New Mexico EPSCoR State Committee Meeting
26 October 2009
New Mexico EPSCoR State Office

Agenda

11:00: Meeting called to order and State Committee updates (Jack Jekowski, Chairperson)

- Introductions
- Welcome to new members Dr. Viola Flores, Secretary of Higher Education, State of NM, and Valerie Montoya, Vice President of Academic Affairs, SIPI.
- Review agenda
- 29 September 2009 CUP Meeting and approval of new committee members
- Approval of Minutes from Spring 2009 meeting
- Perspectives on NSF Reverse Site Visit

11:25: Response to NSF Reverse Site Visit report (Bill Michener, Project Director)

- Summary of official response
- Briefing and discussion of "Diversity Plan"

11:50: Summary of EPSCoR Year 1 progress and upcoming events and milestones (Bill Michener, Project Director; Katherine Mitchell, Associate Director)

- Track 1 RII - Year 1 in review
- Track 1 RII - Upcoming events and milestones
- Track 2 CI - Award and Kick-off
- C2 Proposal - Update
- Search for Associate Director

12:15: LUNCH

12:45: *Climate Change Research and Education at the Valles Caldera* (Robert Parmenter, Chief Scientist)

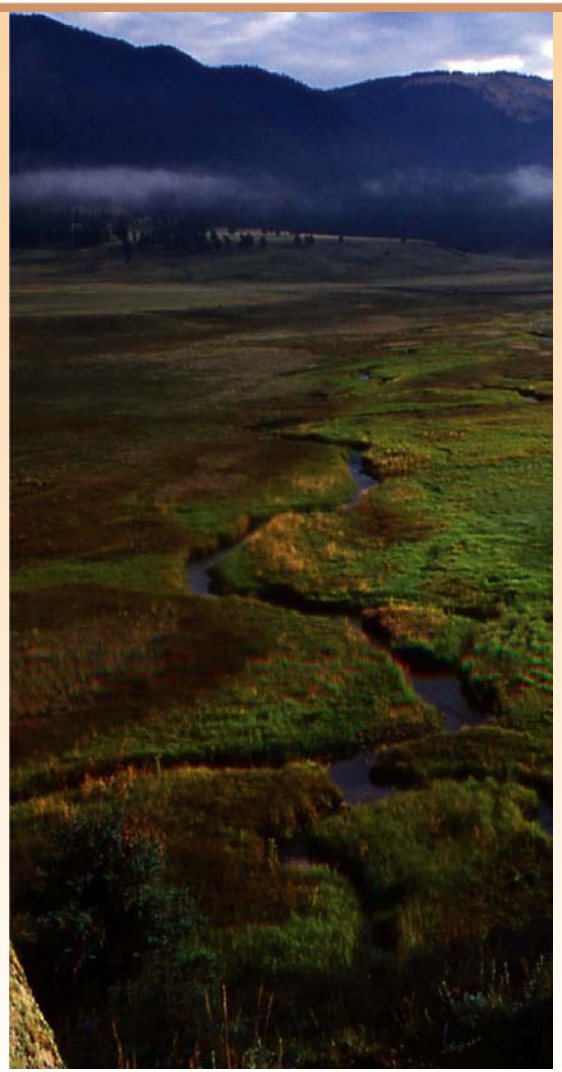
1:20: DOE EPSCoR Lab-Partnership update (Katherine Mitchell, EPSCoR) and Communicating DOE Opportunities (Nan Sauer, Los Alamos National Laboratory; Anne Marie Garcia, Sandia National Laboratory)

1:50: Other business (Jack Jekowski)

- Spring meeting at Valles Caldera?
- Agenda items

2:00: Close of meeting

New Mexico EPSCoR



NM EPSCoR
State Committee Meeting

October 26, 2009

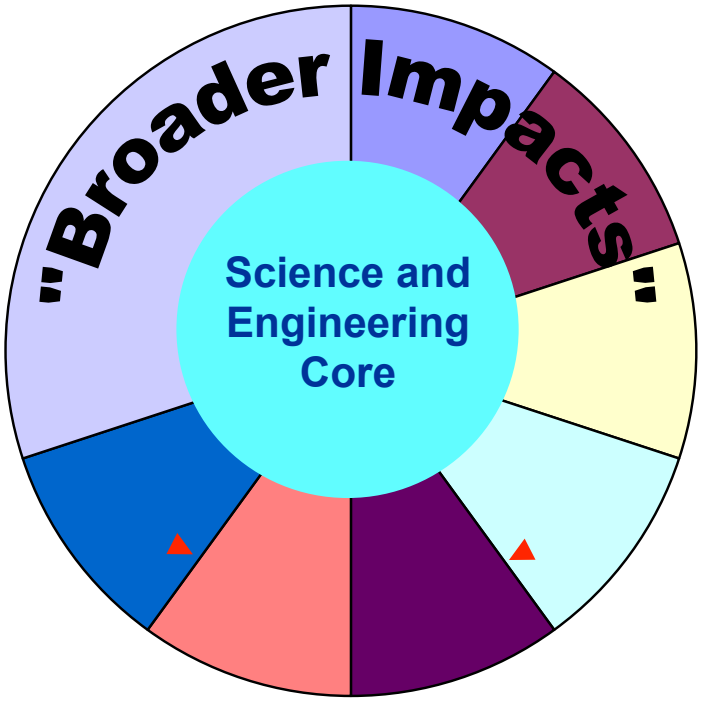
State Committee Updates, Jack Jekowski

- Introductions
- Welcome to new members, Viola Flores, Secretary of Higher Education, State of NM, and Valerie Montoya, Vice President of Academic Affairs, SIPI.
- Review agenda (packet)
- 29 September 2009 CUP Meeting and approval of new committee members
- Approval of Minutes from Spring 2009 meeting (packet)
- Perspectives on NSF Reverse Site Visit

The "New" NSF EPSCoR

RII – Research Infrastructure Improvement Grant Program

- EPSCoR is now in the NSF Director's Office (Office of Integrated Activities)
- New NSF EPSCoR Director – Dr. Henry Blount
- RII is for five years – up to $15M
- NSF Strategic Initiatives are now included specifically in RII RFP and tied to the American Competitiveness Initiative and America COMPETES Act
- RII award approval by Director's Office and National Science Board



"Broader Impact" Areas

- Diversity
- Cyberinfrastructure
- Outreach/Communications
- Evaluation and Assessment
- Management Succession
- Education
- Sustainability/Partnerships
- Administration/Pgm Mgt

Note: % distribution of funding and resources for each of the Broader Impact areas will be reviewed by NSF responsible program officials for adequacy as part of an integrated proposal from the Jurisdiction

Broader Impact Criterion

- How well does the activity advance discovery and understanding while promoting teaching, training, and learning?
- How well does the proposed activity broaden the participation of underrepresented groups (e.g. gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?
- Will the results be disseminated broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to society?

Response to NSF RSV, Bill Michener

- NSF Reverse Site Visit in DC September 14, 2009
- Summary of official response
  - NSF RSV Review Panel comments (packet)
  - NM EPSCoR response (packet)
- Briefing and discussion of “Diversity Plan” (packet)

Response to NSF RSV

1. Enhance diversity at research institutions—see diversity plan
2. Track long-term outcomes of summer workshops (especially students)—response by Minnick & Associates
3. Succession plan to grow junior staff—see succession plan
4. Develop a scientific synthesis plan—see plan which includes IAS-supported synthesis workshops, IWGs, and semi-annual meetings
5. Consider working with pre-service teachers—response by education leaders

Response to NSF RSV

6. Consider additional dissemination of Spanish-translated educational resources—response by education team
7. Increase leadership diversity on diversity working group—see plan endorsed by co-Chairs Marnie Carroll and Mike Pullin
8. Advisory committee scheduled for Jan. 11-13, 2010
9. Enhance formative and summative evaluation—response by Minnick & Associates
10. Plan for sustaining meteorological stations—response by Al Rango
11. Coordination between NMHU and NMT water quality researchers—response by Pullin (NMT) and Martinez (NMHU)

Planning for “Diversity Plan” modification

- (1) complete an environmental scan of institutional diversity at colleges and universities in New Mexico and at peer institutions within our region
- (2) compile pointers to existing diversity plans at New Mexico institutions and highlight exemplary plans within and outside our state; and
- (3) convene a diversity workshop as part of our New Mexico EPSCoR State Committee meeting that will be held Monday October 26th in Albuquerque
- Use input (1-3) to fashion a best practices diversity plan for New Mexico’s research universities that highlights EPSCoR diversity goals, builds on key EPSCoR programs such as the Faculty Leadership Program, and provides recommendations and approaches for increasing the participation of women and underrepresented minorities on the faculty.
- Plan will be researched and presented for review at the spring meeting of the New Mexico EPSCoR State Committee. Pending approval of the State Committee, the final Plan will be presented to the Council of University Presidents at their fall 2010 meeting.

Year 1 EPSCoR Summary, Bill Michener

- Track 1 RII
  - Year 1 in review
- Track 1 RII
  - Upcoming events and milestones
- Track 2 CI
  - Award and Kick-off
- C2 Proposal
  - Update
- AD Search

Track 1 RII - Year 1 in review

- Northern NM watersheds instrumented for hydrology and meteorology research
- 2 key climate models ported to Encanto
- Faculty Leadership Program attracted 19 NM faculty: ENMU, NMT, SJC, NMSU
- Funded 3 Innovation Working Groups: 1 NMSU, 1 NMT and Dine, 1 Tri-State led by NV
- First K-12 Teacher Professional Development Workshop run by the Northern Network
- NM Museum Natural History and Science climate change exhibit—completed formative input and design stages

Track 1 RII - Upcoming events and milestones

- Upcoming Meetings
  - All Hands Meeting, November 23, 2009
  - Faculty Leadership Program, January 5-7, 2010
  - External Advisory Committee on-site visit, January 11-13, 2010
  - National EPSCoR PD/PA meeting in Albuq., January 19–21, 2010
- Year 2, some milestones in 2010
  - Complete field installation of hydrology, meteorology and snowpack monitoring network in north central NM
  - Begin climate change impacts on water quality research
  - Initiate SEED grants program, up to $40,000 per school
  - Open *Climate Change in New Mexico* exhibit at NMMNHS

Track 2 CI - Award and Kick-off

- *Cyberinfrastructure Development for the Western Consortium of Idaho, Nevada and New Mexico*
- $2 million per state over 3 years; awarded October 2009
- Project Goals and Objectives
  - Increase connectivity and bandwidth
  - Enhance data and model interoperability
  - Utilize CI to integrate research with education
- Kick-off and planning meeting November 5, Reno, NV.

