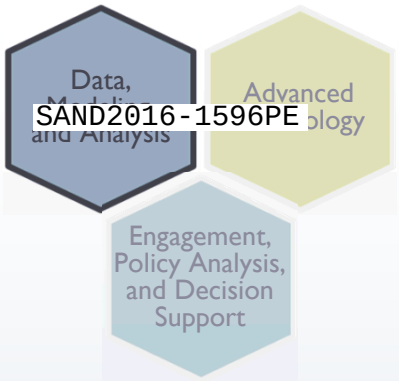
Data, Modeling and Analysis

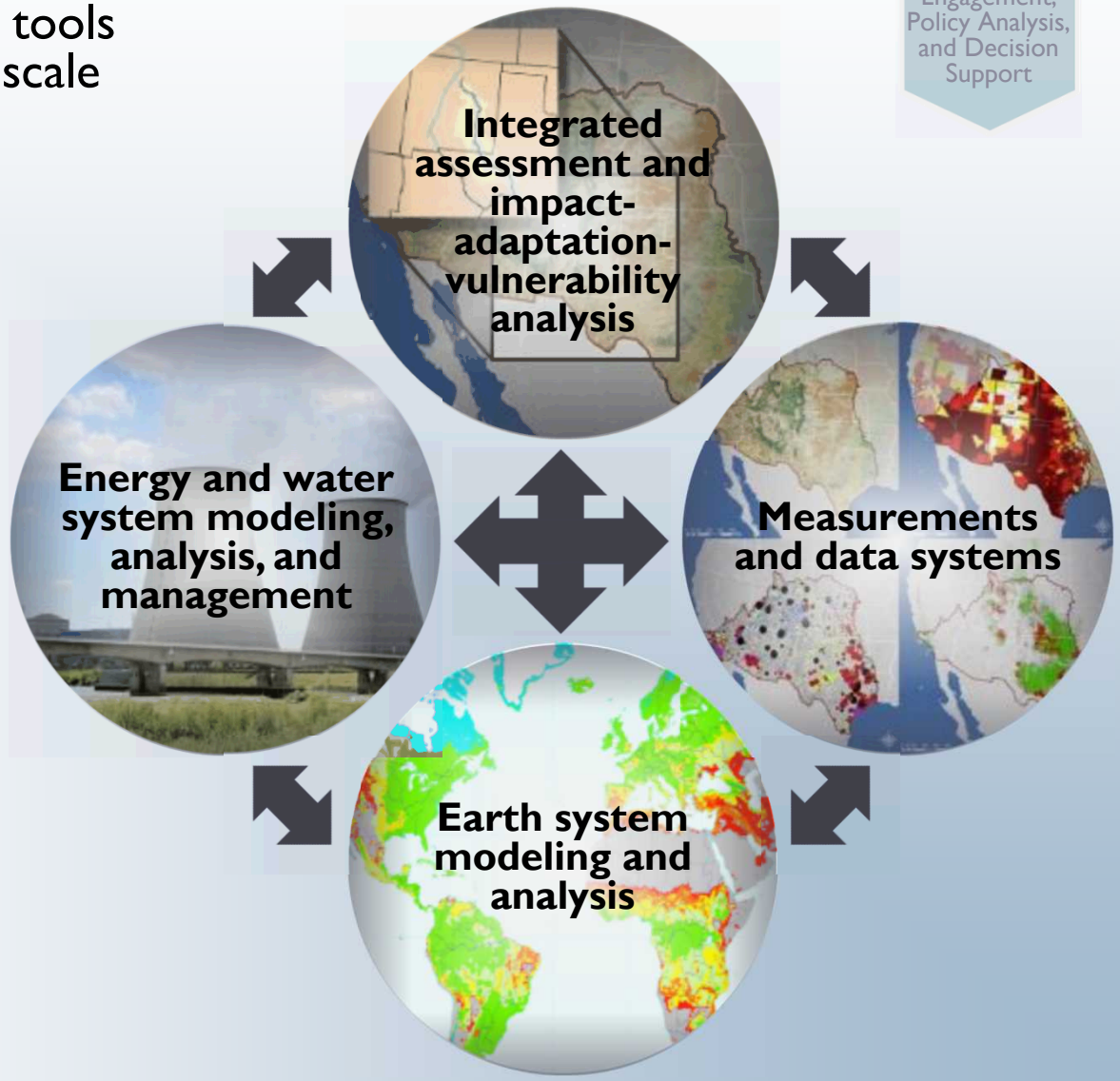


SAND2016-1596PE

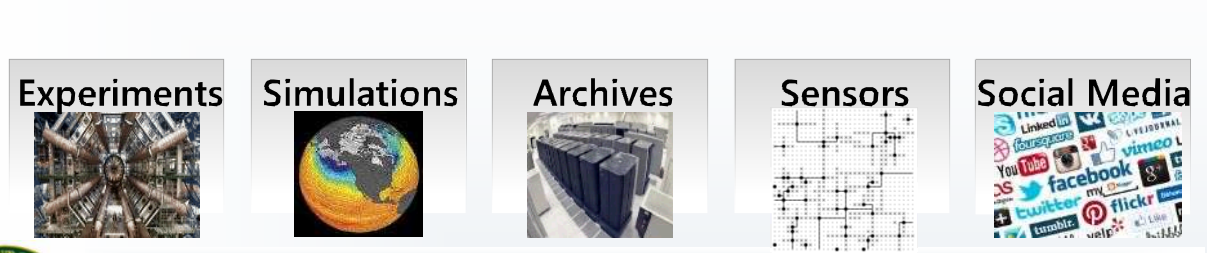
Enhanced and interoperable tools for understanding the multi-scale dynamics of the integrated energy-water system and analyzing response options.

