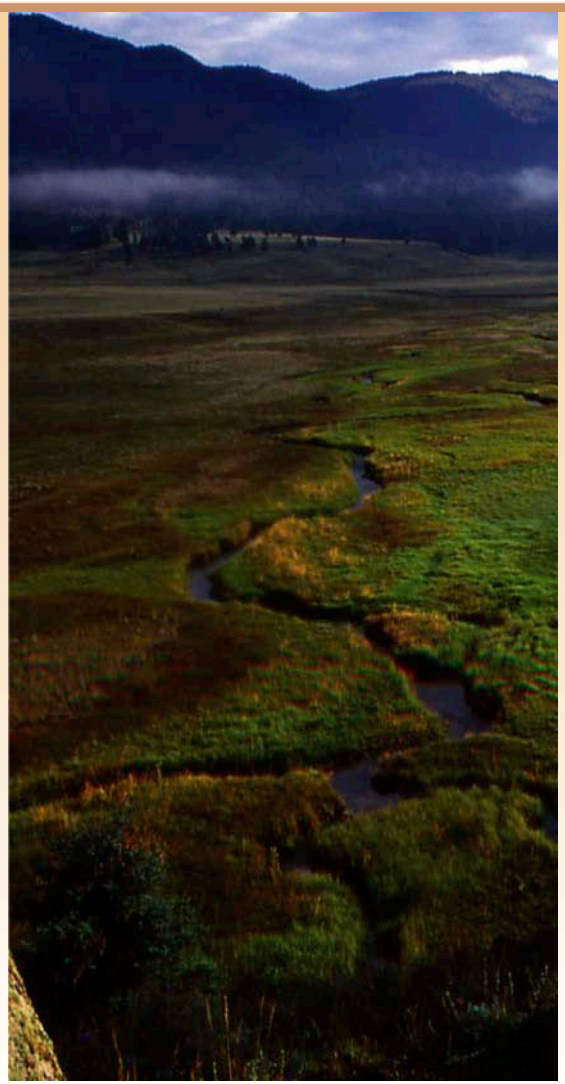
New Mexico EPSCoR



New Mexico EPSCoR

RII3 Next Steps and NSF RII4 Planning

30 September 2011

New Mexico Nexus of Energy, Water and Environment (NM-NEWE)

2013-2018

Key RII 3 Next Steps—Ongoing Work

- Publish, publish, publish
- Final equipment purchases and installation
  - (NMSU and NMT)
- Continue research activities per Strategic Action Plan
- Submit IWG proposals (Dec. 1)
- Continue to increase diversity of participants
- Junior Faculty Leadership Workshop: Jan 4-6, 2012
- Tri-State Annual Meeting: April 3-5, 2012
- Teacher Summer Institute, UROP Program – summer 2012
- Graduate Interdisciplinary Modeling Course– summer 2012

EPSCoR New/Developing Initiatives

- Town Hall Meeting
  - Connect research and policy
  - Involve multiple stakeholders
- FastForward New Mexico
  - Workshops connecting CI with small entrepreneurial business
- Connecting Data & Models with K-12 Education
  - Working with pre-service and in-service educators
  - Cyberlearning Summit
- New Training for Stakeholders
  - Navajo and other tribes on use and maintenance of meteorological stations

