



What is the value proposition by which investors, governments, and business can come together to create a sustainable city of the future on the border between the U.S. and Mexico?

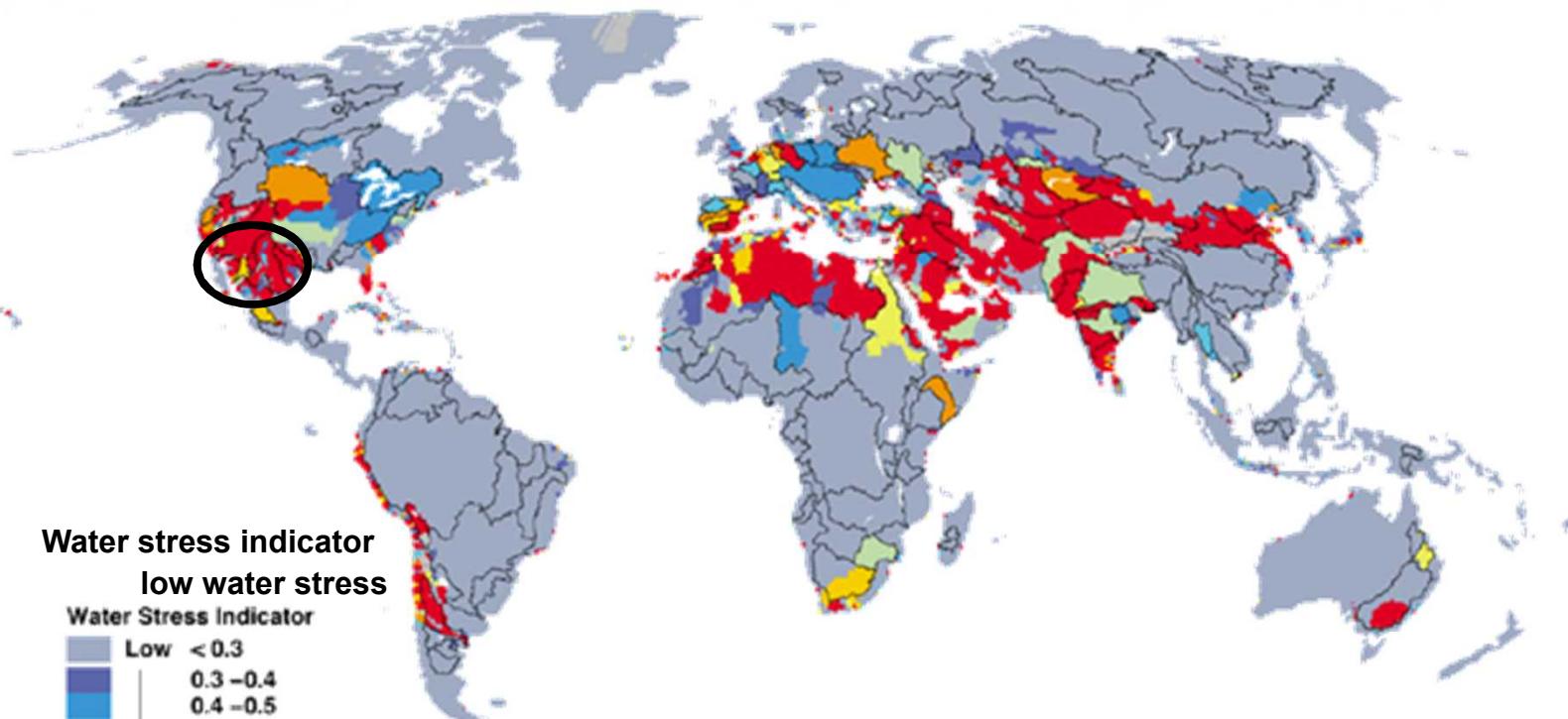
What can Sandia do to realize this value proposition?