Key outcomes:

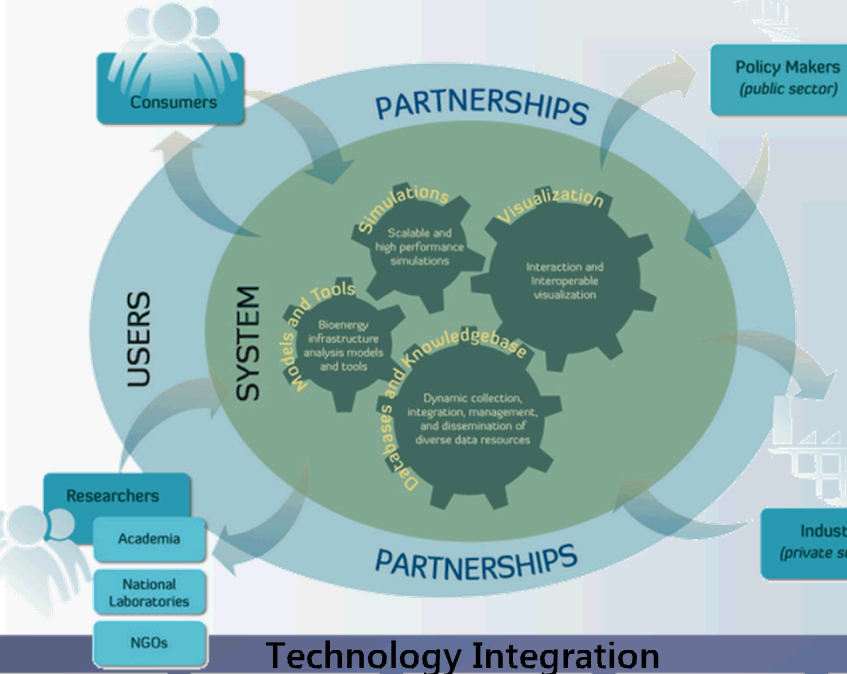
- Federated energy-water data and information system
- Robust projections, analyses, and scenarios, including extreme events
- Risk and uncertainty characterization