RII 4 Planning Overview

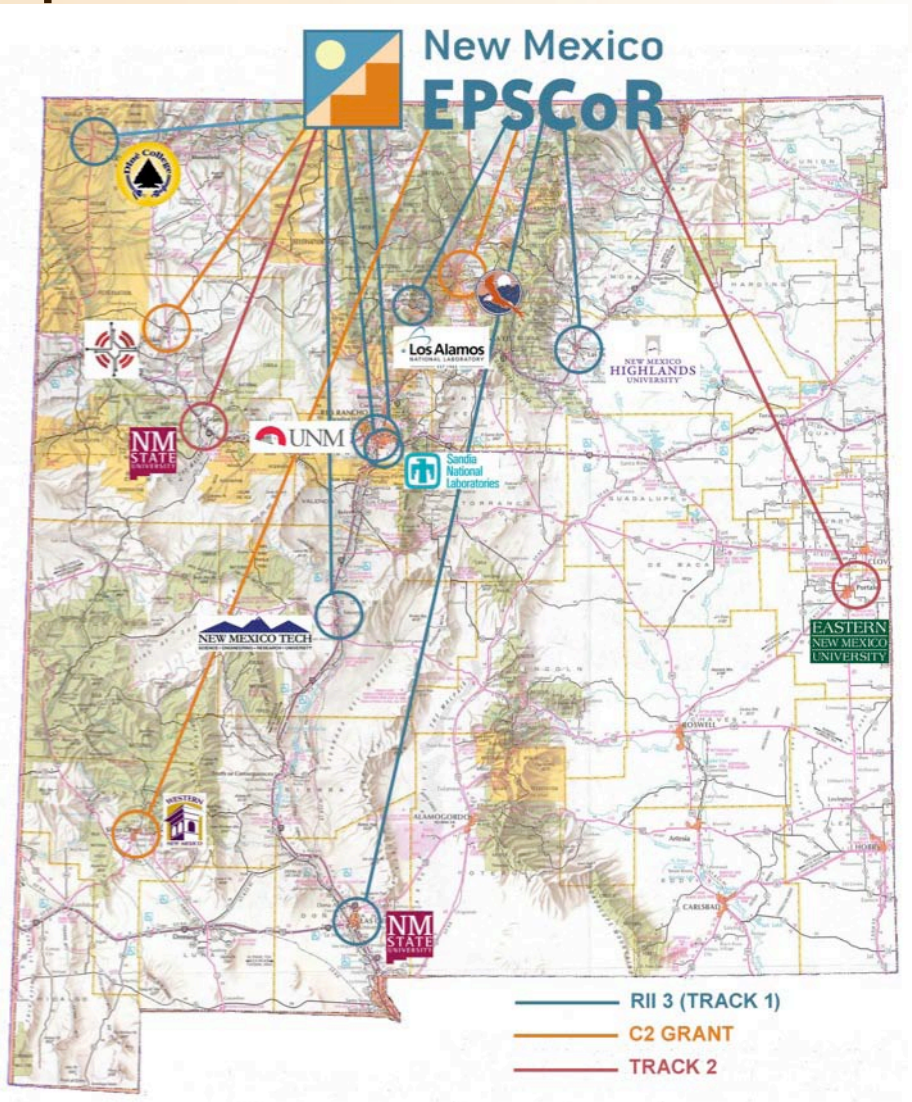
- Energy-water-environment nexus
- The planning process

NSF EPSCoR Program Definition

- Experimental Program to Stimulate Competitive Research
  - Track 1 – $20M for 5 years ($4M/yr); capacity building
  - Other related EPSCoR support:
    - Track 2 – $2M for 3 years; cyberinfrastructure
    - C2 – $1M for 2 years; network connectivity
    - Workshops
    - Cost-share on NSF proposals that are competitive but not top-ranked

The New Mexico Landscape

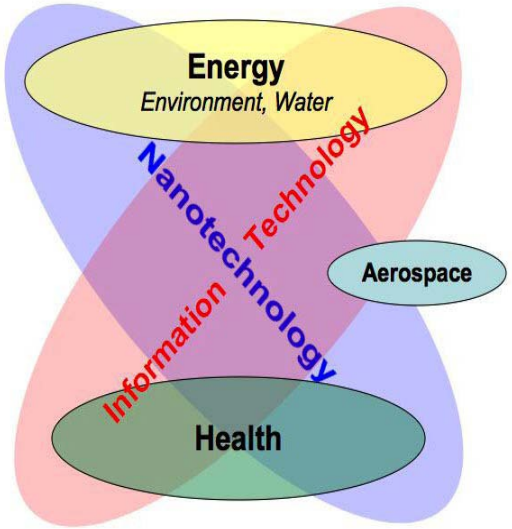
- New Mexico People
  - 46% Hispanic
  - 9.4% Native American
  - 2.1% Black
- 5th Largest State
  - 121,355 square miles
- 6th most sparsely inhabited state
  - ~2,000,000 people
  - 17 people/square mile



Source: U.S. Census Bureau

New Mexico State S&T Plan Core Areas

- Aerospace
- Bioscience
- Energy, Environment, and Water
- Information Technology
- Nanotechnology



Additional Focal Areas: Economic Development, Education, and Workforce Development

Technology21

Source: http://www.edd.state.nm.us/scienceTechnology/intro/index.html

EPSCoR RII4 Proposal

- Research: Energy, Water, Environment Nexus
  - SEC decision following AAAS recommendations:
    - Builds on current project (RII 3)
    - Increased focus on building capacity of regional and tribal colleges
    - Strongly integrative cyberinfrastructure component
    - Extend and expand current efforts on building STEM pipeline
    - New and related workforce development activities