C2 Proposal - Update

- *C2: Improving Broadband Access for Tribal and Regional Colleges in New Mexico*
- $ 1 million over 2 years; proposals due November 2nd
- Project Goals and Objectives
  - Northern New Mexico College
    - Improving on-campus broadband connectivity
  - Navajo Technical College
    - Extending inter-campus wireless connectivity
  - Western New Mexico University
    - Improving on-campus broadband connectivity

Lunch, Speakers and Discussion

- 12:15: LUNCH
- 12:45: *Climate Change Research and Education at the Valles Caldera* (Robert Parmenter, Chief Scientist)
- 1:20: DOE EPSCoR Lab-Partnership update (Katherine Mitchell, EPSCoR) and Communicating DOE Opportunities (Nan Sauer, Los Alamos National Laboratory and Marie Garcia, Sandia National Laboratory) (packet)
- 1:50: Other business (Jack Jekowski)
  - Spring meeting at Valles Caldera?
  - Agenda items
- 2:00: Close of meeting

DOE EPSCoR

- Dr. Plamen Atanassov (UNM CNE Department) presented his team's research at the Annual DOE EPSCoR meeting at Brookhaven National Labs; considered to be the highlight of the meeting
- State/National Laboratory Partnership Grants; 8 pre-proposals submitted by NM with 2 accepted by DOE for full applications (packet)
  - Nikolai Kalugin, NMT and SNL, "Brand Structure, electron relaxation properties, and Raman scattering in planar and nonplanar nanostructures"
  - Zayd Leseman, UNM and SNL, "Manipulation of Phonons with Phononic Crystals"

NM EPSCoR State Committee Meeting Minutes
May 27, 2009
2:00 – 4:00 pm
Hotel Santa Fe, Santa Fe, New Mexico

Attending:
Jack Jekowski (Chair)
Michael Dougher (UNM)
John Montgomery (WNMU)
Linda LaGrange (NMHU)
Anthony Sena (NNMC)
Nam Sauer (LANL)
Kurt Steinhaus (LANL)
Tom Bowles (State of NM)
Stephan Helgesen (State of NM)
Ron Tafoya (Intel)
William Michener (EPSCoR)
Katherine Mitchell (EPSCoR)
Anna Morrato (EPSCoR)

On conference call:
Vimal Chaitanya (NMSU)
Beverlee McClure (ACI)

Meeting called to order 2:10 pm

Introductions

Welcome by Jack Jekowski, Chairman

- The NM EPSCoR climate change research and education agenda is well-positioned at this time considering national and state political and scientific agendas on this topic
- "Right Time and Right Place" for NM EPSCoR

Current RII 3 Overview and Progress

- PowerPoint Presentation by Bill Michener and Katherine Mitchell
- www.nmepscor.org/- About Us – State Committee
- http://nmepscor.unm.edu/node/93

Discussion:
- Jekowski – nice to see the broader impacts focus played out in actual programs and student activities
- Michener – new EPSCoR Track 2 award decision denied funding to states that did not understand/deliver on the broader impacts agenda

EPSCoR State Program News and Activities Update

- PowerPoint Presentation by Bill Michener
- www.nmepscor.org/- About Us – State Committee
- http://nmepscor.unm.edu/node/93

Discussion:

- Michener – post card mailings as a means to raise NM EPSCoR exposure, mailed to state legislators and others, 4 times per year; asked for input and suggestions
- Jekowski – new "Climate Change Impacts on Mountain Sources of Water" poster looks good; offer that EPSCoR office will mail printed copies as requested
    - Chaitanya – requested copy
- Michener - comments in addition to Power Point presentation slide content:
    - Strategic Plan –our office and NSF will use it for annual review; available from our website
    - Tri-State Western Consortium – NSF saw the climate change theme similarity among the 3 states of NM, ID and NV and requested a plan for interactions; idea blossomed into a joint annual meeting and collaborations; positioned states well for Track 2 CI proposal collaboration requirement; collaboration builds the critical mass needed for bigger NSF projects and improves our ability to generate good proposals and have higher success rate
    - New NSF EPSCoR C2 RFP will be released in June; amount may be 1 million total or 1 million per year for 2 years; funds for inter and intra-campus connectivity with MSI emphasis; EPSCoR office will work with Tom Bowles and Lenny Martinez
    - Steinhaus: How much is the DOE Lab Partnership award? Its $200,000 total.
    - External Advisory Committee – scientists asked for a meeting end of 09; accelerated to hold meeting in late August due to NSF reverse site visit in September
    - NSF Reverse Site Visit – in DC on September 14
    - EPSCoR National Meeting – held in Alabama in October around October 20th; no agenda yet; what State Committee members are interested in attending? Need to contact Michener if they would like to come

Committee Member Vacancies: Tribal Colleges and Business Sector

Discussion:

- Jekowski – discussed lack of representation by the tribal colleges; suggested Valerie Montoya, VP of Academic Affairs at Southwestern Indian Polytechnic Institute (SIPI), and asked to put her name in nomination
- Steinhaus – moved to recommend Valerie Montoya as a representative to the State Committee
- Sena– seconded the motion; the motion passed unanimously by the group and will be forwarded to the Council University Presidents (CUP) for approval
- Bowles – discussed Tom Davis, Navajo Technical College (NTC) as a possible representative; need for Tom Davis to attend meetings by distance technologies; offered new Gateway system being installed as an option; EPSCoR office will contact Tom Davis and ascertain his interest
- Sena – Mark Bauer from Dine as a possible committee member
- Michener – NSF does not consider Dine a New Mexico school because its main office is in Arizona
- Jekowski – asked McClure for assistance in increasing participation from the private sector; Beverly agreed to solicit interest and suggest names

Committee Member Vacancies: Co-Chair position

Discussion:

- Jekowski – discussed whether the NM Secretary of Higher Education should have a permanent position as Co-Chair on the State Committee; current Secretary is Dr. Peter White; Jack talked to Chair of CUP, Dr. Dan Lopez to make him aware of the suggestion
- Jack suggested if this is approved by the CUP we consider changing the By-Laws to reflect the policy - does this position require a change to the by laws or not?
- Chaitanya – Does the Deputy Secretary of Higher Education serve as an alternate if the Secretary cannot attend? Is Dr. Bill Flores still the Deputy Secretary?
- Jekowski – recommended that the Deputy Secretary be an alternate to the Secretary and be a full participant in the committee
- LaGrange – stated it was a reasonable approach; motioned to recommend to the CUP that the Secretary serve as permanent Co-Chair and the Deputy as an alternate; unanimous approval

New Secretary of Higher Education, Dr. Peter White

Discussion:

- Jekowski – discussed Secretary White's appointment and issues discussed in the release of his first newsletter
    - Recommended change in higher education funding formula
    - "Toolbox Revisited" article and achievement criterion for high school students
    - Proposed UNM Rio Ranch campus and NMSU Dona Ana campus as alternative 4-year institutions

NSF Emerging Directions

Discussion:

- Jekowski – Obama Administration Office of Science and Technology white papers on science investment
    - Climate change science R&D called out (page 8)
- Jekowski – Responsibility of the State of NM and NM EPSCoR to hold a broader picture of science and technology in the state and how it plays a role in benefitting the nation

- PowerPoint Presentation by Bill Michener
- www.nmepscor.org/- About Us – State Committee
- http://nmepscor.unm.edu/node/93

- Discussion/comments in addition to Power Point presentation slide content:
    - ARI – large multi-million award that is per institution; most NM institutions should pursue these funds; $200 million in Recovery Act funds
    - 2009 budget – Recovery Act Money went to Research and Related and not other areas; EPSCoR has $50 million allocated that will go to the C2 award
    - DOE & NSF – less joint funding and partnerships than is desirable especially on climate and energy interface
    - Steinhaus – seen recent advances toward better DOE & NSF linkages especially regards Recovery Act money
    - Jekowski – DOE Recovery Arct funds for ARPA E of $400 million in FY10
    - Michener – use NM EPSCoR Innovation Working Group (IWG) funds to bring together DOE, labs, Higher Ed to hammer out a climate and energy proposal
    - NSF total budget is predicted by NSF to double in years from 2006 – 2016
    - Lesson is that this is a great time to encourage faculty to put together some competitive NSF proposals

State of NM Science and Technology Plan

- PowerPoint Presentation by Tom Bowles
- www.nmepscor.org/- About Us – State Committee
- http://nmepscor.unm.edu/node/93
-
- Jekowski – Introduced Tom Bowles and Stephan Helgesen and commented that the current political infrastructure supports the State S&T Plan
- Jekowski – updates to the Research Investment Landscape map; addition of the NM Research Applications Center (NM RAC)
- Tom Bowles acknowledged NM EPSCoR's role in promoting the need for, and assisting with the S&T Plan – the first of its kind ever produced by New Mexico.
- Jekowski – commented that this will be well received by NSF. Michener – commented that this plan will serve as the basis for future RII proposal calls.

- Discussion/comments in addition to Power Point presentation slide content:
    - Overarching goal of S&T Plan is to improve the standard of living for New Mexicans by moving increasingly to a high tech economy
    - NM RAC – by legislated statute (S.B. 209), a private, non-profit organization that can take State funds and support collaboratory research efforts by industry, universities, and all entities; RAC will serve as a central clearinghouse and coordinate proposals for federal Recovery Act – for eg. Green Grid
    - NM CAC – status is that it did not received legislative funding; discussion of LFC report,; Albq Jrnl article on LFC report; NM CAC refuted LFC inaccuracies through documentation and corrected information; NM CAC will have an Albq Jrnl article reply
    - NM CAC – importance to EPSCoR through the Gateways being installed at every Higher Ed institution in the State; Gateway rollout will begin late summer; deferring the Gateway installations by 9 months reduced the cost by a factor of 3 due to newer technologies at lower costs
    - Green Grid – goal is to know risks and return on investment well enough to spur venture capitalists to invest in demonstration projects; Japan METI will partner and invest $60 Mill in an Albq demonstration project; Recovery Act state match requirement is a constraint but under discussion and Japanese partners should also count towards match
    - Sauer – who is lead on Green Grid proposal?
    - Bowles – NM RAC, if stood up by due date, would submit proposal
    - Steinhaus – Tom Bowles has been outstanding as Science Advisor to the Governor. Kudos repeated by Jekowski, remarking on the difficulties associated with coordinating among so many diverse interests, and the significance of the accomplishment that had long been sought by NSF for every EPSCoR state.

Proposed Agenda Items for the Fall State Committee Meeting

- Michener – suggests two important topics for the fall meeting:
    1) Workforce Development as an issue that NSF is strongly incorporating into all awards; invite NSF participation
    2) DOE-NSF partnerships
- Jekowski – requested whether Nan Sauer and Marie Garcia could help build an NSF & DOE collaboration agenda for the fall meeting

- Sauer – agreed to assist; NNSA labs have a growing relationship with the Office of Science; probably will ask Office of Science Project Director at LANL to talk with us on DOE landscape and how it relates to NSF
- Follow up on ARPA E – what has gone on up to now and what can this committee do to seed opportunities in nano-technology
- Jekowski – need to get feedback from Bowles and Helgesen on their legislative priorities and how it links to EPSCoR mission and that of the Higher Ed institutions
- Jekowski – ACI education committee has a workforce development goal; need to include ACI in meeting planning
- Steinhaus – request to have one of the lead Investigators for the RII 3 Climate Change research present on a research area and findings

Hand out materials from the meeting. Available for download from the website.

www.nmepscor.org - Navigate to - About Us – State Committee – Meeting May 09
Or direct link: http://nmepscor.unm.edu/node/93

1) State Committee Meeting May 09 packet. This is a pdf of all materials distributed at the meeting. Notes below address materials that were not in the packet, or that underwent changes for the final presentation.
2) Agenda. Pdf file.
3) EPSCoR RII 3 Broader Impact Areas. This is a pdf of a Power Point slide illustrating the important role played by NSFs "Broader Impact" criterion. (*Not included in packet*)
4) EPSCoR RII 3 Project Update and Program News and Activities. This is a pdf file of the Power Point presentation given by William Michener and Katherine Mitchell. (*Version has some changes from the one included in the packet*)
5) Office of Science and Technology 2010 Policy and Budget. This is a pdf of the Obama Administration science policy and budget priorities.
6) New Mexico Science and Technology Plan Update. This is a pdf of the Power Point presentation given by Tom Bowles, Governor Science Advisor. (*Not included in the packet*).
7) NSF Emerging Issues. This is a pdf of the Power Point presentation on NSF FY 2009 and FY 2010 budget information given by William Michener. *(Not included in the packe*t).
8) Notice of Appointment of new Secretary of Education. This is a pdf of the announcement from the Governor's office. (*Not included in the packet*).
9) Newsletter from new Secretary of Higher Education, Dr. Peter White. This is a pdf of the May 26, 2009 newsletter from Secretary White with education policy overview. (*Not included in the packet*).
10) "Toolbox Revisited" paper. This is a pdf of the paper cited by Secretary of Higher Education White. (*Not included in the packet*).
11) Poster: New Mexico Research Landscape. This is a pdf of an updated version of the poster.
12) Poster: Climate Change Impacts on New Mexico's Mountain Sources of Water. This is a pdf of the new EPSCoR RII 3 poster. (*Not included in the packet*).