Federated Database



Data.gov

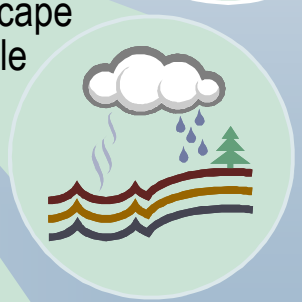


DMA

Global scale

National scale

Regional scale



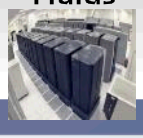
Landscape scale

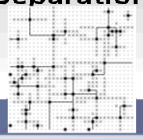
Local scale

Technology Integration


Cooling


Materials

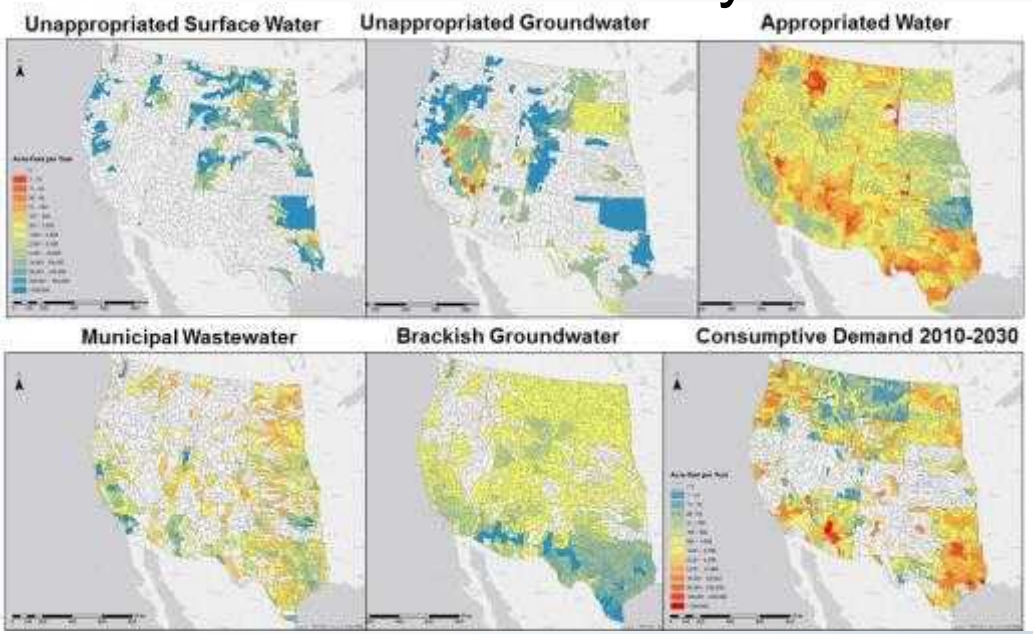

Fluids


Separation

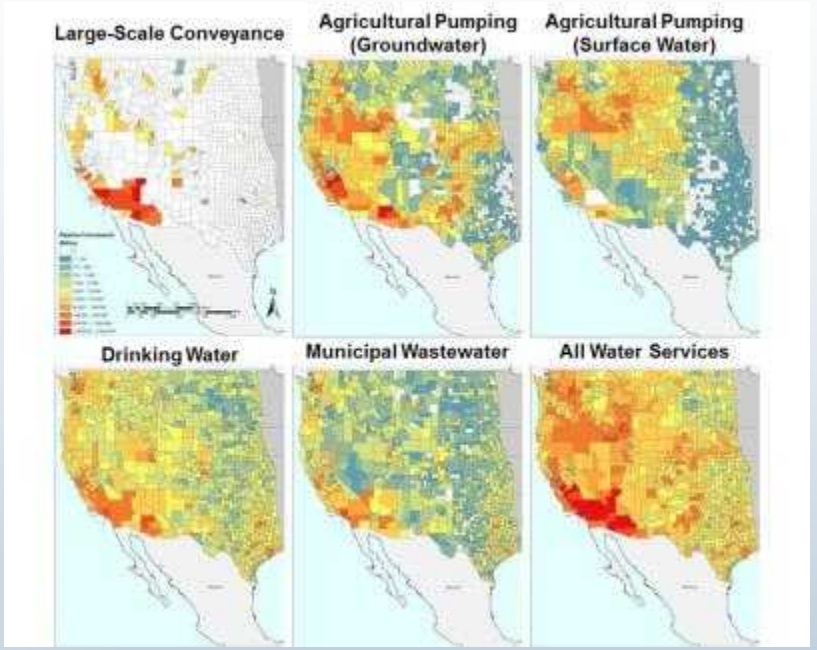

Recovery

Dataset Examples

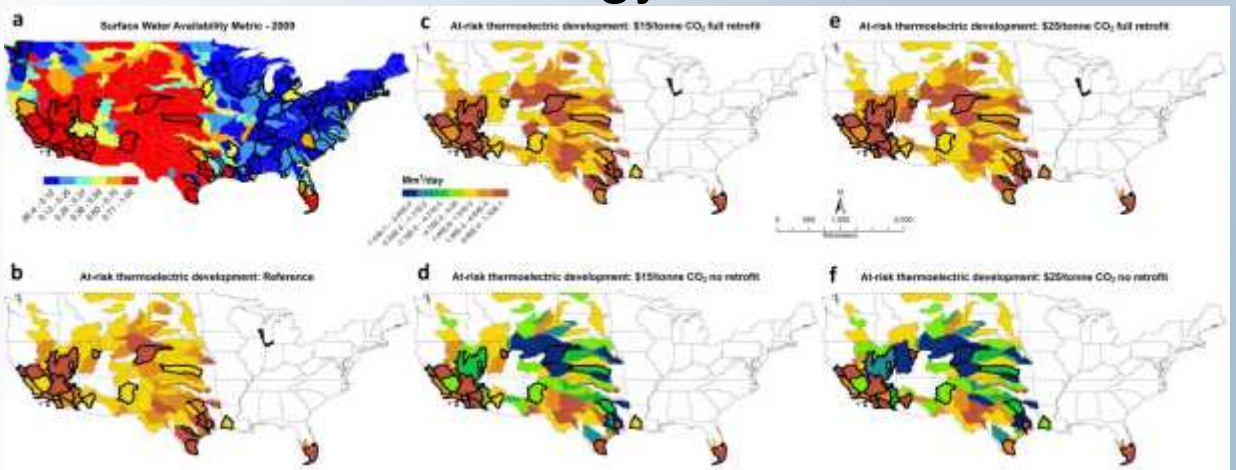
Water Availability



Energy for Water



Future Energy Scenarios

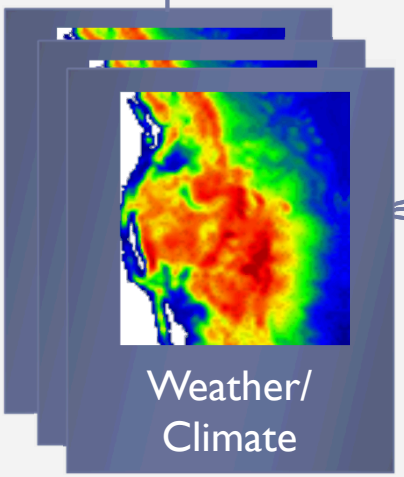


Integrated Multi-scale, Multi-sector Modeling

Multiple inter-operable tools

Many different scenarios

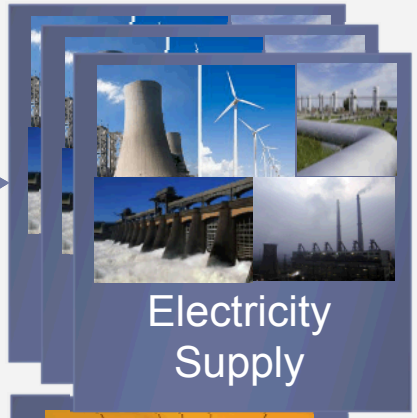
UQ and adaptation analysis

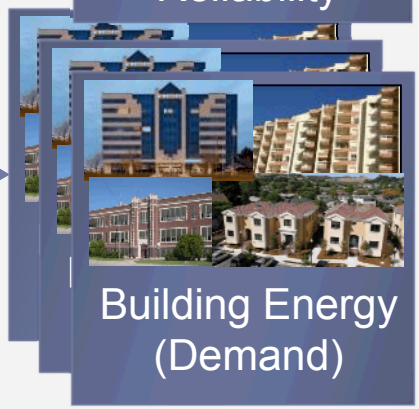


Water availability
- Hydropower
- Cooling water (amount and temperature)

Flooding
Storm Surge?
Wildfire?
Cold snaps?
Wind damage?

Heat Waves:
- Reduced power plant capacity
- Reduced line ratings
- Increased cooling demand





Other stresses:
- GHG emissions (climate policy)
- Energy policy (e.g. natural gas exports)
- Technological change
- Land use / land cover change
- Resource constraints

Goal: Predictive understanding of energy system vulnerabilities and resilience for multiple climate, policy, & technology scenarios, with an emphasis on the water-energy nexus

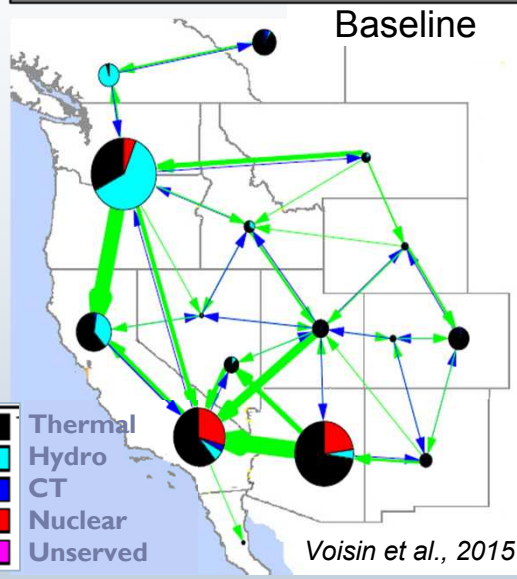
Initial Case Study: San Juan River

Framework that links natural and engineered systems to evaluate climate vulnerabilities:

- Multiple interdependent systems,
- Multiple interacting scales, and
- Multiple stakeholders.

