

Exceptional service in the national interest



Energy-Water Nexus MIPM

Stephanie Kuzio

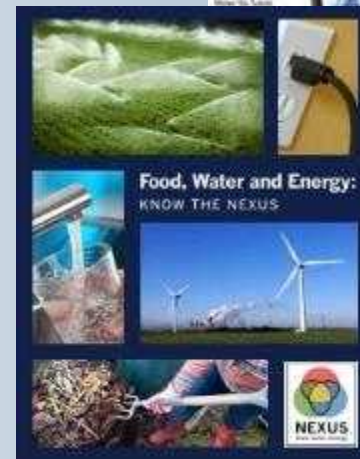
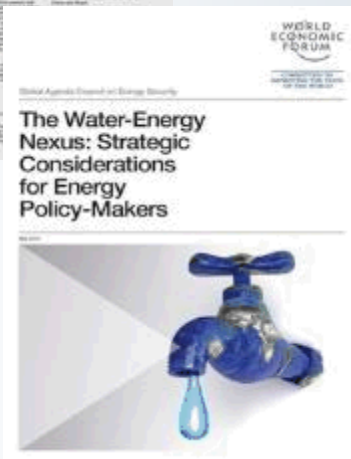
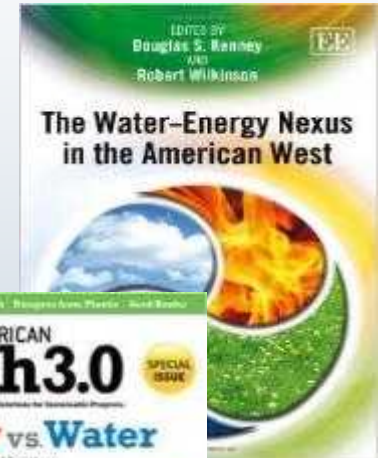
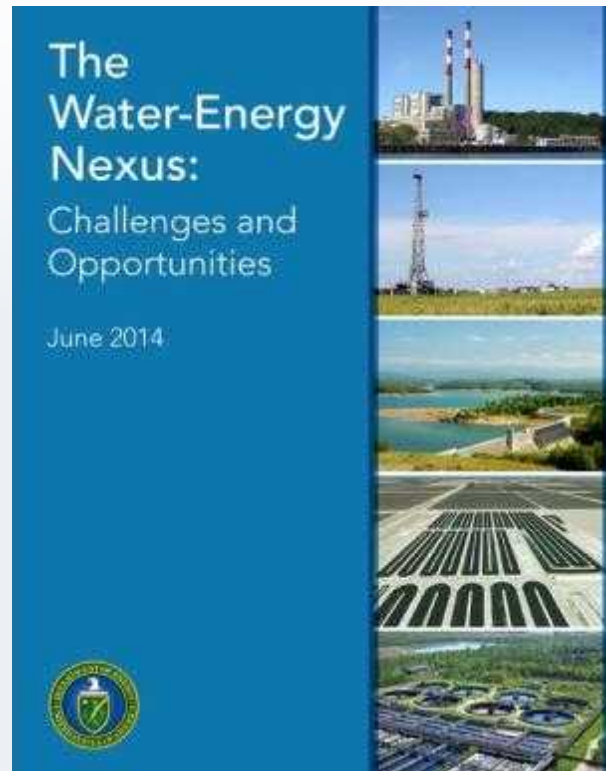
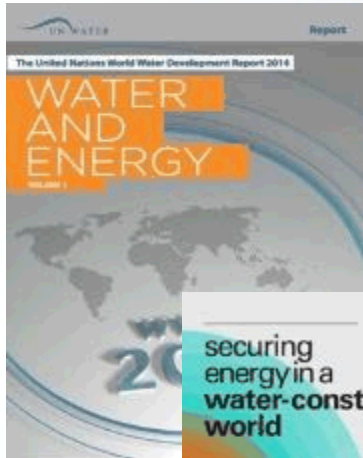
Program Manager Energy Water