Water is a fundamental source of conflict and a fundamental platform for cooperation

Global Trends 2015*:

“By 2015 nearly half the world’s population – more than 3 billion people – will live in countries that are water stressed... mostly in Africa, the Middle East, South Asia, and northern China”



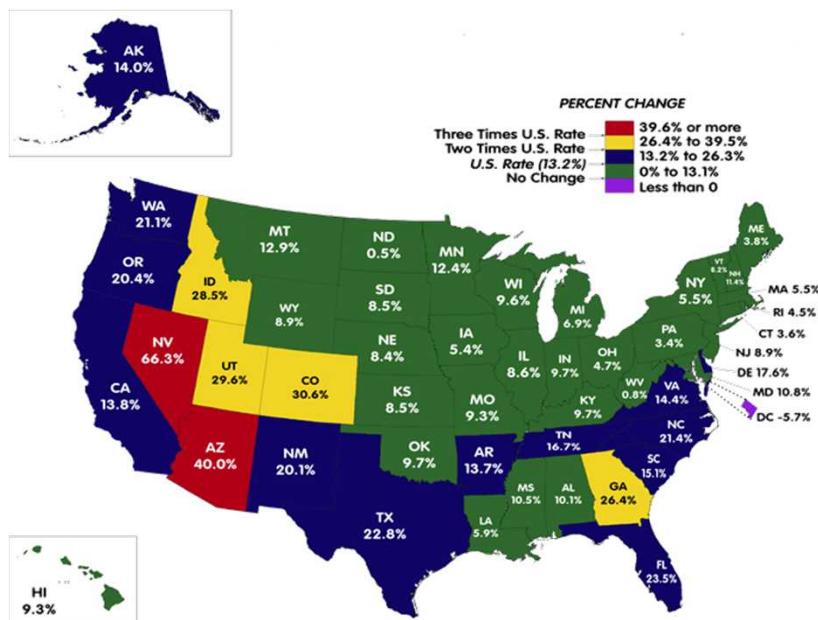
Global Trends 2015*: “... as countries press against the limits of available water between now and 2015, the possibility of conflict will increase.”

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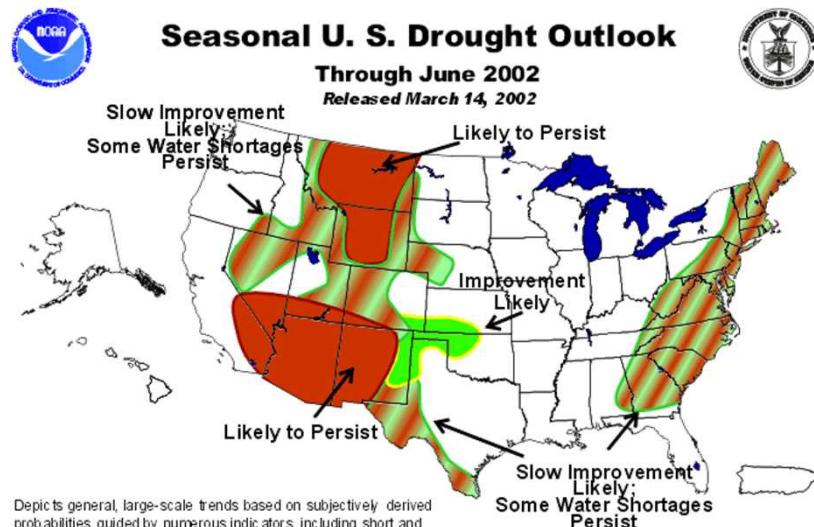


Climate change, drought, and population growth have produced unsustainable water use and elevated water conflict in the United States

Population projections indicate major growth in multiple states with growing water shortages