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL ECONOMIC COUNCIL
OFFICE OF SCIENCE AND TECHNOLOGY POLICY

A STRATEGY FOR AMERICAN INNOVATION: DRIVING TOWARDS SUSTAINABLE GROWTH AND QUALITY JOBS

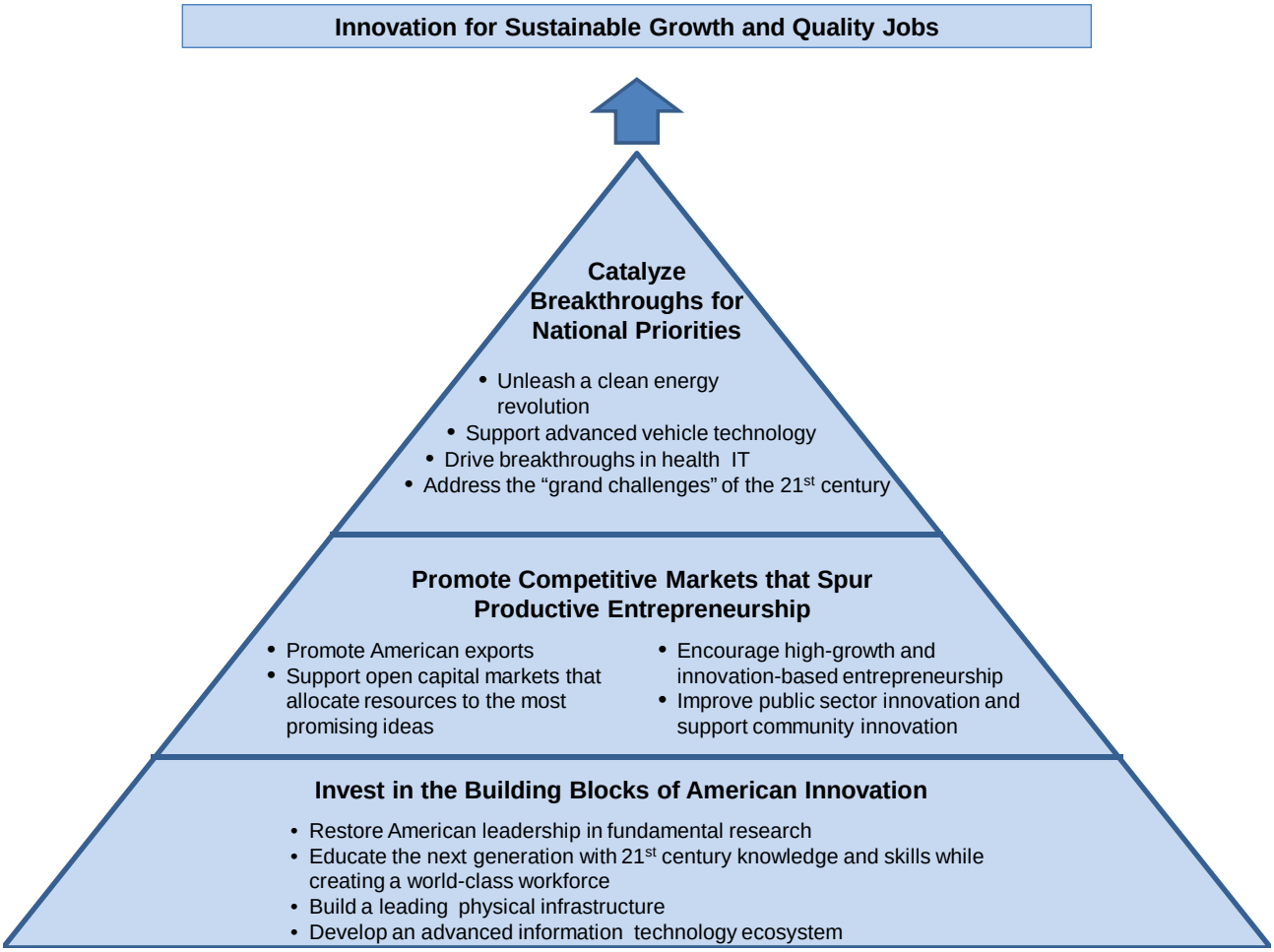
History should be our guide. The United States led the world's economies in the 20th century because we led the world in innovation. Today, the competition is keener; the challenge is tougher; and that is why innovation is more important than ever. It is the key to good, new jobs for the 21st century. That's how we will ensure a high quality of life for this generation and future generations. With these investments, we're planting the seeds of progress for our country, and good-paying, private-sector jobs for the American people."

-President Barack Obama, August 5, 2009

SEPTEMBER 2009

EXECUTIVE SUMMARY

Since taking office, President Obama has taken historic steps to lay the foundation for the innovation economy of the future. The Obama Innovation Strategy builds on well over $100 billion of Recovery Act funds that support innovation, additional support for education, infrastructure and others in the Recovery Act and the President's Budget, and novel regulatory and executive order initiatives. It seeks to harness the inherent ingenuity of the American people and a dynamic private sector to ensure that the next expansion is more solid, broad-based, and beneficial than previous ones. It focuses on critical areas where sensible, balanced government policies can lay the foundation for innovation that leads to quality jobs and shared prosperity. It has three parts:



1. **Invest in the Building Blocks of American Innovation.** We must first ensure that our economy is given all the necessary tools for successful innovation, from investments in research and development to the human, physical, and technological capital needed to perform that research and transfer those innovations.
   - **Restore American leadership in fundamental research.** President Obama implemented the largest increase in basic R&D in history, which will lay the foundation for new

discoveries and new technologies that will improve our lives and create the industries of the future.

- **Educate the next generation with 21st century knowledge and skills while creating a world-class workforce.** President Obama has proposed initiatives to dramatically improve teaching and learning in K-12 education, expand access to higher education and training, and promote student achievement and careers in STEM (Science, Technology, Engineering, and Mathematics) fields.
- **Build a leading physical infrastructure.** Through the Recovery Act, the President has committed to a historic investment in our nation's roads, bridges, transit, and air transportation networks to connect our people and our businesses.
- **Develop an advanced information technology ecosystem.** For America to lead the world in the technologies of the future, President Obama believes that all Americans must have affordable 21st century access to the Internet.

2. **Promote Competitive Markets that Spur Productive Entrepreneurship.** It is imperative to create a national environment ripe for entrepreneurship and risk taking that allows U.S. companies to be internationally competitive in a global exchange of ideas and innovation. Through competitive markets, innovations diffuse and scale appropriately across industries and globally.
   - **Promote American exports.** Exports will play an increasingly critical role in the future of the American economy, and the President's plans will ensure fair and open markets for American producers.
   - **Support open capital markets that allocate resources to the most promising ideas.** Open capital markets are one of the greatest strengths of the American economy, and the President is committed to making sure these markets work.
   - **Encourage high-growth and innovation-based entrepreneurship.** The Obama Administration believes it is essential that entrepreneurs continue to create new and vibrant businesses that lead to new jobs and economic growth.
   - **Improve public sector innovation and support community innovation.** Innovation must occur within all levels of society, including the government itself. The Obama Administration supports the broad adoption of community innovations that work and is committed to making government perform better and more efficiently, including by working more openly.

3. **Catalyze Breakthroughs for National Priorities.** There are certain sectors of exceptional national importance where the market is unlikely to produce the desirable outcomes on its own. These include developing alternative energy sources, reducing costs and improving lives with health IT, and manufacturing advanced vehicles. In these industries where markets may fail on their own, government can be part of the solution.
   - **Unleash a clean energy revolution.** Historic investments in smart grid, energy efficiency, and renewable technologies like wind, solar, and biofuels will help unleash a wave of ingenuity and progress that creates jobs, grows our economy, and ends our dependence on oil.
   - **Support advanced vehicle technologies.** Record battery grants announced last month are part of a concerted effort to place the U.S. on the cutting edge of advanced vehicle technology, from electric cars to biofuels to advanced combustion.

- **Drive innovations in health care technology.** The President's health IT initiative is designed to drive technological innovation that will help prevent medical errors, improve health care quality, reduce costs, and cement U.S. leadership of this emerging industry.
- **Harness science and technology to address the "grand challenges" of the 21st century.** The President's commitment to science and technology will allow the United States to set and meet ambitious goals, such as educational software that is as effective as a personal tutor and smart anti-cancer therapeutics that deliver drugs only to tumor cells.

I –PROBLEMS WITH THE BUBBLE-DRIVEN GROWTH OF THE PAST

A strong economy, but too reliant on precarious, bubble-driven growth, is unsustainable

Despite American economy's historic strength, our economic growth has rested for too long on an unstable foundation. Explosive growth in one sector of the economy has provided a short-term boost while masking long-term weaknesses. In the 1990s, the technology sector climbed to new heights. The tech-heavy NASDAQ composite index rose over 650 percent between 1995 and 2000, but then lost two-thirds of its value in a single year, triggering a painful recession.

After the tech bubble burst, a new one emerged in the housing and financial sectors. During the course of the decade, the formula for buying a house changed: instead of saving to buy their dream house, many Americans found they could take out loans that by traditional standards their incomes could not support. The financial sector willingly propped up real estate prices, funneling money into real estate and finding innovative ways to spread the credit risk throughout the economy. From 2000 through 2006, house prices doubled while the financial sector grew to account for fully 40 percent of all corporate profits.

This too proved to be unsustainable. House prices lost a quarter of their value in two and a half years. The housing decline and accompanying stock market collapse wiped out over $13 trillion in wealth in 18 months. The bursting of the bubble based on inflated home prices, maxed-out credit cards, over-leveraged banks, and overvalued assets wreaked havoc on the real economy, triggering what is expected to be the longest and deepest recession since World War II and driving the unemployment rate to its highest level in a quarter century.

This type of growth isn't just problematic when the bubble bursts, it is not entirely healthy even while it lasts. Between 2000 and 2007 the typical working-age household saw their income decline by nearly $2,000. As middle-class incomes sank, the incomes of the top one percent skyrocketed. This phenomenon has a number of causes, but among them were the rising asset prices and the proliferation of financial sector profits.