Western Grid

Baseline



Voisin et al., 2015

Los Alamos NATIONAL LABORATORY EST. 1943

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Pacific Northwest NATIONAL LABORATORY

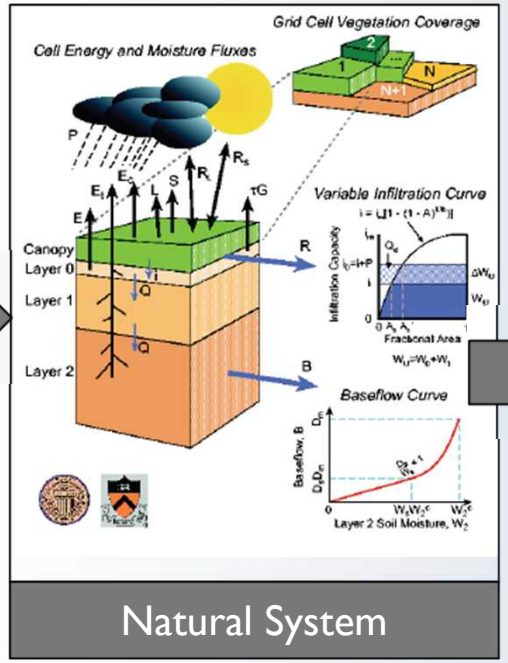
Sandia National Laboratories

PNM

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

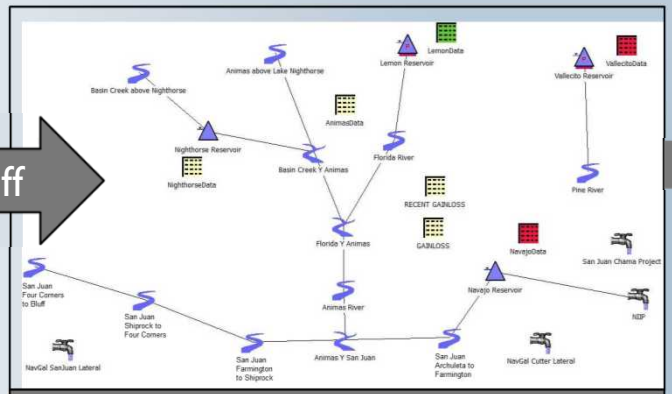
aps

Climate



Natural System

Runoff



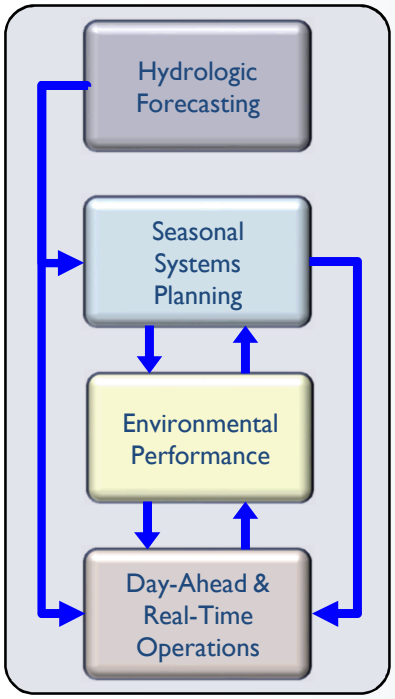
Engineered System

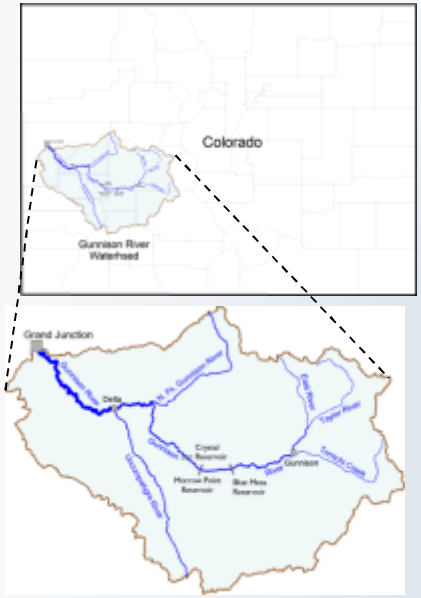
Deliveries

- Electric Power
- Irrigation
- Instream Flows
- Compact Native American

Hydropower and Source Optimization

Hydropower Optimization Toolset
Funding Source: DOE





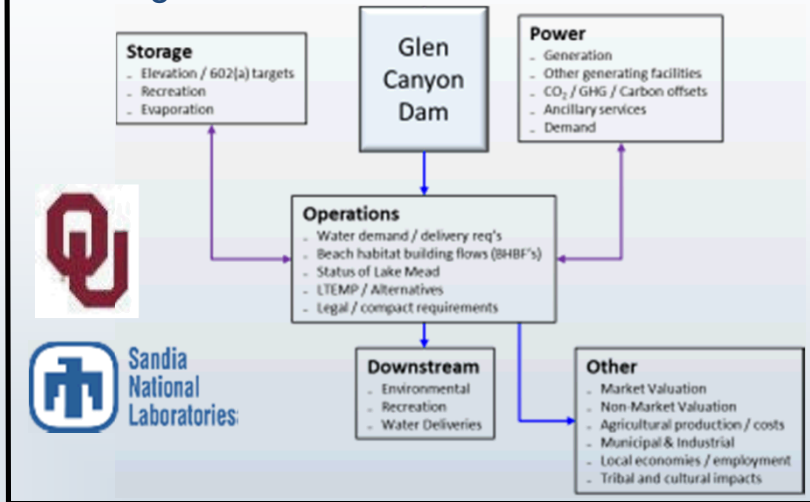
Applied to 3 reservoir system of the Aspinall Cascade on the Gunnison River

