
- Activities – Utilize BOR regional brackish groundwater and produced water research facility
- Partners – NM State Engineer, Texas Water Development Board, NM Energy Minerals and Natural Resources, BLM, Bureau of Reclamation's Brackish GW National Desalination Facility, UT Austin, Texas Tech, NMSU, UNM, MIT, and EPRI
- Benefits – Accelerate desal testing of multiple brackish and produced water qualities with dedicated research test bays of various scales up to 300 gpm

New Mexico State University

U.S. Department of the Interior Bureau of Reclamation

EPRI Electric Power Research Institute

The University of Texas at Austin

The University of New Mexico

New Mexico State Engineer

Desalination