A short-term focus has neglected essential fundamental investments

A short-term view of the economy masks underinvestments in essential drivers of sustainable, broadly-shared growth. It promotes temporary fixes over lasting solutions. This is patently clear when looking at how education, infrastructure, healthcare, energy, and research – all pillars of lasting prosperity – were ignored during the last bubble.

Too many children are not getting the world class education they deserve and need to thrive in this new innovative economy.

- Despite research documenting that quality matters greatly in early childhood education settings and that investments in high-quality early learning have the highest potential rates of return, the Federal government lacks the level of investment needed to transform the quality of, and enhance access to, early education for our youngest children. Studies

show a school readiness gap as early as kindergarten –and as wide as 60 points –between children from the highest socio-economic background and their less affluent peers.

- We have neglected to provide our children with the rigorous curriculum and instruction needed to prepare them for college and career. By the end of high school, African American and Latino students have math and reading skills equivalent to those of 8th grade white students. Across the nation, the students with the greatest need for a qualified and effective teacher are also exactly those students most likely to be taught by teachers who lack sufficient background in the subject they teach.
- The problems persist when students look toward continuing their education past high school. The average tuition and fees at public, four-year institutions rose 26 percent between the 2000-2001 school year and the 2008-2009 school year. As a result, while 94 percent of high school students in the top quintile of socioeconomic status continue on to post-secondary education, barely half of those in the bottom quintile do so.
- Given rising costs of four-year institutions, many Americans are turning to community colleges for quality higher education. Yet the Federal government has historically under-invested in community colleges, giving them one-third the level of support per full-time equivalent student that it gives to public four-year colleges.

Our physical and technological infrastructure has been neglected, threatening the ability of American businesses to compete with the rest of the world.

- The American Society of Civil Engineers grades our country's physical infrastructure as a "D." In 2007, drivers on our clogged highways and streets experienced over 4.2 billion hours of delay and wasted 2.8 billion gallons of fuel.
- The United States once led the world in broadband deployment, but now that leadership is in question. Wireless networks in many countries abroad are faster and more advanced than our own.
- Our electrical grid is still constructed around the same model employed immediately after World War II. Power interruptions and outages cost American individuals and businesses at least $80 billion each year.

Health care costs have been allowed to spiral out of control, squeezing individuals and businesses at a time when they are feeling pressure on all sides.

- Since 2000, health insurance premiums have increased about 60 percent, 20 times faster than the average worker's wage.
- At the same time, the number of uninsured Americans has jumped by 7 million to 46 million.
- Overall, healthcare is consuming an increasing amount of our Nation's resources. In 1970, healthcare expenditures were 7 percent of GDP; now they are 16 percent of GDP; at this rate they will hit 20 percent of GDP by 2017.

Our economy has remained dependent on fossil fuels, exposing consumers and businesses to harmful price shocks, threatening our economic and national security, and resulting in a missed opportunity to lead the clean energy economy of the future.

- Between 1999 and 2004, the production tax credit for renewable energy was allowed to expire on three separate occasions. In each subsequent year (2000, 2003, and 2004) new wind capacity additions in the U.S. fell by more than 75 percent from the year before.
- Instead of focusing on finding ever more fossil fuels, other countries made aggressive investments in renewable energy, creating jobs and growing domestic energy sources.

Furthermore, we have compounded the problem by ignoring essential investments in high-technology research that will drive future growth.

- Over the last four decades, Federal funding for the physical, mathematical, and engineering sciences has declined by half as a percent of GDP (from 0.25 percent to 0.13 percent) while other countries have substantially increased their research budgets.

Despite this underinvestment in key drivers of growth, the American economy remains the most dynamic, innovative, and resilient in the world. We still have world-class research universities, flexible labor markets, deep capital markets, and an energetic entrepreneurial culture. Americans are twice as likely as adults in Europe and Japan to start a business with the intention of growing it rapidly. We must redouble our efforts to give our world-leading innovators every chance to succeed. We cannot rest on our laurels while other countries catch up.

II –A VISION FOR INNOVATION, GROWTH, AND JOBS

Innovation is Necessary to Fuel Our Recovery

Amidst the worst recession since the great depression, the Administration's initial economic objective has been to rescue our economy. We have taken – and will continue to take – bold and aggressive steps to stabilize the financial system, jumpstart job growth, and get credit flowing again.

But as the economy begins to stabilize, we must move on from rescue to recovery. Reflecting on the lessons of the past, we must rebuild a new foundation for durable, sustainable economic growth.

Innovation and investment must be a pillar of this new foundation. The basis of competition and the nature of the economy have changed, and we must change with them. Twenty years ago, the United States was losing domestic manufacturing firms and was competing with other countries to sell its goods. Now, manufacturing and services have merged, knowledge is a key factor of production, and services we thought could only be provided in particular countries are available anywhere. We need new ideas to provide Americans with new jobs, new services that take advantage of our globally interconnected world, and new skills that improve our manufacturing capabilities (See Box 1). Other countries understand that innovation is fundamental to their economic well-being and are finding new ways to advance their innovation agendas. We can be

even more ambitious, even more successful, and even more focused on building the essential sidewalks of innovation.

Box 1. The Importance of a National Innovation Strategy

Fundamentally, innovation is the development of new products, services, and processes. In our increasingly interconnected and globally competitive world economy, unleashing innovation is an essential component of a comprehensive economic strategy. As global competition erodes the return to traditional practices, the key to developing more jobs and more prosperity will be to create and deploy new products and processes. Put another way, the greatest job and value creators of the future will be activities, jobs, and even industries that don't exist yet today. The countries that catalyze their development will reap the greatest rewards.

Innovation is essential for creating new jobs in both high-tech and traditional sectors. In recent years, innovation has led to new jobs in high-tech and advanced manufacturing sectors as diverse as aerospace, nanotechnology, life sciences, and alternative energy. At the same time, innovations ripple through the economy, creating jobs for workers installing broadband networks, manufacturing biopharmaceuticals, and building advanced infrastructure.

A more innovative economy is a more productive and faster growing economy, with higher returns to workers and increases in living standards. America's average standard of living will double every 23 years if innovation catalyzes annual productivity growth of three percent, but it will take 70 years if productivity growth is only one percent. Currently, the U.S. enjoys a significant productivity advantage: one study calculates that the average productivity advantage of the United States over all other OECD countries as a group accounted for a full three quarters of the per capita income advantage the U.S. enjoys. Continued innovation in products, business practices, and technology is essential for extending our productivity gains.

Innovation is also crucial for maintaining the dynamism and resilience of our economy. Future challenges are impossible to predict, but what is certain is that an economy better able to switch gears, innovate solutions, and re-deploy old activities, jobs, and industries will be least susceptible to adversity.

Finally, innovation is itself the key to meeting some of the greatest challenges facing our nation and the world. It will be pivotal to ending our dependence on fossil fuels, helping Americans live longer, healthier lives, and protecting our freedom and our troops both at home and abroad.

Innovation is the key to global competitiveness, new and better jobs, a resilient economy, and the attainment of essential national goals. A strategy is clearly needed to direct our government's funding and regulatory decisions in order to capture the innovation opportunity.

Our Vision for American Innovation

Our vision of America's future is one where prosperity is built by skilled, productive workers and sound investments that will spread opportunity at home and allow this nation to lead the world in the technologies, innovation and discoveries that will shape the 21st century.

Innovation will create new jobs and catalyze broadly shared economic growth. The lives of every American will improve as innovations diffuse and scale throughout the economy, leading to breakthroughs in health, education, energy, transportation, information, and much more. We can set and meet grand challenges such as developing solar cells as cheap as paint, building anti-cancer drugs that spare healthy cells, and fitting the contents of the library of congress on a device the size of a sugar cube.

Sustained innovation will drive a dynamic evolution in the nation's workforce towards better paying jobs. American workers will continue to lead across a broad range of industries and sectors old and new, and will prosper accordingly. Workers making innovation-induced shifts to new jobs within and across industries will receive the transition and training support necessary to ensure no one is left behind.

The American economy is and will remain highly diversified. To a large extent these jobs of the future will be spread across major industries in a similar distribution to today's economy. As the Council of Economic Advisors described in a July report, one forecast that uses the most recent data available to project employment growth finds that the distribution of jobs across industries in the economy of 2020 will strongly resemble the distribution of 2008. Health and education services will see the most significant growth, while there will be proportionally fewer jobs in business and financial services as well as retail trade, in part because the growth in consumer spending is expected to slow. But by and large the picture is similar to today.

Box 2. The Transformation of the Semi-Conductor Industry

In the 1980s, the U.S. semiconductor industry lost its market share to Japanese competitors. But then it innovated its way back, replacing the old jobs in the dynamic-random-access-memory (DRAM) business with jobs producing microprocessors, digital signal processors, microcontrollers, and automotive semiconductors. Companies like Intel, Texas Instruments, and Motorola invested and succeeded, creating better jobs for hundreds of thousands of Americans. Throughout this shift to higher-value-added jobs, the total number of U.S. jobs in the industry held constant.

Of course, such forecasts are necessarily imperfect. They cannot capture the growth in industries that may not yet exist. For example, in the late 1980s there were no models that predicted the rapid growth of Internet-based information and computing services that now employ several million workers. Innovation in this sector –initially catalyzed and continuously supported by government investment –has made key contributions to our economy. Some experts estimate that the Internet adds as much as $2 trillion to annual GDP, over $6,500 per person.

Another shortcoming of these models is that they fail to capture many of the most important innovations and developments occurring in sub-industries. Yet the U.S. has a history of innovating towards higher-wage jobs within industries. The experience of industries as diverse as semi-conductors and boatbuilding illustrate this point amply (see Boxes 2 and 3).

We see an American future where this process of innovation in next-generation technologies and business ideas becomes pervasive, diffusing throughout the economy and generating better jobs and improved lives for all Americans. It is imperative that we turn this vision into a reality.

Box 3. Boat Builders along Maine's Eastern Coast

The Maine boat building industry is an example where innovation-led transformations occur on a smaller, more local scale. Maine boat builders have a 400-year heritage of skilled craftsmanship, but technological change was threatening to leave them behind. Instead, the boat builders have enthusiastically embraced cutting edge innovation in advanced composite technologies, replacing old jobs with better jobs in the same industry. Today, the Maine boat building industry produces a highly regarded product line that includes racing yachts, pleasure craft, workboats, and military vessels. As a result, wages in Maine's boat building industry have risen 19 in percent in real terms over the last decade while employment has risen 12 percent.

III –THE APPROPRIATE ROLE FOR GOVERNMENT

Framework for Government Involvement

While it is clear that a new foundation for innovation and growth is needed, the appropriate framework for government involvement is still debated. Some claim that the laissez-faire policies of the last decade approach the right strategy, and that the recent crisis was the result of too much rather than too little government support. This view calls for cutting government regulation and gutting public programs, hoping the market will take care of the rest.

However, the recent crisis illustrates that the free market itself does not promote the long-term benefit of society, and that certain fundamental investments and regulations are necessary to promote the social good. This is particularly true in the case of investments for research and development, where knowledge spillovers and other externalities ensure that the private sector will under-invest –especially in the most basic of research.

Another view is that the government must dominate certain sectors, protecting and insulating those areas thought to be drivers of future growth. This view calls for massive, sustained government investment supported by stringent oversight, dictating the type and direction of both public and private investments through mandates and bans.