Sandia National Laboratories

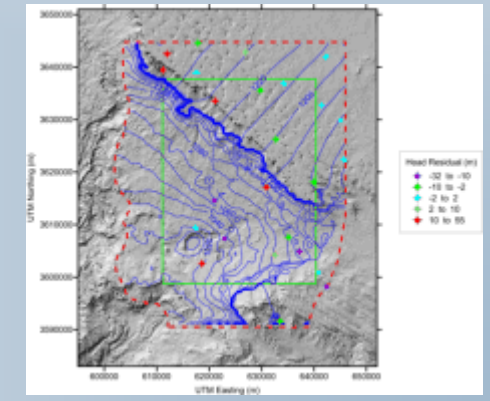
Argonne NATIONAL LABORATORY

Pacific Northwest NATIONAL LABORATORY

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

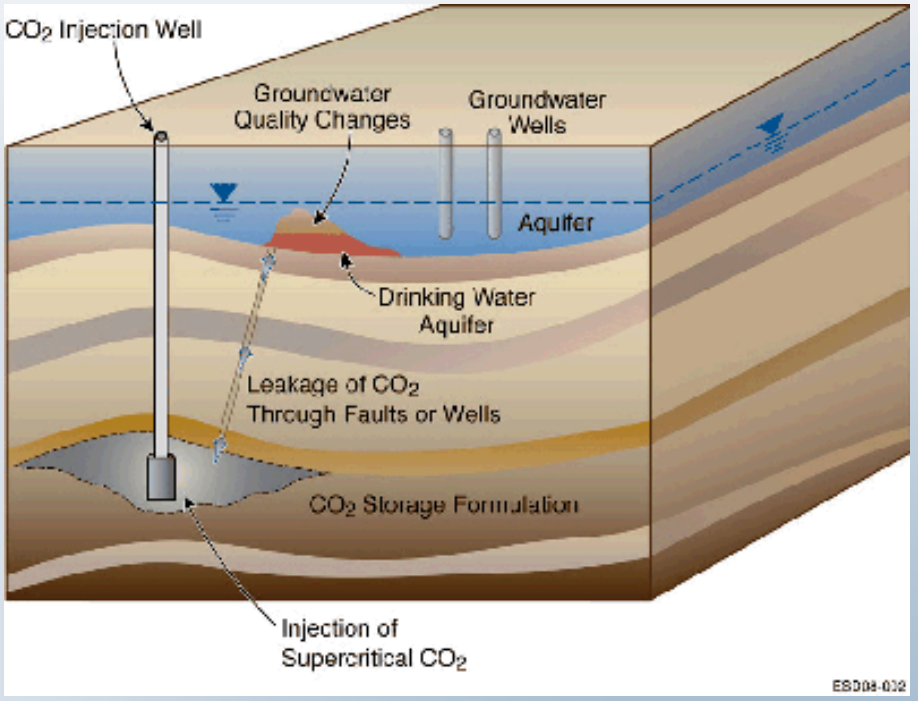


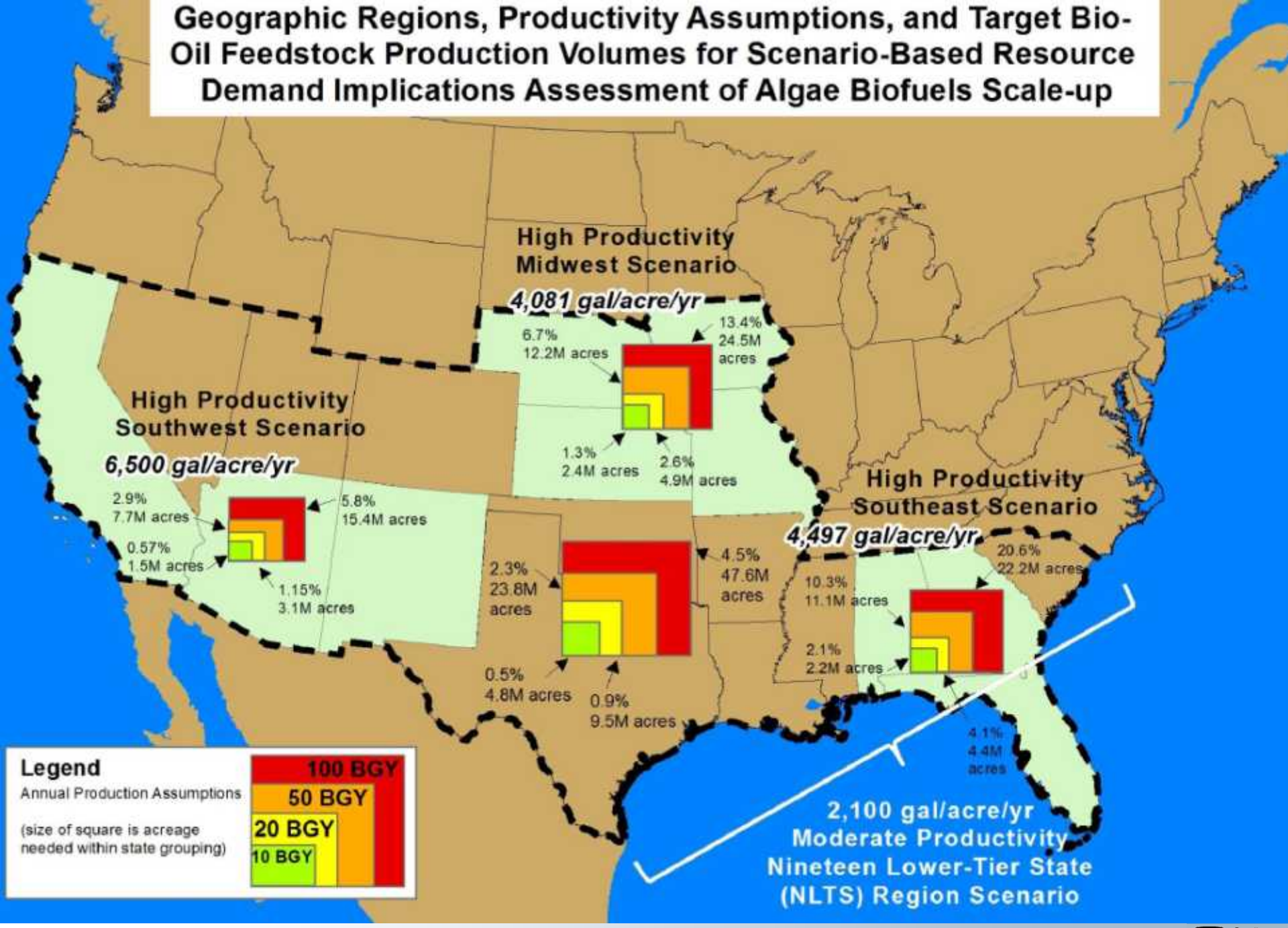
Hydrogeologic Assessment of the Dewey Lake and Santa Rosa Aquifers, SE New Mexico
Funding Source: B. of Land Management