Earth Systems Analysis Department manager

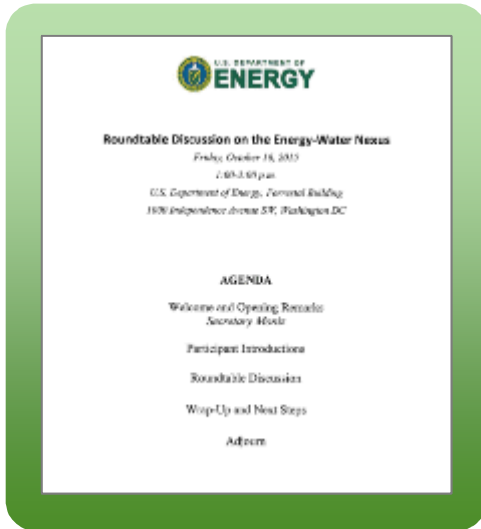


Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

The Problem

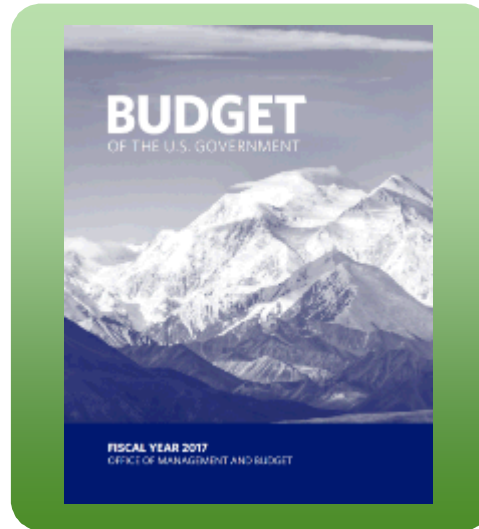


Energy-Water Nexus Recent Policy/Budget Developments

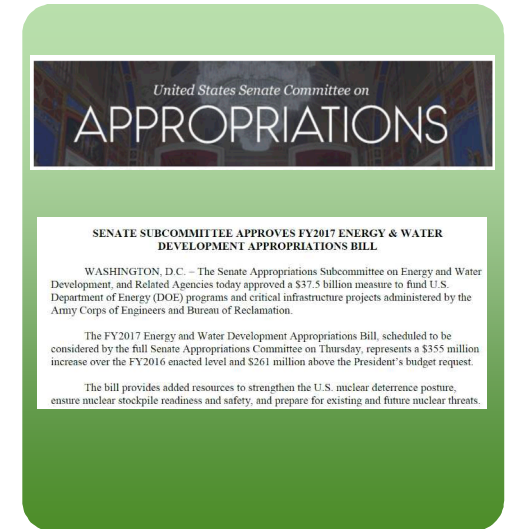


October 2015 Secretary Moniz Hosted Capstone Energy-Water Roundtable

December 2015 White House Hosted Energy-Water Event

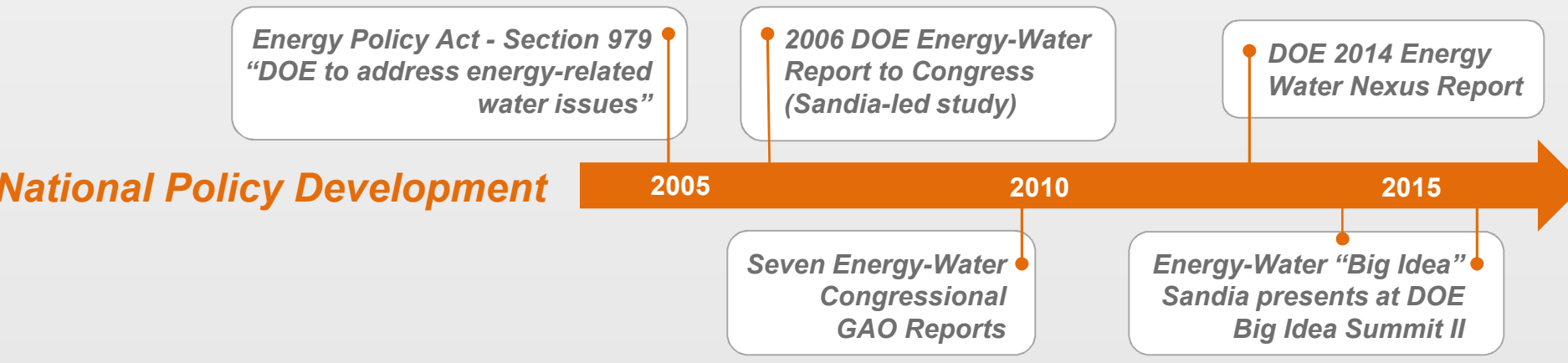