But historical experience in this country and others clearly indicates that governments who try to pick winners and drive growth too often end up wasting resources and stifling rather than promoting innovation. This is in part due to the limited ability of the government to predict the future, but also because such exercises are distorted by lobbyists and rent seekers, which are more likely to favor backward looking industries than forward looking ones. In the United States such failures at picking winners and losers includes most prominently the Synthetic Fuel Corporation, a $20 billion Federal project in the 1980s that failed to provide the promised alternative to oil.

Therefore, we reject both sides of this unproductive and anachronistic debate. The true choice in innovation is not between government and no government, but about the right type of government involvement in support of innovation. A modern, practical approach recognizes both the need for fundamental support and the hazards of overzealous government intervention. The government should make sure individuals and businesses have the tools and support to take risks and innovate, but should not dictate what risks they take.

We propose to strike a balance by investing in the building blocks that only the government can provide, setting an open and competitive environment for businesses and individuals to experiment and grow, and by providing extra catalysts to jumpstart innovation in sectors of national importance. In this way, we will harness the inherent ingenuity of the American people and a dynamic private sector to generate innovations that help ensure the next expansion is more solid, broad-based, and beneficial than previous ones.

Examples of Successful Innovation Programs

We have been successful in the past, and we can be successful in the future. Take the example of DARPA, the historically innovative central research and development organization of the Defense Department. DARPA is tasked with maintaining U.S. technological superiority, and has a history of creating new industries in information technology and advanced manufacturing (see Box 4).

Box 4. DARPA's Successful Innovations

Thirty years ago, DARPA supported the creation of the internet's predecessor, ARPANET, despite discouragement from the private sector. Today, over 1.6 billion people use the Internet. DARPA's innovative research has created entirely new capabilities for the U.S. military such as stealth aircraft, GPS, the M-16 assault rifle, and night vision goggles. It has provided the foundation for new industries like optical networking, supercomputers, and design tools for computer chips. DARPA's commitment to high-risk, high-return research will help ensure America is prepared to meet the 21st century's national defense challenges while also catalyzing breakthroughs in technological innovations that will create new industries and improve people's lives.

Government support has also helped push America to the cutting edge in emerging fields such as nanotechnology, which involves engineering materials and devices on the atomic and molecular level (see Box 5).

The Administration is committed to strengthening and focusing investments in our world-class nanotechnology research and development pipeline; targeting support for nanotechnology transfer and facilitating commercial start-ups; and cross-disciplinary training and education of scientists and engineers in the new-generation workforce. This will enable us to capitalize on our investments and stay at the cutting edge of this rapidly growing technology.

This pattern of government support driving innovations that improve lives and catalyze

industries is pervasive. Of the 88 U.S. entities that received "R&D 100 Awards" as the nation's best innovations in 2006, 77 had received government support. We must build on this record of successful support to build a new foundation for innovation and growth.

Box 5. The Growing Fields of Nanotechnology and Personalized Medicine

A nanometer is a billionth of a meter – or one hundred thousand times smaller than the diameter of a human hair. Nanotechnology promises to transform multiple industries: capturing and storing clean energy, developing next-generation computer chips, early detection of diseases, smart anti-cancer therapeutics that deliver drugs only to tumor cells, and enabling all-new approaches to a wide range of manufacturing activities, among many other examples. While the commercial impact of nanotechnology to date has been limited primarily to nanomaterials applied to a range of consumer goods from healthcare and food products to textiles, automotive composites and industrial coatings, nanotechnology innovation is beginning to accelerate. The ten-year history of U.S. leadership in fundamental nanotechnology research and development under the National Nanotechnology Initiative has laid the crucial groundwork for developing commercial applications and scaling up production, creating demand for many new nanotechnology and manufacturing jobs in the near-term.

Nanotechnology is being applied in the developing medical engineering and personalized medicine industries. The practice of tailoring medical treatment to an individual's unique genetic make-up makes not only treatment, but early detection and prevention, more effective. It also reduces medical costs in cases where expensive treatments are unnecessary or futile. Researchers are currently experimenting with nanotechnology to develop drugs capable of targeting a disease without triggering the body's natural immune response.

The federal government's support has been essential in the development of this technology and this industry. The NIH, a major supporter of medical research, saw its budget increase 163% from 1993 to 2003 before stagnating until this year. President Obama has reversed the recent trend with $10 billion in additional NIH funding in the Recovery Act and a pledge for more sustained increases going forward. This funding will help these emerging industries flourish.

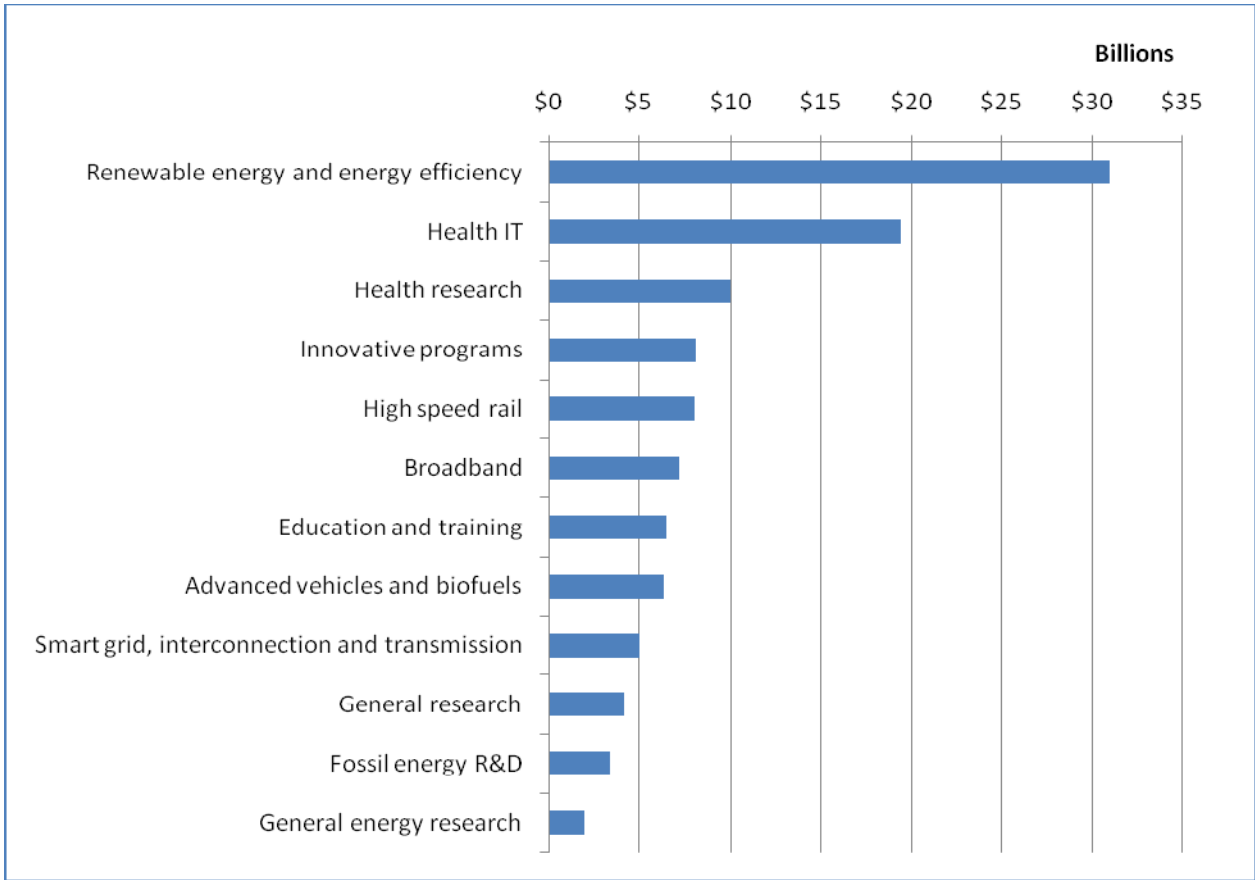
IV –A STRATEGY FOR AMERICAN INNOVATION

For our communities and for our country to thrive in this new century, we need to harness the spirit of innovation and discovery that has always moved America forward. We must foster innovation that will lead to the technologies of the future – which will in turn lead to the industries and jobs of the future.

President Obama has already taken historic steps to lay the foundation for the innovation economy of the future. In the Recovery Act alone the President committed over $100 billion to support groundbreaking innovation with investments in energy, basic research, education and training, advanced vehicle technology, innovative programs, health IT and health research, high speed rail, smart grid, and information technology (see Figure 1). His commitment also includes

broader support in the Recovery Act and in his FY2010 budget on initiatives from education to infrastructure. The President's commitment is not just limited to more government funding, but extends to important regulatory and executive order initiatives such as patent reform, coordinated fuel efficiency standards, net neutrality, permit policy for offshore wind farms, and naming the first ever Chief Technology Officer of the U.S. Government.

Figure 1. Innovation Funding in the Recovery Act



These investments and initiatives are part of The Obama Innovation Strategy, which focuses on critical areas where sensible, balanced government policies can lay the foundation for innovation that leads to quality jobs and shared prosperity. It has three parts:

1. **Invest in the Building Blocks of American Innovation.** We must first ensure that our economy is given all the necessary tools for successful innovation, from investments in research and development to the human, physical, and technological capital needed to perform that research and transfer those innovations.

2. **Promote Competitive Markets that Spur Productive Entrepreneurship.** It is imperative to create a national environment ripe for entrepreneurship and risk taking that allows U.S. companies to be internationally competitive in a global exchange of ideas and innovation. Through competitive markets, innovations diffuse and scale appropriately across industries and globally.

3. **Catalyze Breakthroughs for National Priorities.** There are certain sectors of exceptional national importance where the market is unlikely to produce the desirable outcomes on its own. These include developing alternative energy sources, reducing costs and improving lives with health IT, and manufacturing advanced vehicles. In these industries where markets may fail on their own, government can be part of the solution.

1. INVEST IN THE BUILDING BLOCKS OF AMERICAN INNOVATION

A. Restore American Leadership in Fundamental Research

President Obama recognizes the fundamental role of government in fostering groundbreaking scientific and technological breakthroughs, and has committed resources and energy to ensure America leads the world in the innovations of the future.

- **Enact the Largest R&D increase in our nation's history.** With $18.3 billion in research funding, the Recovery Act is part of the largest annual increase in research and development in America's history.

- **Double the R&D budget of key science agencies.** The President's Budget proposed to double the research budgets of three key science agencies: the National Science Foundation, the Department of Energy's Office of Science, and the National Institutes of Standards and Technology. These investments will expand the frontiers of human knowledge and create the foundation for the industries and jobs of the future, such as the convergence of bio, info, and nanotechnologies. The Obama Administration will increase the impact of this investment by providing more support for high-risk, high-return research, for multidisciplinary research, and for scientists and engineers at the beginning of their careers.

- **Invest three percent of GDP in R&D**. The President has proposed a goal that as a country, we invest more than three percent of our GDP in public and private research and development. This will exceed the level achieved at the height of the space race.

- **Make the R&E tax credit permanent.** The President's Budget includes the full $75 billion cost of making the research and experimentation tax credit permanent. This will provide businesses with the greater confidence they need to invest, innovate, and grow.

B. Educate the Next Generation with 21st Century Knowledge and Skills While Creating a World-Class Workforce

America's high levels of education were an important contributor to rising living standards in recent years. For America to continue to lead the world in science and technology innovation, it must have the most knowledgeable and skilled workers in the world.