S&T Plan: Energy-water-environment nexus

S&T Plan: Energy, Water, Environment

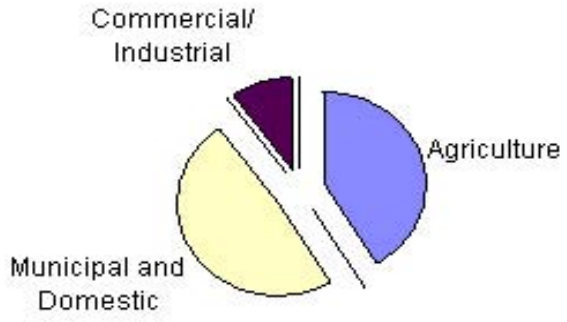
- Energy
  - Oil and gas; renewable energy sources such as biofuels, wind, solar; hydrogen; fuel cells; conservation; clean coal; etc.
- Water
  - Hydrology; sensors; modeling; watershed and aquifer sustainability; groundwater issues; conservation; water quality; desalination; use of brackish and produced water, etc.
- Environment
  - Climate change; remote sensing; ecosystem modeling; impact of forest thinning; atmospheric modeling; soil, air, air and water remediation; etc.
- Socioeconomic
  - Choice; cost trade-offs; individual based modeling; scenario-building and forecasting; etc.

Energy as a growth area in New Mexico

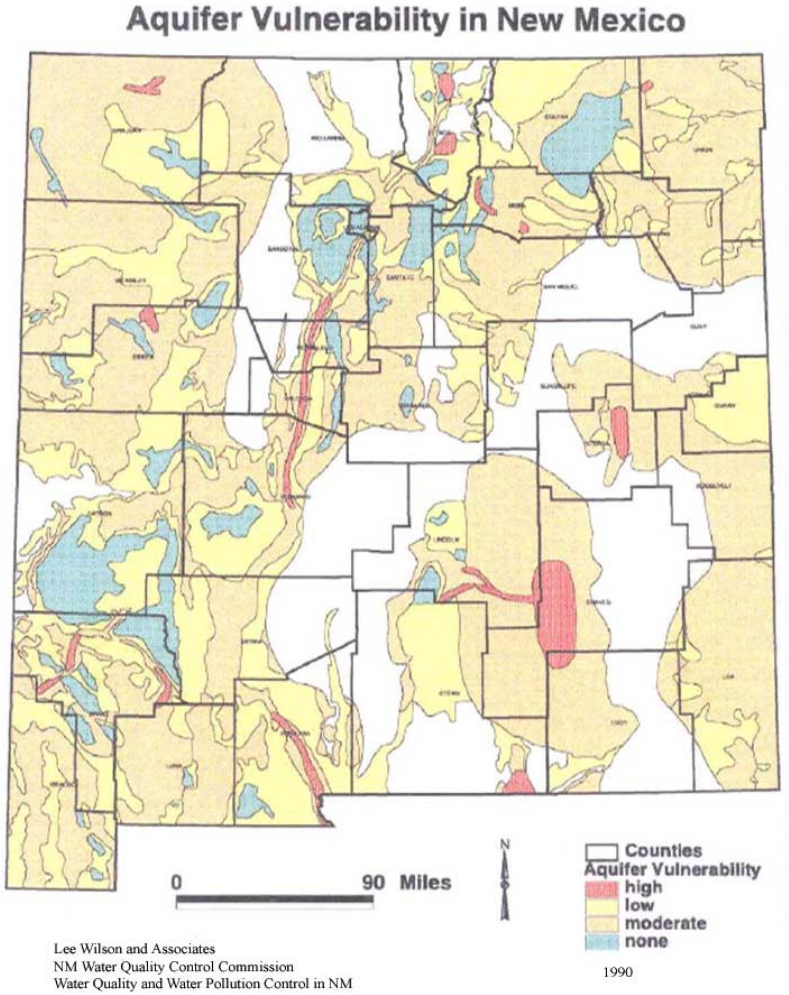
Projected Water Demand in New Mexico

AF Per Year	Agriculture	Municipal and Domestic	Commercial/ Industrial	Total
Year 2000	2,765,879	307,716	208,382	3,281,977
Year 2040*	3,054,937	644,846	278,260	3,978,043
Absolute Increase 2040 over 2000	289,057	337,130	69,878	696,066
Percentage Increase 2040 over 2000	10%	110%	34%	21%

Distribution of Consumption Increases



New Mexico Aquifer Vulnerability



Algal Biodiesel

- Development of biofuels is well underway in NM
- Has potential to be a major economic driver
- Requires large amounts of saline water from aquifers

Competition for water limits energy development, and affects and is affected by environmental issues

- The energy-water-environment nexus is a national concern and encompasses many interdisciplinary grand scientific and societal challenges
- We must develop an understanding of the complex interdependencies among energy, water, environmental, and socioeconomic systems, and apply science, socioeconomic approaches, and engineering to create sustainable systems.