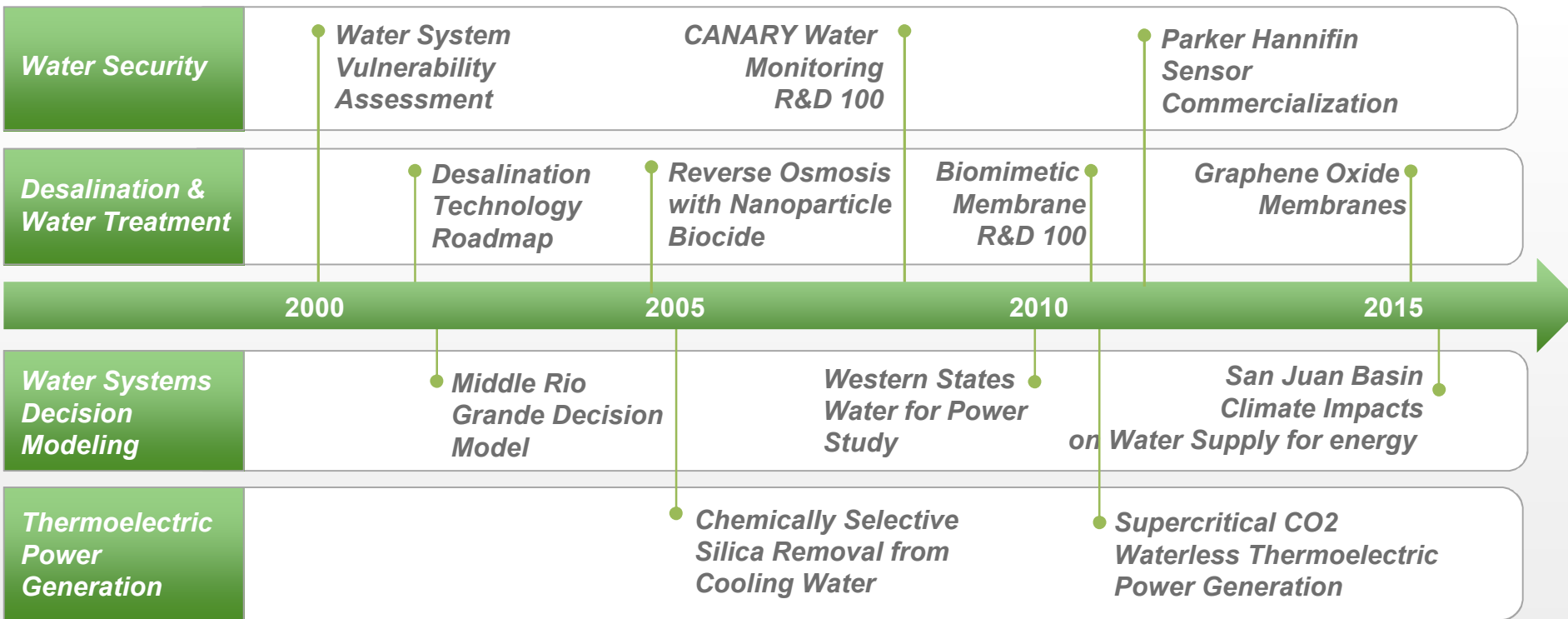


Energy-Water in FY17 President's Budget Request



FY17 Energy & Water Appropriations (Senate Passed 5/12/16)

Sandia Water Security Mission Initiative Begins – 2000

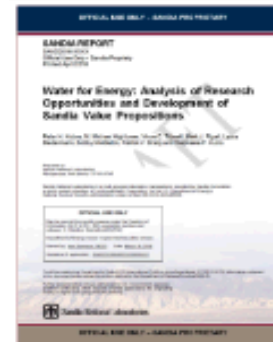
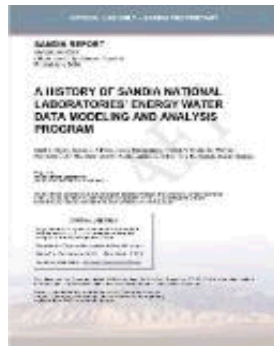


Water for Energy

FY16 Focused Strategic Investment -- Ensure US energy production remains viable and cost effective by reducing water dependencies and water impacts.