- **Reform public schools to deliver a complete and competitive education.** The President is committed to an education system that will prepare every child for success in

a new, global economy. The Obama Administration is supporting the improvement of teaching and learning to ensure that students master world-class knowledge and critical skills for the 21st century; enhance and reward success in the teaching profession; drive innovation in America's classrooms; and expand successful models to improve outcomes for middle- and high-school students. The President's Race to the Top in America's schools will deliver a historic investment and challenge the states to design and enforce higher and clearer standards, attract and keep outstanding teachers in the classroom, and use effective approaches to turn America's lowest-performing schools around.

- **Restore America to first in the world in college graduates**. Colleges, universities, and their students are bedrocks of American innovation. President Obama has called for restoring America to first in the world in the proportion of college graduates by 2020. Between the Recovery Act and the 2010 budget, the Administration is seeking nearly $200 billion over the next decade for scholarships and tax credits to help students complete college. The Obama Administration is investing in innovative strategies to support college persistence, simplify the student aid application and reform the student loan program to shift billions in wasteful spending toward greater help for students to reach and complete college. The Administration has been actively working with Congress to fund these priorities by eliminating waste in the student aid program.

- **Improve America's Science, Technology, Engineering and Math (STEM) education.** STEM education is particularly important to America's future scientific progress and economic growth. As part of his effort to promote innovation in K-12 education, the President has challenged governors, philanthropists, scientists, engineers, educators and the private sector to join with him to dramatically improve achievement in STEM subjects. The President's Race to the Top fund aims to reinvigorate the teaching of STEM in America's classrooms and support advanced learning in these subjects, especially for women, girls and other underrepresented groups. The President is also committed to using the $4 billion Race to the Top fund to encourage states to put STEM at the center of their reform efforts. Finally, the Recovery Act provided a down payment toward the goal of tripling the number of NSF Graduate Research Fellowships in science and engineering.

- **Develop new career pathways in community college programs**. Given the innovation and advances coming in future years, jobs requiring at least an associate's degree are projected to grow twice as fast as those requiring no college experience. President Obama has proposed the American Graduation Initiative to produce 5 million more community college graduates by 2020, a key part of his college completion goal. The initiative would invest in promising reforms to raise graduation rates, tie courses to business needs, improve remedial education and strengthen transitions with high schools and four-year colleges. It would also leverage $10 billion in facilities modernization and repairs amongst other projects.

- **Design world-class online courses for post-secondary students**. The President is proposing to invest up to $500 million over the next 10 years to create world-class online courses available at community colleges for students to gain knowledge, skills and

credentials. These courses will be freely available, and enable students to extend learning opportunities and successfully complete their course work. Colleges, universities, publishers, and other groups will be invited to compete to create state-of-the-art online courses that combine high-quality subject matter expertise with the latest advances in cognitive and computer sciences.

- **Improve the processing of high-tech visas.** In order to maintain our role as a global leader and convener of scientific conferences and other gatherings, the Obama Administration has worked to ensure foreign scientists and technological leaders can visit the United States to participate in important events while continuing to protect sensitive technologies.

C. Build a Leading Physical Infrastructure

The President has committed to a historic investment in our nation's roads, bridges, transit, and air networks to connect our people and our businesses.

- **Invest in our nation's roads, bridges, and mass transit.** The Recovery act provides $36 billion for infrastructure projects to improve our nation's highways and mass transit systems. The Obama Administration has also proposed "investing for performance" reforms that will improve transparency and accountability in the transportation financing system. Specific reform measures include building state and metropolitan project evaluation capabilities, improving project assessment tools, and creating stronger public reporting requirements. These reforms will promote accountability in the transportation financing system and increase the return to transportation investments, thereby boosting long-term economic growth.

- **Modernize the Electric Grid.** Our current electricity transmission grid must be expanded and modernized to reduce congestion, maintain reliability, and accommodate the output from new sources of renewable energy. New technologies are being developed that present significant opportunities for consumers and businesses to control their energy use and costs, reducing the strain on the electric grid and improving performance. The Recovery Act provides $4.5 billion for the development of technologies to enable greater energy efficiency, customer demand response, energy storage, and other components of the "Smart Grid." The Recovery Act increased the borrowing authority of the Bonneville Power Authority by $3.25 billion and provided new borrowing authority of $3.25 billion for the Western Area Power Authority, enabling both Authorities to invest in transmission lines that will increase the development of renewables in their regions.

- **Fulfill a new transportation vision with high-speed rail.** The President has proposed a long-term strategy to build an efficient, high-speed rail network of 100-600 mile intercity corridors, as one element of a modernized transportation system. The President made a down payment on this strategy with an $8 billion investment in the Recovery Act. This will be used to leverage other public and private funding to invest in infrastructure, equipment, and intermodal connections along three tracks.

First, the strategy will advance new express high-speed corridor services (operating at speeds above 150 mph in some areas) in select corridors of 200-600 miles. Second, the strategy will develop emerging and regional high-speed corridor services (operating at speeds between 90 and 150 mph) in corridors of 100 to 500 miles. And third, the strategy will upgrade the reliability and service on conventional intercity rail services (operating at speeds up to 79-90 mph).

The President has also budgeted for another $1 billion per year to continue to develop the high-speed rail network.

- **Develop the next generation of air traffic control.** The FY2010 Budget provides $865 million for the Next Generation Air Transportation System in the Federal Aviation Administration. The Administration supports moving from a ground-based radar surveillance system to a more accurate satellite-based surveillance system, the development of more efficient routes through the airspace, and improvements in aviation weather information.

D. Develop an Advanced Information Technology Ecosystem

For America to lead the world in the technologies of the future, President Obama believes that all Americans must have affordable 21st century access to the Internet.

- **Expand access to broadband.** The Recovery Act provides $7.2 billion for broadband expansion and the 2010 budget includes $1.3 billion in USDA loans and grants to increase broadband capacity and telecommunication service. This support is a kickstart towards ensuring that all Americans have affordable 21st century access to the Internet. Widespread high-speed Internet access is essential for economic growth, job creation, and global competitiveness, and will foster the next generation of innovators while enabling reductions in energy consumption through telework, making online distance education tools accessible to all, enhancing remote medical monitoring capabilities, facilitating civic engagement, and supporting enhanced communications networks for first responders.

  Increased broadband access is a key input for rural economic development. It will enable rural businesses to improve their efficiency and expand their market reach; enable rural populations to compete remotely for a wide range of service jobs; and allow rural communities to retain their populations while attracting new businesses. The farm sector, a pioneer in rural Internet use, is increasingly comprised of farm businesses that purchase inputs and make sales online. Only 46 percent of adults in rural households have broadband access, compared to 67 percent for non-rural adults. America should lead the world in broadband adoption and Internet access, and we should not leave rural populations behind.

- **Assure net neutrality to preserve the freedom and openness of Internet access.** The Internet is the ultimate level playing field, making possible the widest and most lucrative

variety of entrepreneurial activity and innovation that the world has ever seen. FCC Chairman Julius Genachowski announced on September 21st that providers of Internet access should not discriminate against lawful applications or content. We want to make sure it remains possible for anyone to start a business in a garage that creates new jobs, new ideas, and new opportunities for Americans. Our nation's economy is increasingly dependent on the Internet; the Internet is an essential infrastructure, like roads and electricity; and the global leadership that America provides today stems directly from historic policies that have ensured that telecommunications networks are open to all lawful uses by all users. That's the way the Internet has always worked, and we want it to stay that way – not because we treasure our past, but because we care about our economic future.

- **Support research for next-generation information and communications technology.** The Administration is committed to supporting research that will foster the next wave of innovation in information and communications technologies, such as "cognitive radio" that allows for the efficient sharing of spectrum, quantum computing, efficient programming of parallel computers, cyber-physical systems, secure computers and networks, data-intensive supercomputers, and nanoelectronics that enables the continuation of Moore's Law for decades to come. The President's Budget supports this research through grants for the National Science Foundation, DARPA, and other public and private institutions.

- **Appoint a Chief Technology Officer of the U.S. Government**. In April, President Obama named the first ever Chief Technology Officer of the U.S. government. The CTO position was created to oversee the application of technology to create jobs and spur economic growth. The Administration is committed to recruiting high-level champions for innovation across the government.

- **Secure cyberspace**. The President has identified cybersecurity as a national priority to ensure that cyberspace – the globally-interconnected digital communications infrastructure - is sufficiently resilient and trustworthy to support U.S. goals of economic growth, civil liberties, privacy protections, national security, and the continued advancement of democratic institutions. Leadership in this effort has been anchored in the White House through the positions of the U.S. Chief Technology Officer, the U.S. Chief Information Officer, and the President's coming Cybersecurity Coordinator. This leadership team is partnering across the public and private sectors to build capacity for a digital nation through education, training and awareness; enhance security through information sharing, effective incident response planning, and privacy-enhancing identity management strategies; and encourage innovation through game-changing research and development strategies.

2. PROMOTE COMPETITIVE MARKETS THAT SPUR PRODUCTIVE ENTREPRENEURSHIP

A. <u>Promote American Exports</u>

Exports will play an increasingly critical role in the future of the American economy, and the President's plans will ensure fair and open markets for American producers.

- **Open markets abroad.** The Obama Administration is working with our trading partners to negotiate mutually beneficial trade agreements and to maintain the worldwide flow of goods, services, and capital. Only by keeping markets open can American producers sell to world markets and derive the benefits of participating in an open exchange of ideas and innovations.

- **Promote American Exports.** President Obama is committed to robust support for American exporters. The United States Trade Representative (USTR) and the Department of Commerce are proactively coordinating our support through programs such as the International Trade Administration and the Trade Promotion Coordinating Committee.

- **Enforce our trade agreements to ensure access for American products abroad.** Over the last eight years the enforcement of trade agreements slowed dramatically, with the United States bringing only an average of three WTO cases per year – as opposed to the approximately 11 annually from 1995 to 2001. In this era, the United States lost its focus on ensuring that other countries lived up to their promises to open their markets, not violate America's intellectual property, and not use dumping or subsidies to penetrate America's markets. Under President Obama, USTR and the Department of Commerce are committed to a new emphasis on enforcing our existing agreements.

- **Protect intellectual property rights.** Intellectual property is to the digital age what physical goods were to the industrial age. We must ensure that intellectual property is protected in foreign markets and promote greater cooperation on international standards that allow our technologies to compete everywhere. The Administration is committed to ensuring that the United States Patent and Trademark Office has the resources, authority, and flexibility to administer the patent system effectively and issue high-quality patents on innovative intellectual property, while rejecting claims that do not merit patent protection.

- **Reform U.S. export controls**. The President has directed that the National Economic Council and the National Security Council review the overall U.S. export control system, tasking them to consider reforms that enhance America's national security, foreign policy, and economic security interests. While the U.S. has one of the most robust export control systems in the world, it remains rooted in the Cold War era of over 50 years ago. It must be updated to address the threats we face today and the changing economic and technological landscape.

B. <u>Support Open Capital Markets that Allocate Resources to the Most Promising Ideas</u>

Open capital markets are one of the greatest strengths of the American economy, and the President is committed to making sure these markets work.

- **Promote open capital markets.** In our economic system, freely moving capital searchers for the most promising innovations to nurture and propel. Providing American leadership in well regulated, open markets will support global technology development, and the President is committed to this system.