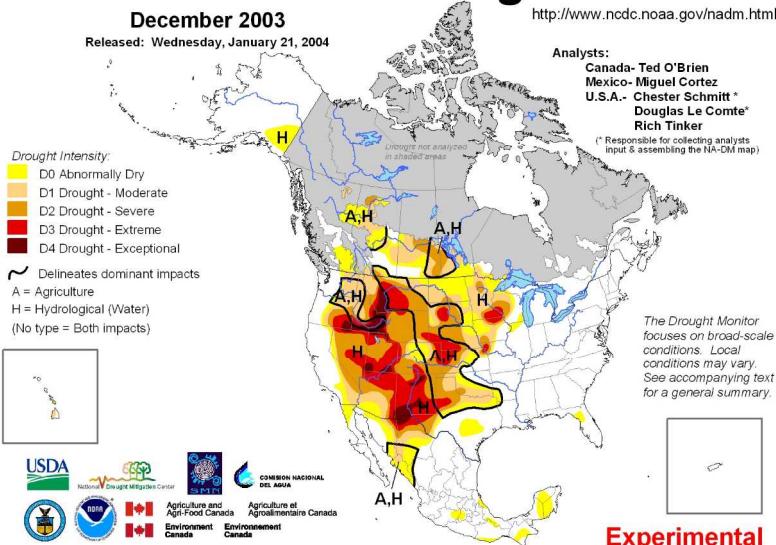


Recent studies indicate that “drought” experienced in some regions are closer to “normal” climatic conditions

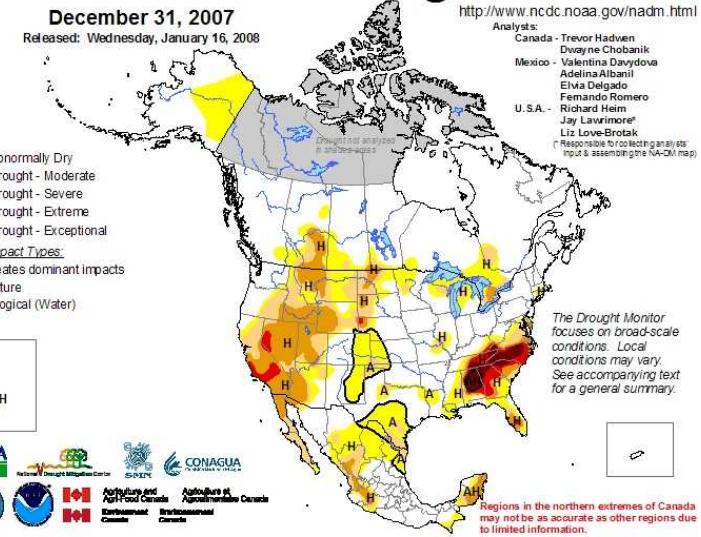


The same water issues that are seen in the southwestern United States are seen in northern Mexico along the border with the U.S.

North American Drought Monitor



North American Drought Monitor



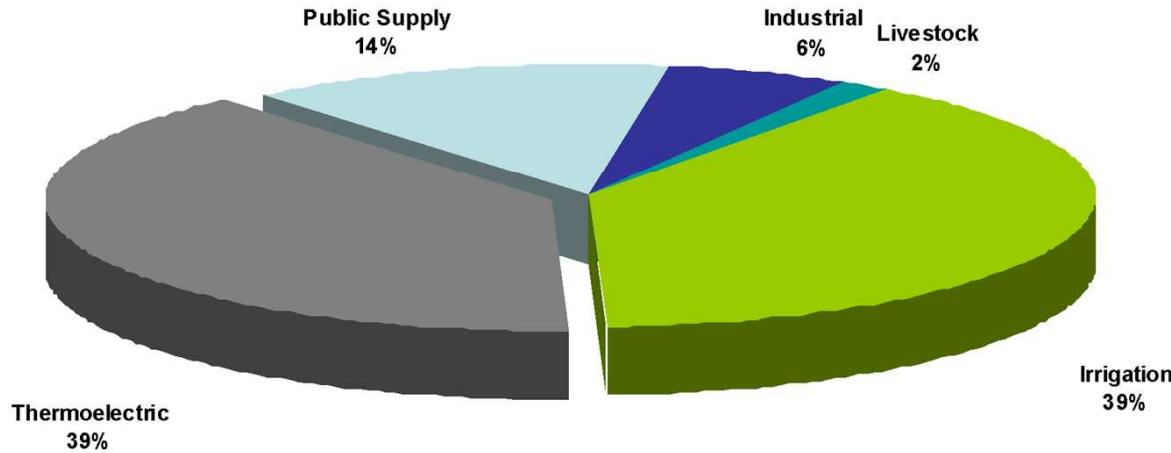
Sustainability is a major challenge in already arid regions made even more difficult with episodic weather changes