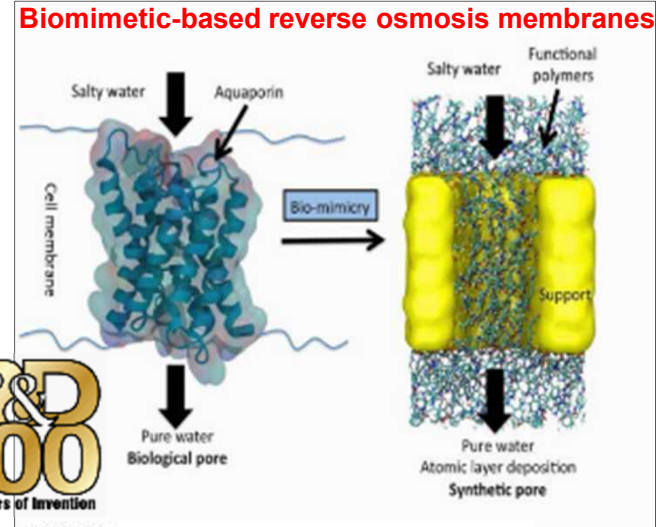
Identified Energy Water Research Opportunities in the following areas

- ***Data Modeling and Analysis Water for Energy***
- ***Water treatment technologies for Desalination***
- ***Concentrating Solar Power for Desalination***

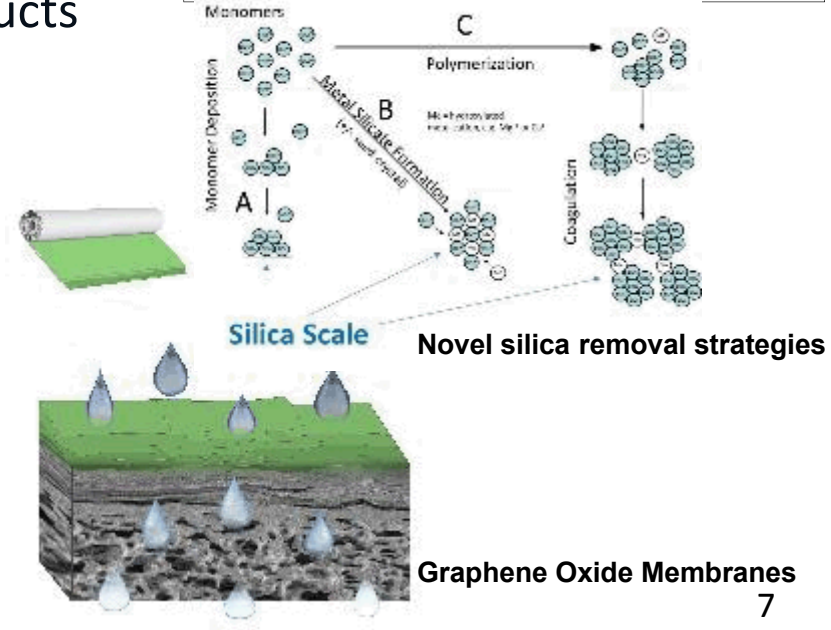


Water Treatment Technologies

- Research goal: Low-Carbon, low-energy, low-cost desalination: DOE goal \$.50/m³
- Research need
 - Functional low pressure/high yield membranes
 - Upscaling of lab-scale membranes swatches for manufacturing
 - Controlling silica scaling
 - Developing selective salt precipitation
 - What to do with water-treatment byproducts
- Current and previous work:



Pilot demonstration of cooling tower and produced water treatment and arsenic removal from drinking water.