The Planning Process

- Fall 2011 – Stakeholder planning meetings
  - Sept 19 – science questions to be addressed
  - Oct 21 – research infrastructure and CI
  - Nov 21 – education, outreach, and workforce development
- Dec 2011 – Establish Proposal Steering Committee
- Jan – July 2012 – Proposal writing and additional workshops
- June 2012 – AAAS Review
- July 2012 – NSF RFP Released (tentative)
- July 2012 – Revisions to proposal based on AAAS Review and RFP
- Aug 2012 – External Review by Tiger Team
- Aug – Sept 2012 – Final revisions, budgeting, and processing
- Oct 2012 – Proposal to G&C for compliance checking
- November 2012 – submit proposal

[illegible]

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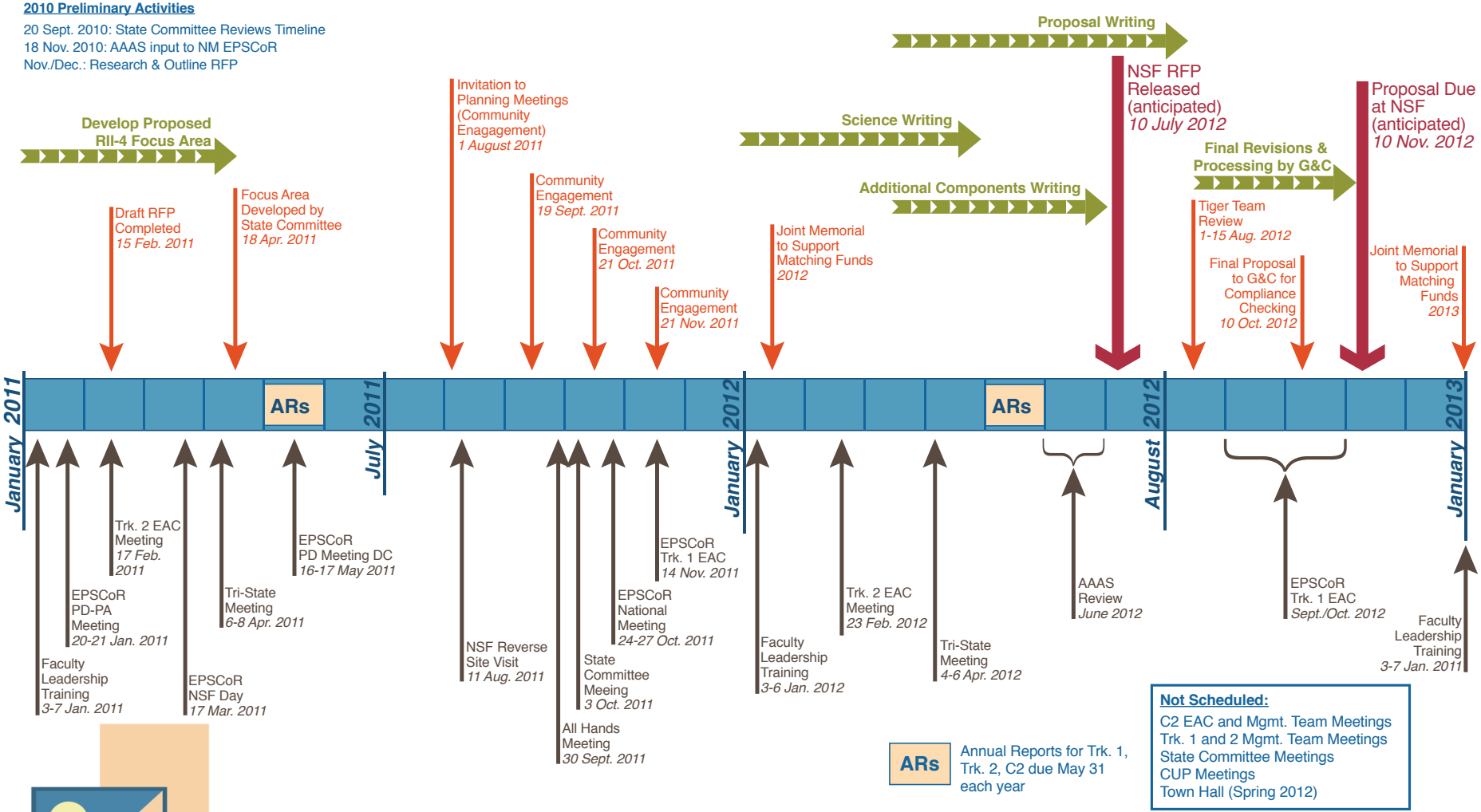
2010 Preliminary Activities