Water is on the critical path for future U.S. energy supplies

→ *Electric Power Generation*

Estimated Freshwater Withdrawals by Sector, 2000



Source: USGS Circular 1268, March, 2004

40% of U.S. daily freshwater withdrawals is 140 billion gallons/day.

Freshwater resources are fully (or over) allocated in many parts of U.S. and could impact water availability to meet growth in energy demands.

Water markets could play a role in developing water for energy, but are currently not well established due to highly fragmented water regulation at regional, state and local levels.

Growth in thermoelectric power generation will require robust water supplies and efficient water utilization technologies

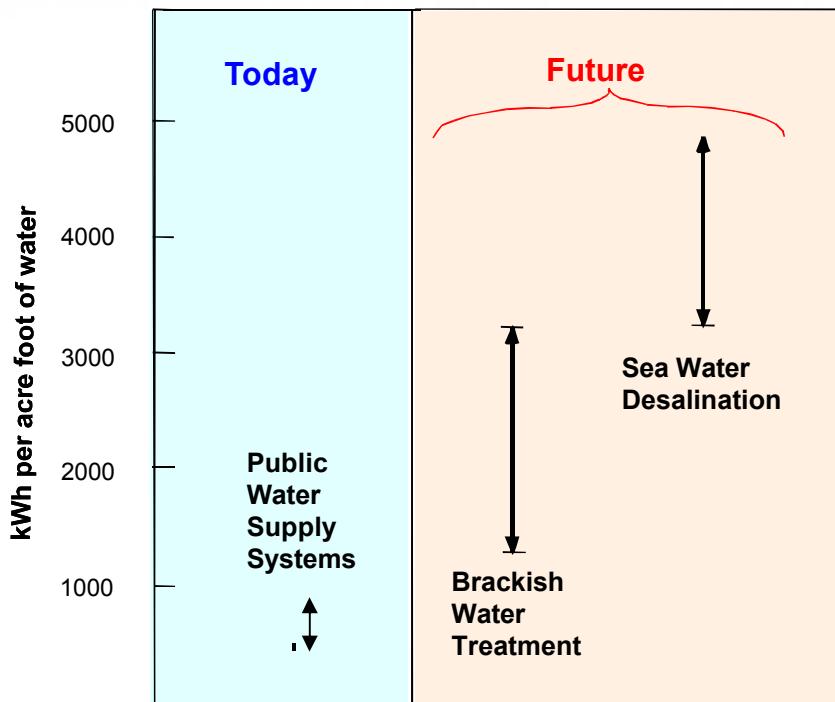


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Water is on the critical path for future U.S. energy supplies

→ Energy for Water

Power requirements for current and future water supply



U.S. cities and industry are turning to energy-intensive desalination and advanced water treatment technologies to meet growing demand.

40% of sea-water desalination is for energy.

Current Senate and House Bills seek \$200M in direct energy subsidies from DOE in order to defray the cost of desalinating water in the western, southern and eastern U.S.

Rapidly growing new-water demands will use increasingly energy-intensive technologies. In the absence of more efficient technologies, DOE may be asked to provide direct energy subsidies

What are some *Innovative Ideas* that could “Jumpstart” investment in a bi-national sustainable *city of the future*?