Sandia has been actively working in a broad range of water treatment technical challenges for over a decade

DESALINATION TECHNOLOGY ROADMAPS



DEVELOPMENT OF SWEEPING GAS MEMBRANE DESALINATION USING COMMERCIAL HYDROPHOBIC HOLLOW FIBER MEMBRANES

BRACKISH GROUNDWATER NATIONAL DESALINATION RESEARCH FACILITY



COMMERCIALIZATION OF ZERO LIQUID DISCHARGE PROCESS FOR BRACKISH WATER DESALINATION (PARTNERSHIP WITH USC & ZDD)



BIOMIMETIC MEMBRANE R&D 100 AWARD



PATENT ON METHODS FOR RECOVERING ALKALI METALS



NATIONAL CLIMATE ASSESSMENT REPORT: CHAPTER 10, ENERGY WATER, AND LAND USE

GRAPHENE OXIDE MEMBRANES



2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

2000

- ADVANCED CONCEPTS DESALINATION PROGRAM BEGINS

2001

- PATENT DESCRIBING A METHOD FOR SYNTHESIZING A LAYERED DOUBLE HYDROXIDE CAPABLE OF SORBING BOTH ANIONIC AND CATIONIC CONTAMINANTS FROM FLUID

2002

- SELF-SEALING EVAPORATIVE POND LINER
- DESALINATION OF BRACKISH GROUNDWATERS & PRODUCED WATERS USING IN-SITU PRECIPITATION
- CAPACITIVE DEIONIZATION FOR COAL-BED NATURAL GAS PRODUCED WATER TREATMENT
- UV ULTRAVIOLET WATER PURIFICATION SYSTEMS FOR RURAL ENVIRONMENTS AND MOBILE APPLICATIONS

2003

- REVERSE OSMOSIS with NANOPARTICLE BIOCIDES

2004

- PRODUCED WATER PILOT SAN JUAN BASIN, NM



2005

- CHEMICALLY SELECTIVE SILICA REMOVAL FROM COOLING WATER

2006

- INTERFACIAL WATER PROJECT TO UNDERSTAND INTERACTIONS AMONG WATER, MEMBRANES AND CONTAMINANTS



2007

- COAGULATION CHEMISTRIES FOR SILICA REMOVAL FROM COOLING TOWER WATER
- CSTS FOR RADIOACTIVE CESIUM REMEDIATION
- WATER RECOVERY USING WASTE HEAT FROM COAL FIRED POWER PLANTS
- NOVEL SILICA REMOVAL STRATEGIES FOR INDUSTRY PARTNER




2008

- PATENT FOR MITIGATING MEMBRANE BIOFOULING

2009

- PATENT ON METHODS FOR ATTACHING POLYMERIZABLE CERAGENINS TO WATER TREATMENT MEMBRANES USING SILANE LINKAGES

2010

- APATITE PERMEABLE REACTIVE BARRIERS FOR IN SITU REMEDIATION OF URANIUM IN SUBSURFACE OF UMTRA SITE



2011

- MEMBRANE DISTILLATION PROJECT FOR NM SMALL BUSINESS

2012

- PATENT ON METHODS FOR RECOVERING ALKALI METALS




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Concentrating Solar Power for Desalination

Research Need:

- Hybridizing CSP with Desalination
- Which thermal technology to use
 - MD, MSF, MEE, or other.
- Direct Utilization, Novel technologies
 - For example direct-contact flash distillation using molten salt is an untested technology that can provide desalination using existing heat-transfer and storage media (molten salts). Salt water is added directly to molten salt for flash distillation; if the composition of salt gets too high, some can be bled off and cooled to form solid bricks of salt, which can be transported away and/or reused.
- Sandia's molten-salt test loop can be used to investigate novel desalination technologies using molten salt



Sandia's National Solar Thermal Test Facility (NSTTF) is the only test facility of this type in the United States.