20 Sept. 2010: State Committee Reviews Timeline
18 Nov. 2010: AAAS input to NM EPSCoR
Nov./Dec.: Research & Outline RFP



ARs Annual Reports for Trk. 1, Trk. 2, C2 due May 31 each year

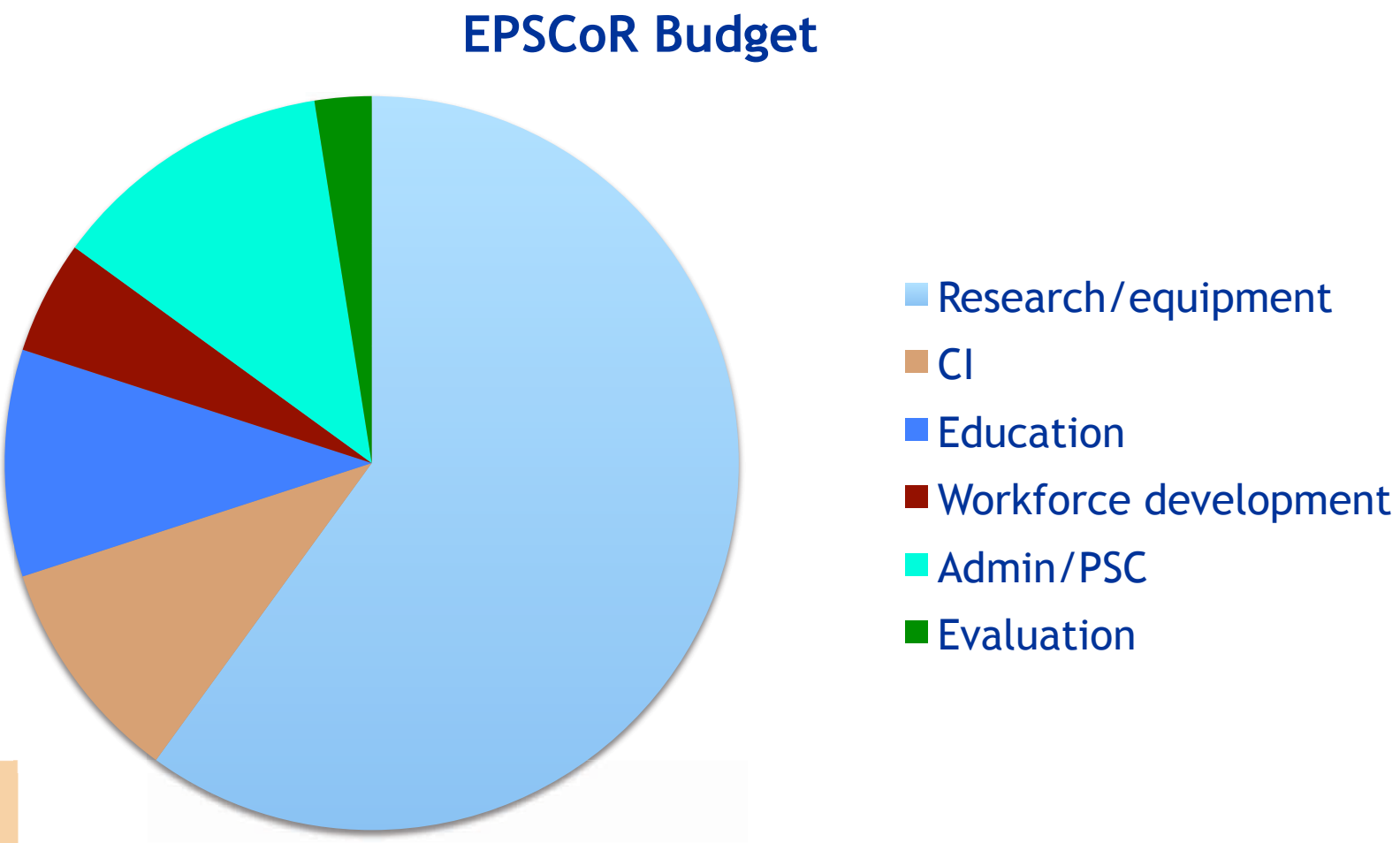
Not Scheduled:

C2 EAC and Mgmt. Team Meetings
Trk. 1 and 2 Mgmt. Team Meetings
State Committee Meetings
CUP Meetings
Town Hall (Spring 2012)