WECSim

- Joint effort with NETL
- Analysis of opportunities to use saline aquifers for carbon sequestration
- Analysis considered
  - Aquifer storage capacity,
  - Location and production of CO_2,
  - Reservoir dynamics of injection,
  - Recovery and use of saline water, and
  - System operation cost.





- Pate, Ron, Goeff Klise, and Ben Wu (2011). "Resource Demand Implications for US Algae Biofuels Production Scale-up", Applied Energy, v.88, pp. 3377-3388.

Engagement, Policy Analysis, and Decision Support

Interactive visualization and decision analysis tools that utilize—and inform—advanced technology and data, modeling, and analysis activities

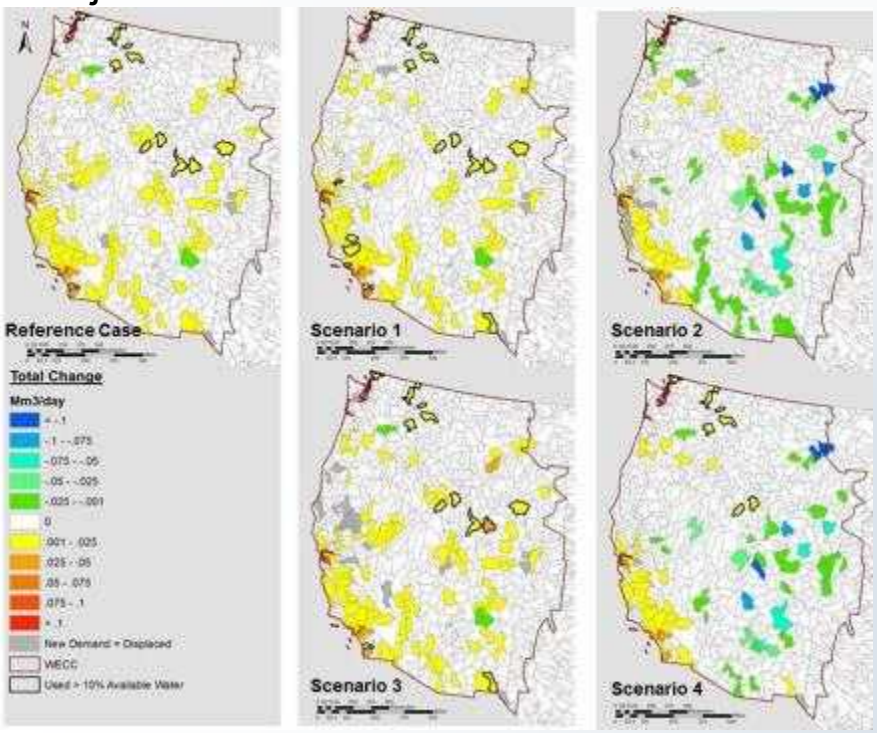
Single- and multi-sector analyses to highlight tradeoffs and opportunities for co-optimization and technology adoption

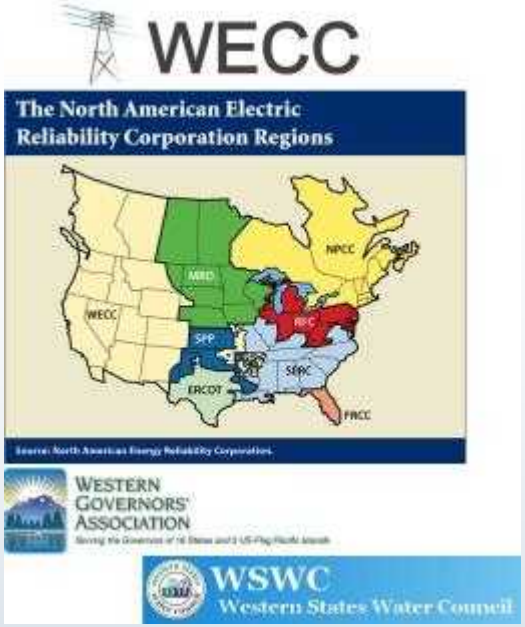
Quantitative regional metrics for measuring success of energy-water investments

Mechanism for stakeholder input, sharing, and enabling access to data and cross-fertilization of technology and data insights across DOE