- **Ensure working financial markets.** While free and open markets provide significant benefits, they must work for consumers and investors. The recent financial crisis highlighted the danger of managing a 21st century economy with a 20th century regulatory framework. We are committed to building a system where individuals and businesses can innovate and take chances without fearing that the system will pose untenable risks. Our plan:

    - Requires that all financial firms that pose a significant risk to the financial system at large are subjected to consolidated supervision and regulation.
    - Increases supervision of financial markets to help ensure that our markets are strong enough to withstand system-wide stress and the potential failure of one or more large financial institutions.
    - Rebuilds trust in our markets by creating a Consumer Financial Protection Agency to focus exclusively on protecting consumers in credit, savings, and payment markets.
    - Provides the government with the tools to cope with crises by ensuring the orderly unwinding of failing firms and avoiding the untenable choice between bailouts or damaging collapse.
    - Raises international regulatory standards and improves international coordination.

C. Encourage High-Growth and Innovation-Based Entrepreneurship

Entrepreneurship has played, and will continue to play, an essential role in generating innovation and stimulating U.S. economic growth. Firms with fewer than 20 employees accounted for approximately 18 percent of private sector jobs in 2006, but nearly 25 percent of net employment growth from 1992 to 2005. Small businesses employ 30% of high tech workers such as scientists, engineers, and information technology workers. The Obama Administration is committed to helping entrepreneurs build new and vibrant businesses that lead to new jobs and economic growth.

- **Increase access to capital for new businesses**. Providing access to credit for entrepreneurs and small business owners is a foundational element of economic recovery and growth. The Recovery Act reduced fees and increased guarantee levels on small business loans, while the U.S. Small Business Administration (SBA) has increased small business lending by more than 61% from the depths of the recession while broadening the base of commercial SBA lenders. Growth capital is essential. The Small Business Investment Company (SBIC) Debentures program provides debt and mezzanine financing at a time when the equity markets have pulled back from providing capital to these companies. The President has also proposed eliminating the capital gains tax on small businesses.

- **Provide training and mentoring to entrepreneurs.** Entrepreneurs with access to a network of trainers, mentors, and counselors can improve their chances for success in building high-growth businesses. The SBA has 68 district offices and over a thousand nonprofit "resource partners" that offer 14,000 counselors who serve about 1.5 million entrepreneurs and small business owners each year. The Administration is partnering with community colleges, universities, and the philanthropic sector to deliver more training and mentoring resources to aspiring entrepreneurs to promote the creation of new businesses, particularly among women and minorities.

- **Create competitive communities by promoting regional innovation clusters.** In various regions of the U.S., entrepreneurs are collaborating with local researchers, educators and industry leaders to foster specialized knowledge, technical expertise, and cutting-edge products. This will help American businesses retain and achieve new levels of competitiveness. The President's Budget provides $50 million in regional planning and matching grants within the Economic Development Administration (EDA) to support the creation of regional innovation clusters that leverage regions' existing competitive strengths to boost job creation and economic growth. The Budget also launches a $50 million initiative in EDA that will create a national network of business incubators to encourage entrepreneurial activity in economically distressed areas.

- **Stimulate entrepreneurship through increased access to government data.** The Administration launched Data.gov, a one-stop shop for free access to data generated across all Federal agencies. By empowering the American people to find, use, and repackage data, Data.gov will give rise to new businesses (like the GPS and genomics industries that grew from increased access to public information) and empower entrepreneurs to evaluate opportunities.

- **Protect small businesses from unfair business practices**. In many industries, small companies are critical innovators, bringing enormous benefits to consumers while putting competitive pressure on incumbent firms. The Obama Administration is committed to enforcing the antitrust laws to insure that innovative entrepreneurs are not excluded from the market by anti-competitive conduct. The Department of Justice actively investigates allegations of exclusionary conduct as part of its law enforcement mission to keep markets open and competitive.

D. <u>Improve Public Sector Innovation and Support Community Innovation</u>

Innovation must occur within all levels of society, including the government and civil society. The Obama Administration is committed to increasing the ability of government to promote and harness innovation. The Administration is encouraging departments and agencies to experiment with new technologies that have the potential to increase efficiency and reduce expenditures, such as cloud computing. The Federal government should take advantage of the expertise and insight of people both inside and outside the Federal government, use high-risk, high-reward policy tools such as prizes and challenges to solve tough problems, support the broad adoption of

community solutions that work, and form high-impact collaborations with researchers, the private sector, and civil society.

- **Make the government more transparent, participatory, and collaborative.** On his first day in office, the President signed the Memorandum on Transparency and Open Government, thereby placing government accountability and civic engagement at the forefront of the Administration's governing philosophy. The President's Memorandum urged agencies to promote three principles for bringing innovation to government: transparency, participation, and collaboration. Transparency promotes accountability by providing citizens with information about what their Government is doing. Public participation in decision-making strengthens democracy and ensures that Government makes policies with the benefit of information that is widely dispersed in society. Collaboration improves the effectiveness of Government by encouraging cooperation and knowledge-sharing within the Federal Government, across levels of Government and between the Government and private institutions.

- **Promote Open Government**. The Administration created the White House Open Government Initiative to coordinate Open Government policy, projects, and design technology platforms that foster openness across the Executive branch. The Initiative has achieved many important milestones, including:

    - Publishing government data online to make it easy for anyone to remix and reuse, thus involving the American people in the development of public policy,
    - Challenging thousands of Federal employees to propose ideas for slashing the time required to process veterans' disability benefits,
    - Releasing information on Executive branch personnel and salaries, and
    - Launching the IT dashboard, a one-stop clearinghouse of information that allows anyone with a web browser to track government spending on technology and hold the government accountable.

- **Use innovation to improve government programs.** President Obama is committed to using novel techniques and research support to improve the efficiency and effectiveness of government programs. For example, the Recovery Act includes a $7 billion fund to incentivize innovative reforms in states' Unemployment Insurance programs. States that use the most recent wage data and commit to cover more groups of job seekers get rewarded with higher payments. Already 32 states have qualified, and of these 24 of them changed their laws to do so. Another example is support for patient-centered health research in the Recovery Act. This research will lead to higher quality and more effective ways to deliver healthcare. The results will stimulate action across the health system to incorporate these findings into programs.

- **Commit White House Resources to scaling and promoting community innovations**. The President created the White House Office of Social Innovation and Civic Participation to grow the marketplace for community innovations and provide the technology and tools for greater civic participation to help tackle our nation's toughest problems. The office will build upon efforts across the agencies, such as the Department

of Education's $650 million Invest in Innovation (i3) Fund, to create new models of Federal grant-making that focus on encouraging, testing and scaling the most promising ideas and programs. The office uses its convening power to coordinate and partner with citizens, philanthropists, and the private sector to create a supportive environment for on-going innovations in communities. Part of the effort will include using innovative tools such as prizes and challenges. The President's Budget includes $50 million in seed capital for the nation's first Social Innovation Fund, which will identify the most promising, results-oriented non-profit programs and provide the capital needed to replicate their success in communities around the country.

3. CATALYZE BREAKTHROUGHS FOR NATIONAL PRIORITIES

A. Unleash a Clean Energy Revolution

President Obama is committed to U.S. leadership in the new clean energy economy of the future. The Administration's investments will put American innovators ahead of the curve, creating new jobs in cutting edge industries while tackling the threat posed by climate change.

- **Double the nation's supply of renewable energy in the next three years.** The President has set a goal to double the generation of renewable energy in the next three years, unleashing a wave of innovation in the clean energy industries of the future. To accomplish this vision, the Recovery Act included billions of dollars to support loan guarantees and the extension of the Production Tax Credit for electricity production from renewable energy sources, leveraging tens of billions of dollars in private investment. The Recovery Act and the President's 2010 Budget also include significant increases for renewable energy technology R&D. In addition, the President pursued regulatory reform to ease the transition to a clean energy economy. In April the Department of the Interior released final regulations that will govern the development of renewable energy in offshore waters. These rules will enable our Nation to tap into the ocean's vast sustainable resources to generate clean, green energy in an environmentally sound and safe manner.

- **Promote energy efficient industries.** The Recovery Act and national energy policy will generate a proliferation of new technologies, processes, and jobs relating to improving energy efficiency. The Recovery Act alone provided $5 billion in funding for weatherization assistance to low-income residents, $4.5 billion for greening Federal buildings, and $6.3 billion for state and local government renewable energy and energy efficiency and conservation efforts.

- **Invest in Clean energy innovation**. The President has proposed a 10 year, $150 billion investment in the research, development and demonstration of clean energy technologies, such as solar, wind, green buildings, efficient lighting, next-generation biofuels, proliferation-resistant nuclear reactors, energy storage, and carbon capture and storage.

- **Enact a cap-and-trade program to curb oil dependence and greenhouse gas emissions while spurring renewable energy technologies.** President Obama supports a

comprehensive cap-and-trade program that will provide a clear signal that the current energy mix is unacceptable and that low-carbon energy sources are the way of the future. The program will provide the certainty necessary for businesses to make transformative investments in renewable alternatives and energy efficiency.

- **RE-ENERGYSE the American workforce.** The President has proposed RE-ENERGYSE, a joint educational campaign from the Department of Energy and the National Science Foundation to inspire tens of thousands of young Americans to pursue careers in clean energy. RE-ENERGYSE will support fellowships, interdisciplinary graduate programs, and partnerships between academic institutions and innovative companies to prepare a generation of Americans to meet the energy challenge**.**

B. Support Advanced Vehicle Technologies

For the sake of our national security, economy, and environment, it is crucial to diversify away from oil as the sole source of transportation fuel. Today, oil accounts for 96 percent of the fuel that powers our country's vehicle fleet. The lack of widespread, affordable alternatives to oil makes us vulnerable to market disruptions and dependent on oil producers. Oil is also responsible for one third of our carbon dioxide emissions and is a significant source of local air pollution, threatening our climate security and the health of our local communities.

The President's strategy is to put the U.S. at the cutting edge of the advanced vehicle technology industry, which will not only reduce our dependence on oil, but will also create jobs, strengthen our manufacturing base, improve the quality of the air we breathe, and offer consumers greater safety, performance, and choice.

- **Make the largest investment in technology for electric vehicles and transportation electrification in U.S. history.** In early August the Administration announced $2 billion in grants which will catalyze private sector investment to build a globally competitive domestic battery and electric drive component industry. With this support, American factories will produce the lightest, cheapest, longest-lasting, and most powerful vehicle batteries in the world. American batteries and components will power affordable electric cars that can travel over hundred miles on a single charge and offer customers superb performance. These vehicles will be even more attractive thanks to the tax credit of up to $7,500 offered for electric and plug-in electric vehicles in the Recovery Act.

  The Administration is also making a $400 million holistic investment in transportation electrification as a system. Beyond batteries, vehicles, and components, this includes demonstrating pilot systems that put the pieces together – testing the infrastructure to plug the cars, training the workers to build and service them, and educating the consumers who will buy them. The lessons from these projects will help the private sector more quickly develop profitable electric vehicles that meet the needs of drivers.