- SMIC – Systems Modeling & Innovation Center
- Water/Energy Technology Development and Implementation Working Group (WETDIWD)
 - Arsenic treatment of groundwater resources in the US/Mexico border region
 - Advanced Membrane water treatment technologies
 - SANS treatment material innovation for developing countries
- Co-production “green” technologies for energy-water-mineral extraction/production
 - Geothermal-water-mineral extraction intersection
 - Biofuel production using regionally available resources
 - Alternative (renewable) energy production for water treatment
 - Micro-turbine energy recapture from wastewater streams



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SMIC – Systems Modeling & Innovation Center

The Systems Modeling & Innovation Center will initially define sustainability in the Energy-Water Sector: The sustainability will be necessary for the city of the future to be sustainable.

The SMIC will utilize SNL-developed System Dynamics (SD) modeling tools to evaluate the numerable interdependencies affecting this goal. The SD models will allow informed decisions and trade-off estimates for transformation of information to insight (I-to-I) for sustainable energy-water resources to grow the border city of the future

SMIC will form the focus of new technology development, attracting venture capital as it defines the roadmap for future technology needs amidst the confusing interdependent landscape of modern and global technology across the myriad of technology areas.



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Water Treatment Technology Working Group

Meet in the “coffee house” located at the border in the city of the future

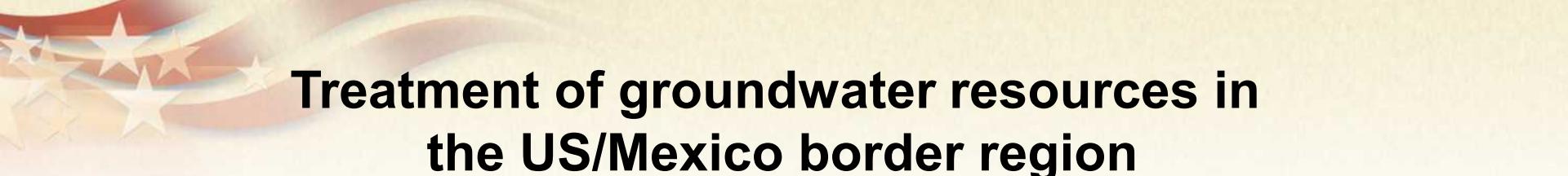
Composed of “water workers” from both sides of the border

Develop an understanding of the water issues facing (current) El Paso, and (future) Santa Teresa communities

Bring stakeholders together (perhaps using SMIC technologies) to inform decision-making and advise on water-energy management, sustainability, water treatment, water reuse, disposal, etc.

Be the catalyst for development of new innovative treatment technologies – create a border business for water treatment technology development and export





Treatment of groundwater resources in the US/Mexico border region

Evaluate the need for arsenic treatment and desalination of groundwater needed to support development of transboundary “city of the future”

Recommend treatment concepts to realize quality/sustainable water-develop a bi-lateral water treatment technology center to:

- *“Hedgehog” technology in distributed treatment concept or as an exportable technology for rural/small systems.*
- *SNL-developed SANS technology – improve the cost-efficiency and create an exportable technology.*
- *Advanced membrane technology development for desalination of groundwater resources. Use for both local water treatment and for technology export.*
- *Novel groundwater aquifer in situ treatment for arsenic removal*





Co-production “green” technologies for energy-water-mineral extraction/production

Create a novel, cost-effective technology intersection between utilization of local marginal geothermal resources with water treatment and mineral capture from brines to develop a new marketable technology for sustainable and “green” cities of the future.

Develop novel new co-generation technologies for algal biofuel production using resources available in the border region. Use sunshine, groundwater, and CO₂ from energy production to create another technology intersection which, when perfected, would create sustainable and green cities of the future.

Development and utilization of new technology to recapture energy through micro-turbine electricity production from wastewater capture and delivery.



BNSL Water-Energy Innovative Idea Summary

Some technologies exist independently but have not been integrated systematically

Concept would be to both share and jointly develop/optimize new technologies described

Technologies would be employed at the city of the future AND would form the basis for new “green” exportable business development and technology/know-how export

Creates a foundation for business sustainability by developing & implementing “green” sustainable technologies

SMIC acts as the “brain” behind sustainable business development, creating future scenarios for stakeholder decision-making