Next Steps and Opportunities

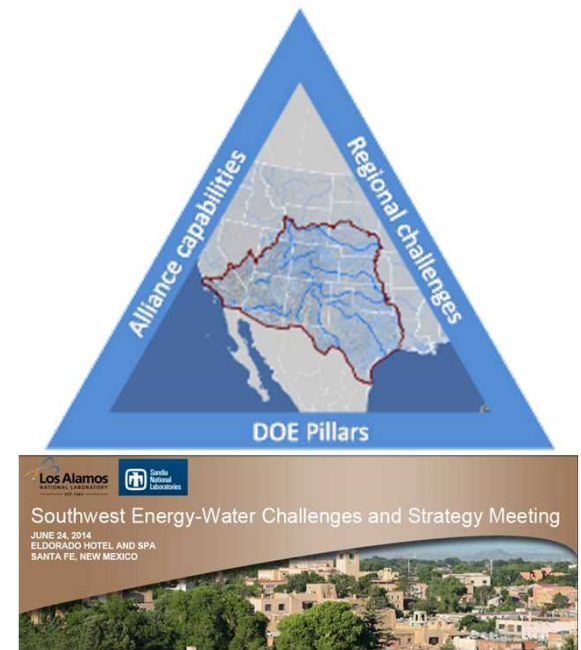
- DOE/Desal Hub \$20M; Respond to anticipated RFI and Hub call
- Engagements and discussions for possible “Hub’ configurations;
 - GE Global Research, David Moore
 - AMO Director, Mark Johnson, Dev Shenoy,
 - UT Austin: Benny Freeman
 - UTEP, Tom Davis, Malynda Cappelle
 - EPRI, Richard Breckenridge
 - LLNL, Doug Rotman, A.J. Simon
 - LBNL, Ravi Prasher
 - Rice University/Baker Institute, Linda Capuano
 - Water Research Foundation, Rob Renner and Beata Wright



15 Year History of Sandia's Water Treatment Partnerships

Next Steps and Opportunities

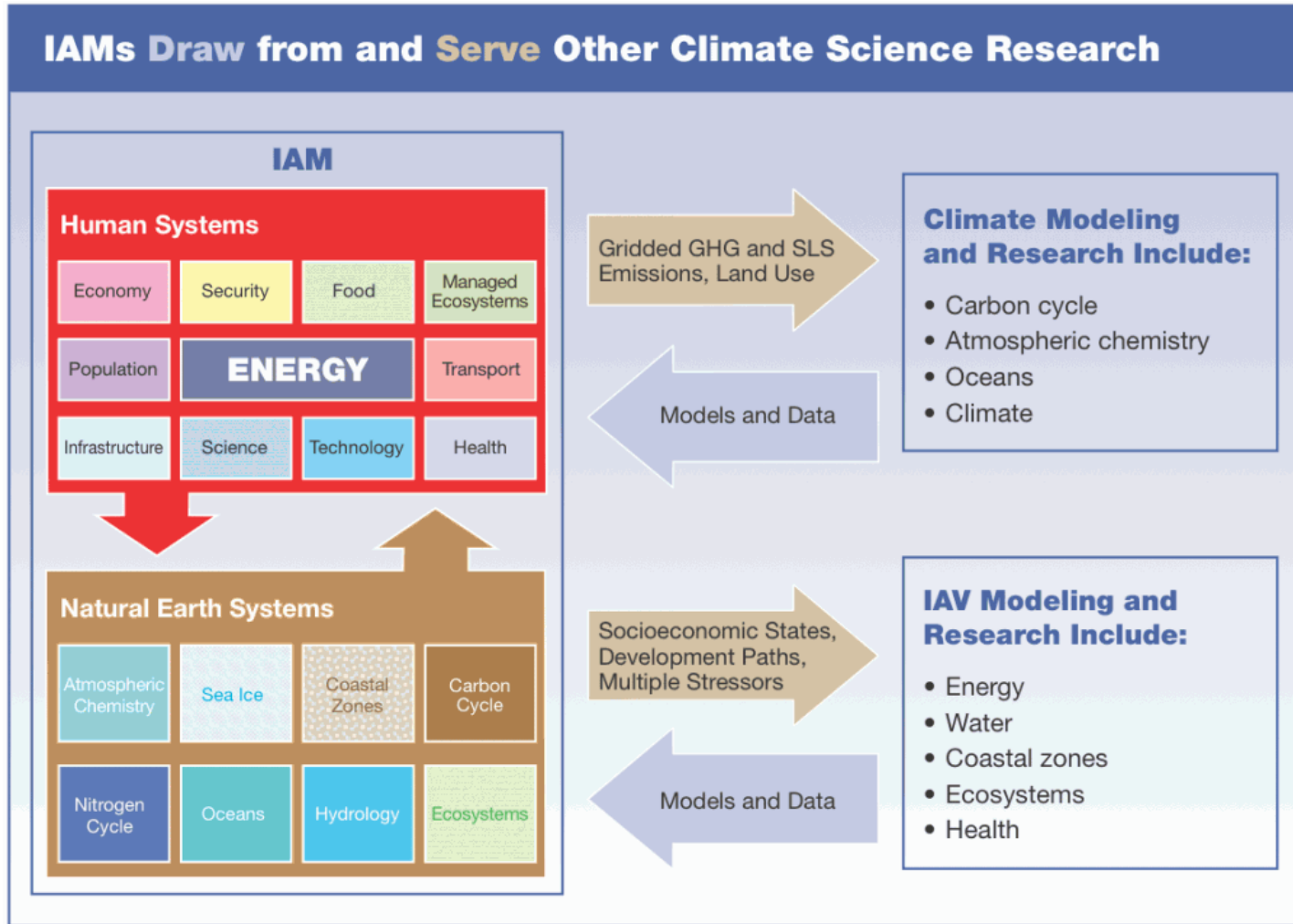
- Opportunity DOE/SC/BER Regional Modeling Test Beds (3)
\$10M total
- IAV Research
- -UT BEG; Michael Young, Bridget Scanlon
- -LANL, Andy Wolfsberg, Nan Sauer
- -NREL, Robin Newmark, Jordan Macknick
- UNM, Kerry Howe
- ASU, John Sobo