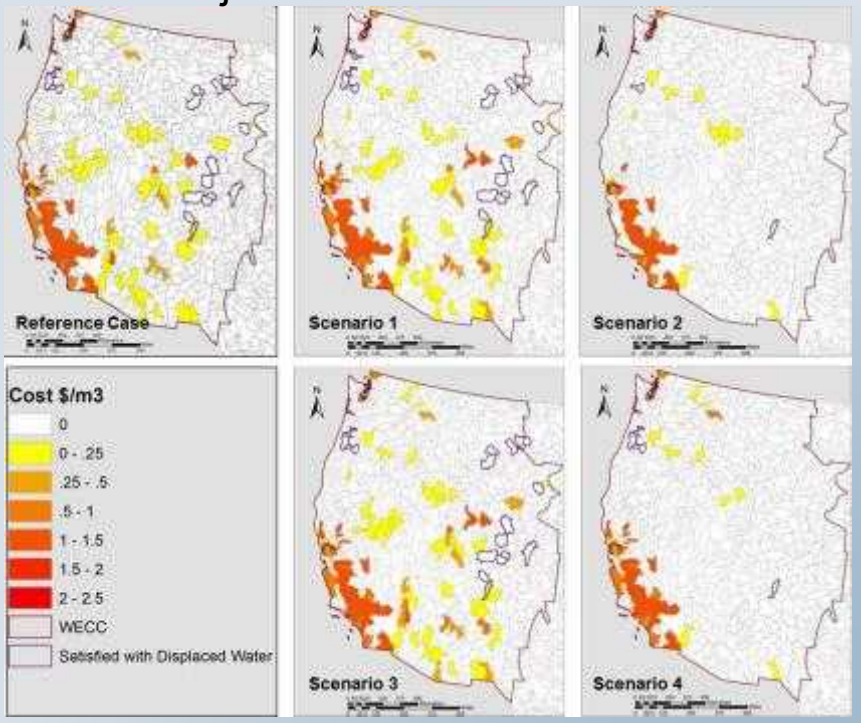
Integrated Planning

Projected Future Thermoelectric Water Use

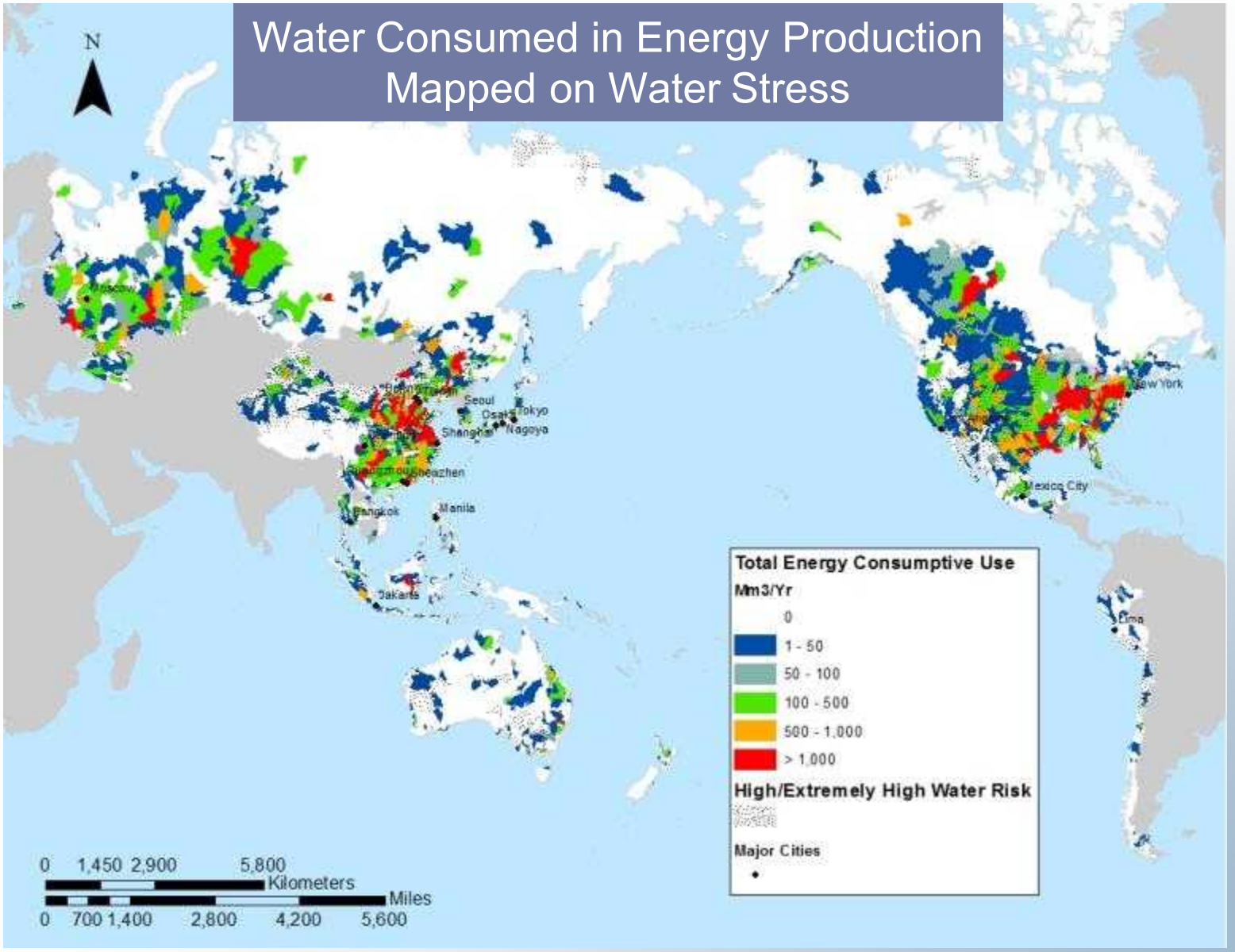




Projected Future Water Cost

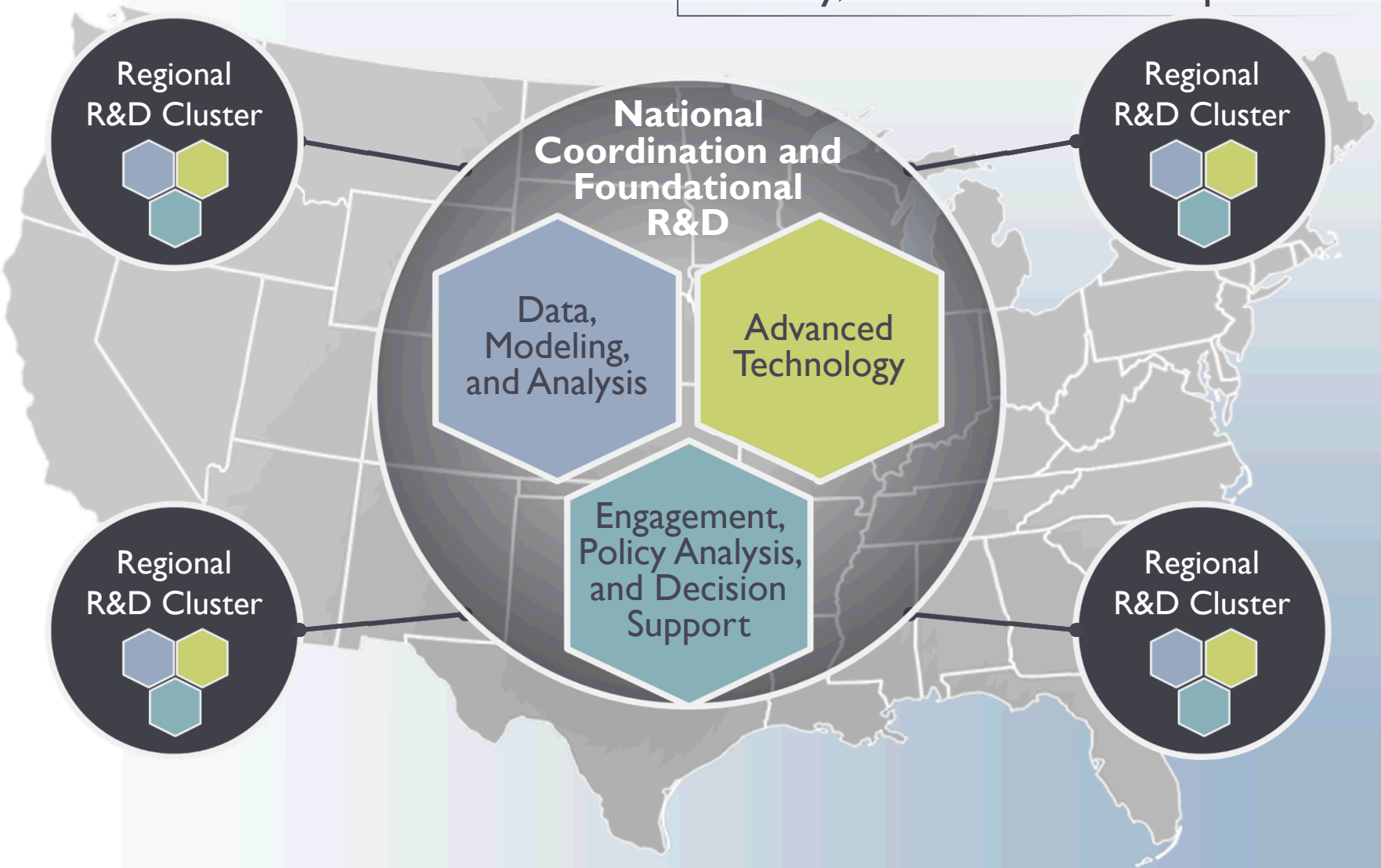


International Energy and Water



The Big Idea

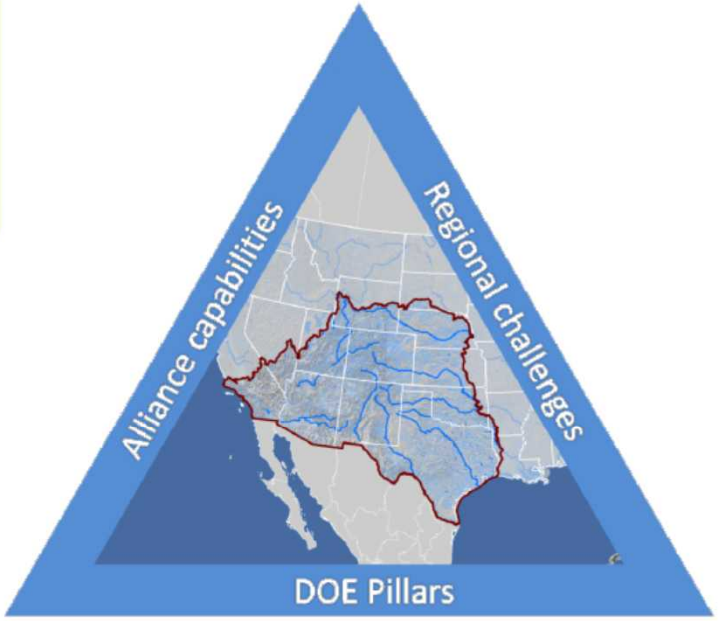
A cross-cutting R&D program that creates an integrated view of energy and water systems, accounts for regional heterogeneity, and enhances security, resilience and competiveness



Regional Partnership

Los Alamos NATIONAL LABORATORY EST. 1943 | NREL NATIONAL RENEWABLE ENERGY LABORATORY | Sandia National Laboratories

Southwest & Rocky Mountain South Water-Energy Nexus Alliance



September 2015

Status and Progress

Advanced Technology

ACCELERATING IMPLEMENTATION

Basic Science

- Advanced Materials
- Separations Science
- Biomass
- Sensors
- User Facilities

Technology Demonstration

- Cooling Technology
- Alternative Fluids
- Water Treatment
- Measurements and Monitoring
- Biomass Conversion

Technology Integration

- Energy and Co-product Recovery
- Combined Renewable Power-Water Treatment
- Water Systems Providing Grid Services

Technology Commercialization

- Demonstration Projects
- Technology Transfer and Partnerships
- Commercial-scale Biofuels
- International Markets

Technology Matchmaking

Environmental Implications

Policy Analysis

Industry and Agency Partnering

Regional Techno/Economic Assessment

Leverage Existing Technology Investments

1 2 3 4 5 6 7 8 9

BASIC DEMONSTRATION COMMERCIALIZATION

TECHNOLOGY READINESS LEVELS