The Proposal Steering Committee

- 12 members +/-
- Expertise
  - Subject area expertise
    - research, CI, education, outreach, workforce development
  - Writing talent and organizational abilities
- Diversity
  - Institutional
    - Major research universities
    - Regional universities and colleges
    - National labs
    - ….
  - Gender, racial, and ethnic diversity

Funding scenario ($20-24M)



Eligible research expenditures

- Research equipment
- Laboratory upgrades
- Field experimental facilities
- Faculty start-up packages
- Undergraduate, graduate and post-doc support
- Miscellaneous
  - Faculty salary for administrative activities
  - Training and professional development
  - Travel, supplies, etc.
  - …

20% match ($4M)

1. Many states receive a state appropriation for the entire cost-share requirement and it is written into legislation.
2. $ contributions from industry and business.
3. Salary and wages and FB for any EPSCoR staff that are supported.
4. Reduced IDC rates.
5. University and foundation contributions to picking up RAs, GRAs, Post-docs
6. University cost-share on faculty start-up packages.
7. Contributions of equipment.
8. Faculty release time.

Science White Papers

- Refine and prioritize questions
  - Identify related activities that might be supported
- Identification of lead writer and key contributors to develop a 3-6 page white paper on the topic
  - Title
  - Authors/contributors and affiliations
  - Background / introduction (1 page)
  - Focal questions (2-3 pages)
    - Relevance of questions to energy-water-environment nexus (0.5 page)
    - Capacity to enhance competitiveness for NSF funding (0.5 page)
  - Other people/institutions that can/should be brought in as partners (appendix)
- Identify others to invite to next meeting to identify research infrastructure and CI needs

Bioalgae/Biofuels

- Writers:
  - Lead Writer: Peter Lammers NMSU
  - Tom Bowles NM CAC
  - Juchao Yan EMNU
  - Robert Parameter, Valles Caldera
  - NMSU:
    - Adrian Hanson
    - Carlos Ochoa
    - Shuguang Deng
    - Tanner Schaub
    - Wiebke Boeing
    - Sudha Murthy
    - Andres Cibilis
    - Doug Cram
  - UNM
    - David Hanson
    - Andrew Schulter

- Focus Areas:
  - Process
  - Water, Waste, Sustainability
  - Scaling of integrated multifuel network energy

Bioalgae/Biofuels (continued)

- Preliminary Questions
  1. Process development to maximize lipid production while minimum energy and water use.
  2. How can bio systems be improved for bio energy production?
  3. What biofuel source makes most sustainable (land, water) by products in addition to energy?
  4. How do we provide solutions for water, nutrients, and $CO_{2\ for}$ sustainable algal-bio fuels?
  5. How to control and minimize the effects of bio waste on environment (air, water, soil)? Which technology converts waste into bioenergy?
  6. What is the efficient way to extract and convert agal biomass to biofuels and co-product?
  7. Monitoring chemical composition of algal feedstock and to produce fuel.
  8. What are technical regulatory and resource constraints to scaling-up algal agronomy?
  9. Evaluate different biofuels, algae, range, ag, forestry, carbon dioxide flux, water use of yield, environment with direct or indirect benefits workforce develop.
  10. Agriculture/forest/range lands potential for generating biofuels; understand and quantify water and energy components involved.
  11. Productivity and stability of algae monoculture vs polyculture
  12. Water sources for algae and implications for feedstock quality
  13. Relationship between scale and economics of pro and by-pro

Geothermal

- Preliminary Questions
  1. New Mexico mostly low temperatures (less the 80 degrees) geothermal resources. How can these resources be best used from an economic and technical perspective? Are there synergies with other renewables such as bio algae?
  2. Cation and silica base geothermometers frequently over estimate deep reservoir temperatures. Can we develop a new geothermometer for low temperature New Mexico's systems?
  3. How does the geologic framework of New Mexico geothermal systems impact production, resource evaluation, and aquifer vulnerability? What are the legal implications for geothermal water development?
  4. Are there synergies between brackish water development or carbon dioxide sequestration with low temperature geothermal?