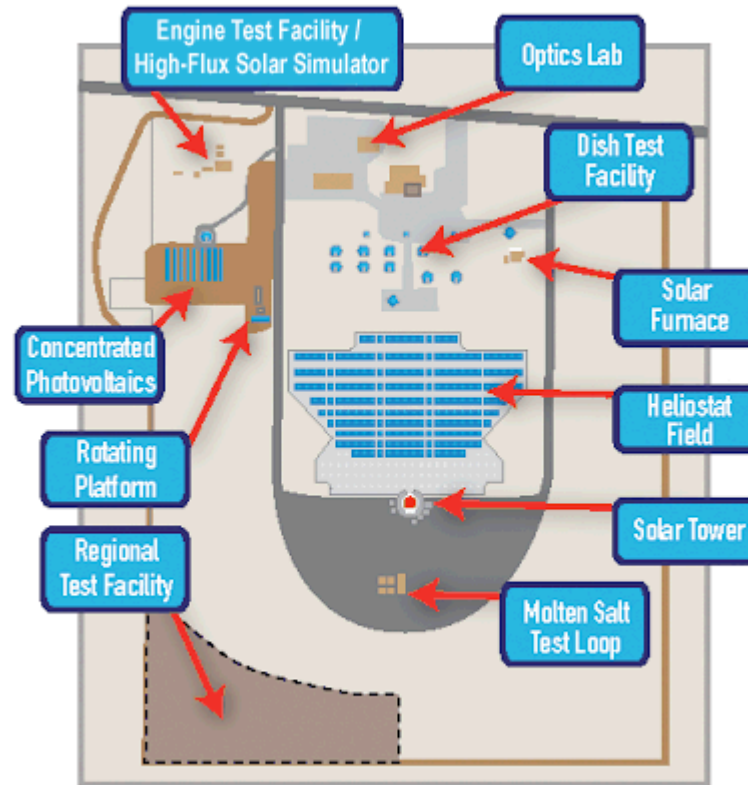
- Related new Start projects:
 - DOE/SC/BER, SFA-Integrated Multi-Scale, Multi-Sector Modeling,

Backup slides

IAMs and IAV modeling



CSP facility



Energy-Water Nexus

Big Idea Summit II



The Landscape

DOE brings unique capabilities and is uniquely positioned to coordinate, leverage, and build on existing efforts at the energy-water nexus