- Lead Writer:
  - Mark Person NMT
- Writers:
  - Laura Crossey UNM
  - Janie Chermak UNM
  - Karl Karlstron UNM
  - Caiti Steele NMSU
  - John Wilson NMT

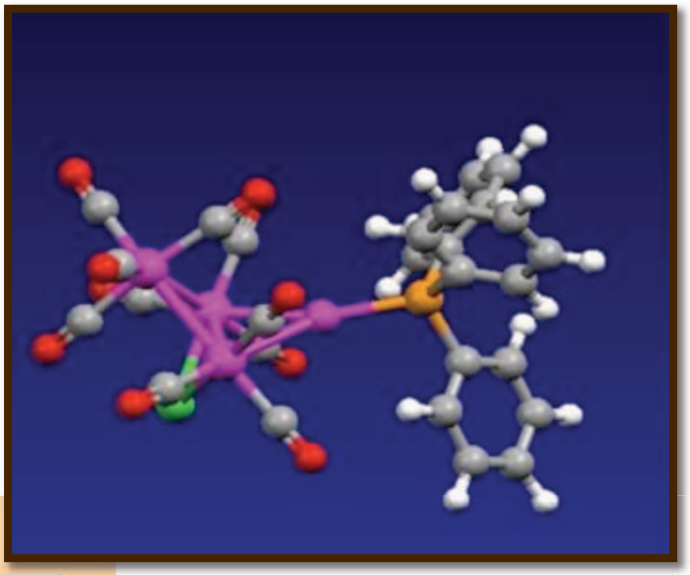
Solar

- Lead Writer:
  - Caiti Steele NMSU
- Writers:
  - Ken Boykin NMSU
- Others to Invite:
  - Olga Lavrova UNM

- Preliminary Questions
  1. How can energy solar driven processes; photochem be used to promote sustainable clean energy?
  2. Where are optimal locations for solar panel installation? (in state) + (US)
  3. What are the impacts of under development on water resources? (future)
  4. How can New Mexico science contribute to U. extraction processing? Dealing with legacy?
  5. What is the environmental and socioeconomic legacy of U. mining?
  6. How can we use dairy wastewater for energy and fertilizer development?
  7. What is the impact of rural local solar PV/thermal use on water resources eg. higher transmission cost of line power vs on site PV generation, including ecosystem function in the wild land urban interface.
  8. How can solar energy be used for carbon dioxide mitigation?
  9. How can we exploit New Mexico's solar potential and support US-made solar panels
  10. How much and how quickly can wind and solar energy production reduce need for coal generated electricity and its use of water?
  11. Is there a strong role for solar ponds for energy production? How can this technology be optimized to also minimize impacts of water and environments?

Photochemistry

- Lead Writer:
  - Michael Haegy NMT
- Writers:
  - Plamen Atimasov UNM
  - Aaron Collins SNL



- Preliminary Questions
  1. How can oil and gas produced water be turned into an economic resource instead of a waste management issue?
  2. The state of produced water from oil and gas production impacts of resources and the environment but is poorly understood. What fundamental and applied research is needed to address this gap?
  3. What is the most robust and efficient water treatment process for recycling produced water?
  4. Is it possible to clean up produced water for other uses in an economically feasible way?
  5. Will water issues constrain oil and gas development?

Water and Gas

- Lead Writer:
  - Jan Hendrickx NMT
- Writers:
  - Frank Huang NMT
  - Laura Crossey UNM
  - Bruce Thompson UNM
- Others to Invite:
  - Robert Balch NMT, PRRC

- Preliminary Questions
  1. Change in water supply from surface ground water, does this mean more dependence on sustainable energy sources (eg wind/solar)?
  2. How can New Mexico become more robust against climate change by optimally combining ragland management for cattle production and energy generation (eg solar)?
  3. How can low-heated micro hydropower be produced for energy in ag irritation systems?
  4. How can the impacts of modern hydrofracting be initiated?

Socioeconomics and Overarching Questions

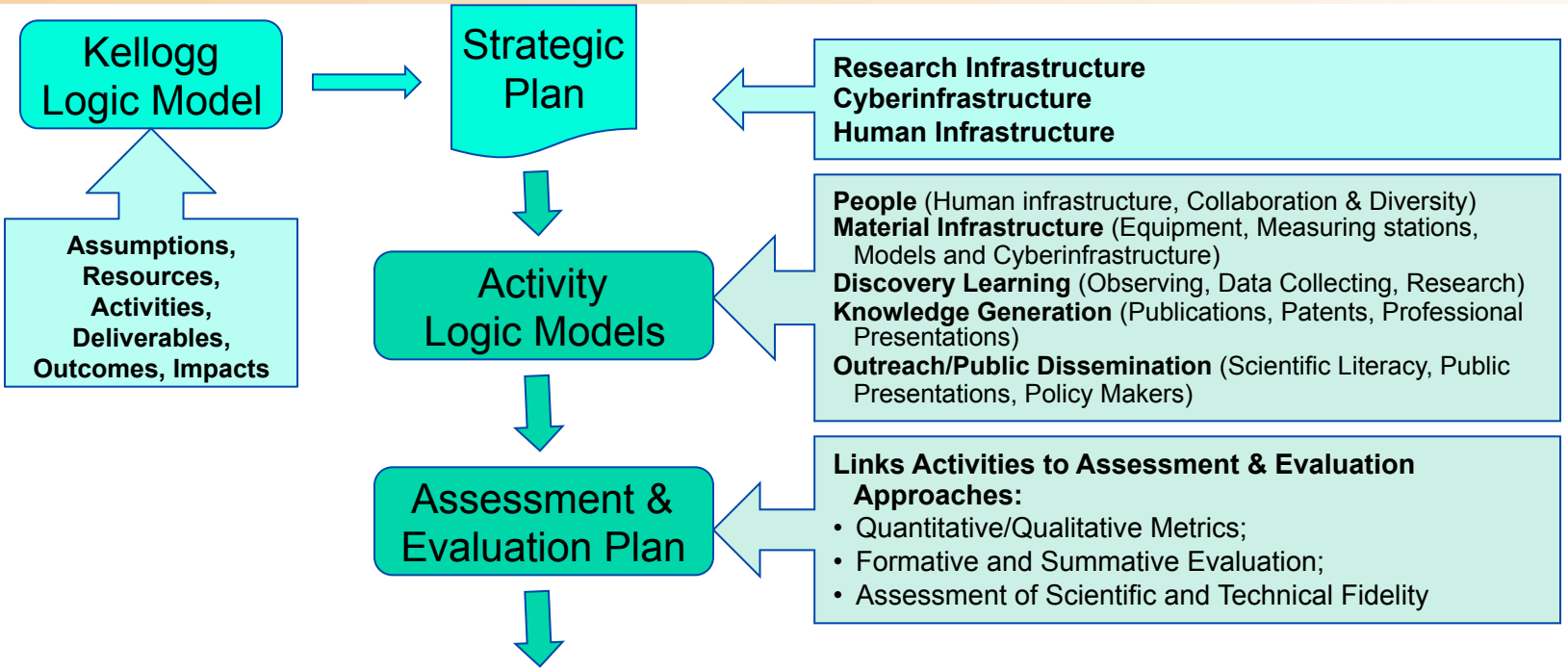
- Lead Writers: Janie Chermak UNM, Sam Fernald NMSU
- Writers: Frank Ward NMSU, Subhasish Mazumdar NMT, Ram Acharya NMT, Vince Tidwell, SNL, Mike Pullin, NMT, Edward Martinez, NMHU, Bill Hudspeth UNM, Cliff Dahm, UNM
- Preliminary Questions

1. Socio ecological landscape resilience to interactions of water as resource for consequences, local energy production
2. What are the energy costs and environmental impacts of extracting transporting, provisioning and treating water in New Mexico?
3. How can we monitor estimate and/or model the impact of energy production of water availability quality?
4. How to promote information flow across New Mexico communities to facilitate environmental monitoring optimal energy usage under constraints climate change predictions for New Mexico and collaborative research for the above?
5. What are the characteristics of a scientific CI?
6. What are the economic and ecological impacts of technological transitions in energy, conservation, and waste?
7. In the face of increasing resources scarcity and climate change how do we create energy and water sufficiency with social and environmental health?
8. Strategies to mitigate the impact of climate change induced water shortage.
9. What WEE policy measures can be taken to reduce economic and environment vulnerabilities to climate change?
10. What are the sustainable alternatives for New Mexico communities as energy and water resources are exploited in a climate-changing world when the physical and social science are considered simultaneously and with feedback?
11. What full life cycle implications of energy extraction processing production on environment, water economy and how does life cycle evolve with climate change?
12. What new sensing technologies should be developed to better monitor resources availability, usage, and quality?
13. How can the public ensure efficient progress sound policies. Re: WEE measures are enacted?
14. How do we evaluate policies?

Next steps

- Science white papers
  - September 28: First draft of white paper sent to team reviewers
  - October 3: Revisions back to lead writer
  - October 10: Draft to full development team
  - October 12: Final comments to lead writer
  - October 16: Final draft to EPSCoR Office (mjdaniel@unm.edu)
- Fall 2011 – Stakeholder planning meetings
  - Oct 21 – research infrastructure and CI
  - Nov 21 – education, outreach, and workforce development
- Dec 2011 – Establish Proposal Steering Committee
- Jan – July 2012 – Proposal writing and additional workshops

Evaluation and Assessment: Process



Michener, Kimbell, & Minnick © 2009

Thank you!