- **Deploy up to $25 billion in loans to support American manufacturing of advanced vehicle technologies.** Through the $25 billion Advanced Technology Vehicles Manufacturing Loan Program, the Administration is supporting competition within the

marketplace to produce the most cost-effective solutions to reduce oil dependence. The Administration awarded the first $8 billion in conditional loan commitments in June. These included $5.9 billion for Ford Motor Company to transform factories across Illinois, Kentucky, Michigan, Missouri, and Ohio to produce 13 more fuel efficient models; $1.6 billion to Nissan North America, Inc. to retool their Smyrna, Tennessee factory to build advanced electric automobiles and to build an advanced battery manufacturing facility; and $465 million to Tesla Motors to manufacture electric drive trains and electric vehicles in California. Up to an additional $17 billion in loans will be made under this program over the next several years.

- **Support the next generation of American biofuels.** The Administration is investing in next generation biofuels that displace oil consumption and reduce greenhouse gas emissions. Through $800 million in Recovery Act grants as well as up to $500 million to support loan guarantees, the Administration is accelerating the development of clean technologies like cellulosic and algae-based biofuels –harnessing recent advances in synthetic biology.

- **Improve vehicle fuel efficiency to reduce oil dependence and spark innovation.** In May, President Obama announced a groundbreaking national autos program that put us on a path to adopting uniform Federal standards to regulate both fuel economy and greenhouse gas emissions. The result will be a projected reduction in oil consumption of approximately 1.8 billion barrels over the life of the program and a projected total reduction in greenhouse gas emissions of approximately 950 million metric tons. This landmark policy will spark innovation in more fuel-efficient vehicles, reduce pollution, and promote energy security.

C. Drive Innovations in Health Care Technology

The inefficiencies in our health care system raise costs and reduce the quality of care. New advances in health information technology will increase efficiency while broad reform will free businesses and individuals to innovate and grow.

- **Expand the use of health IT.** Expanded use of advanced health information technology (e.g. electronic medical records, mobile health applications, sensors for monitoring chronic diseases) will help prevent medical errors, improve health care quality, begin to modernize the American health care system and reduce costs. The Recovery Act provides over $19 billion in investments to modernize health information technology.

- **Renew our commitment to medical research.** The Recovery act included a $10 billion expansion in health research. This will fund projects such as an initiative to identify all of the genetic changes involved in 20 types of cancer, clinical trials of medicines that could help stop the HIV/AIDS pandemic, the largest infusion of funding to discover the causes and treatment for autism, and using DNA sequencing to discover how to prevent and treat heart, lung, and blood diseases

- **Slow the growth of health care costs.** The President is committed to comprehensive reform for a health care system that makes it possible to improve the quality of care while slowing the growth rate of costs. Doing this will free up resources that can be used to invest in American businesses and improve the living standards for all Americans.

D. Harness Science and Technology to Address the "Grand Challenges" of the 21st Century

The President's renewed commitment to science, technology and innovation will allow the nation to set and meet ambitious goals that will improve our quality of life and establish the foundation for the industries and jobs of the future. Examples include:

- Complete DNA sequencing of every case of cancer; smart anti-cancer therapeutics that kill cancer cells and leave their normal neighbors untouched; early detection of dozens of diseases from a saliva sample; nanotechnology that delivers drugs precisely to the desired tissue; personalized medicine that enables the prescription of the right dose of the right drug for the right person; a universal vaccine for influenza that will protect against all future strains; and regenerative medicine that can end the agonizing wait for an organ transplant.

- Solar cells as cheap as paint, and green buildings that produce all of the energy they consume.

- A light-weight vest for soldiers and police officers that can stop an armor-piercing bullet.

- Educational software that is as compelling as the best video game and as effective as a personal tutor; online courses that improve the more students use them; and a rich, interactive digital library at the fingertips of every child.

- Intelligent prosthetics that will allow a veteran who has lost both of his arms to play the piano again.

- Biological systems that can turn sunlight into carbon-neutral fuel, reduce the costs of producing anti-malarial drugs by a factor of 10, and quickly and inexpensively dispose of radioactive wastes and toxic chemicals.

- An "exascale" supercomputer capable of a million trillion calculations per second – dramatically increasing our ability to understand the world around us through simulation and slashing the time needed to design complex products such as therapeutics, advanced materials, and highly-efficient autos and aircraft.

- Automatic, highly accurate and real-time translation between the major languages of the world – greatly lowering the barriers to international commerce and collaboration.

National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

September 28, 2009

Dear Dr. Michener,

Thank you for your participation and presentation at the recent Reverse Site Visit (RSV). The RSV is an important mechanism that the NSF EPSCoR Office uses for project management and oversight, and for providing feedback and guidance to awardees. The NSF EPSCoR Office would like to complement you and your fellow team members for your professional approach to the RSV activity. Your presentation provided a clear indication of the progress made during the first year of your jurisdiction's current Research Infrastructure Improvement (RII) - Track-1 Award. Based on the well-organized presentation, it was obvious that you approached this task with appropriate deliberation, dedication, and diligence.

The attached report is based upon the RSV panel's review of written materials (complete proposal, review panel summary, review analysis, original grant letter, RII strategic plan, annual reports and budget) provided prior to the meeting, the oral presentation made by the project team, visual aids supporting that presentation, and subsequent discussion with the team.

Please review the report and share it with the appropriate individuals in your jurisdiction to develop responses and action plans that address the issues and recommendations identified in the RSV report. Please contact your cognizant NSF EPSCoR Program Director if you have any questions related to the panel's report or if you need further clarification regarding the requested responses. The response to Recommendation #1 should consist of a revised diversity plan to increase the participation of women and underrepresented minorities on the faculty. In response to #8, provide the date and agenda for the planned advisory committee meeting and also provide the date for the EPSCoR state-wide meeting to be held in 2009. In the case of #9, it is anticipated that New Mexico EPSCoR response will consist of a revised evaluation plan to NSF. In addition to the panel recommendations included in the report, also provide a plan for collaboration between the water quality researchers at New Mexico Highlands University and New Mexico Tech, specifically addressing data compatibility and calibration issues.

The NSF EPSCoR Office would like to receive your written responses to each of the RSV panel's recommendations described in the report no later than **October 23, 2009.** Please note that the Year 2 Annual Report for the RII award (and subsequent reports, as appropriate) should include the progress on the RSV recommendation responses and action plans.

Best Regards,

Uma D. Venkateswaran
Program Director
NSF/EPSCoR

Reverse Site Visit Report

NSF EPSCoR Jurisdiction:	New Mexico
RII Award Number:	EPS-0814449
Principal Investigator:	William Michener
RII Program Solicitation:	NSF 08-500
Reverse Site Visit Date:	September 14, 2009

Précis

One year into its third RII, New Mexico EPSCoR (NM EPSCoR) is making impressive progress, guided by a visionary statewide science and technology plan, which features energy/environment/water as one of the five innovation clusters. The major research initiatives of this project focus on observation, modeling, and analysis of high-elevation hydroclimatology and on understanding and forecasting the effects of global climate change on water supply and water quality—clearly both timely and important topics. The extensive cyberinfrastructure effort builds on the high performance computing infrastructure in the state. Education and outreach are well integrated with research and strategically engage K-12 schools and regional universities serving minority populations. Additional attention to diversity planning (especially at the faculty level), evaluation, and broader scientific/economic impacts will pay dividends. Special award conditions have mostly been met.

Progress to Date

Intellectual Merit

This project has clear intellectual merit. The importance of understanding the changes in hydrology and water quality predicted under climate change was well demonstrated. Improved modeling of changes in the distribution of water from high to low elevations that accommodates the distribution of the population centers, and inclusion of the role of community-run water supply systems will allow better prediction of the impacts of change on the systems. The infrastructure investments and planned research appear to be quite strong.

Broader Impacts

In addition to the science component, this project clearly intends to have a significant impact in the educational arena and with the public in general. Several educational efforts are well integrated to the overall project plan, so this was clearly intentional from the start. The exhibits planned for museums are well designed to attract the public's interest and attention. Once the project is completed, it will leave a legacy of well instrumented observatories for the state. Additionally, the data sets collected, when

combined with similar data from the other EPSCoR projects in the Tri-State Consortium, will provide a regional data set.

Progress towards goals and objectives:

1. Strategic Fidelity and Impact

   The team's presentation clearly showed that they are on-track with respect to fidelity to the project goals and essentially on schedule with respect to the project timeline. Likewise, the NM EPSCoR project addresses key components in the current state-wide research and technology plan, and has beneficial collaborative connections with the state planning body.

2. Value Added

   One of the benefits of a large-scale integrated project is that the whole is greater than the sum of the parts. For the NM EPSCoR project, this is clearly evident. The data collection projects contribute well to the modeling effort; the science projects have an integrated education or outreach component often in conjunction with a variety of informal science education groups which provides an additional avenue for dissemination of information. By fostering collaborative relationships with other research groups, ties to other institutions beyond the EPSCoR group are fostered.

3. Cyberinfrastructure

   In general, the CI aspects of this project are very well formed. The project enjoys strong support at the state level in terms of funding for cyberinfrastructure (for example the Encanto machine). The state has consciously decided to train more students in computational climate research with a strong high performance computing (HPC) educational component. Currently, the main universities are experiencing hiring freezes, but work with DOE National Labs involving graduate student and post docs is moving forward.

   In terms of data, this group is well versed in the problems associated with large-scale data sets. NM EPSCoR is engaged with the Tri-State Consortium in looking at these issues, and has a preliminary archive in place leveraging from experience with the New Mexico Resource Geographic Information System (RGIS). There is an expectation of integration with the NSF funded DataNetONE (Observation Network for Earth) infrastructure when that gets up and running, but that is still at least a year away. The fact that the PI for this project is also the PI for the DataNetOne project ensures communication.

   The group has thought about data policy issues, and has cross-project agreement (both policy and enforcement plans) to sharing data. The automatically collected data will be accessible immediately from the web site when the basic infrastructure is in place; it is currently only logged. Quality assurance issues will need to be

addressed with data, but this appears to be straight forward and common with this type of project.

Data connections to education are well understood. Instead of trying to share large-scale data, the team is considering reduced data sets, real world data examples, and use of visualizations from the research data for teaching and museum exhibits.

4. Dissemination and Communication

The dissemination and communication strategies being employed to date are multi-faceted and serve a wide range of target audiences. Significant progress has been made in the planning and implementation of the cyber infrastructure as a means of enhancing not only research productivity, but outreach and dissemination as well. A new web portal is available at http://www.nmepscor.org with specific foci around research, education, outreach and publications. The portal serves both stakeholders (e.g. the public and government entities) as well as project participants for annual reporting and ongoing informational highlights. Plans for Year 2 upgrades include online registration capabilities as well as direct interfacing of EPSCoR participant information with the project's database.

Cyberinfrastucture activities of this RII will facilitate the utilization of shared resources among the Tri-State Consortium. One of the activities enables improved efficiency in document sharing, collaborative writing and messaging, while the other is a shared versioning system.

In helping to prepare faculty to effectively communicate their science to larger audiences, the NM EPSCoR office sponsored a Faculty Leadership Fellowship Program that addressed "Communicating science to decision makers".

One of the strengths of this RII is communication with the public. Mechanisms include statewide lecture series, leveraging National Association of Science and Technology Centers (ASTC) and EPSCoR funding to partner with the New Mexico Museum of Natural History and Science to create a "Climate Change Impacts in New Mexico" exhibit that works with Science on a Sphere, science cafes, and other seminar series in northern New Mexico.

Cultural sensitivity and a demonstrated commitment to diversity permeate dissemination and communication efforts. These include the dissemination of printed materials in Spanish and English, plans to incorporate oral Navajo interpretations at the Climate Change science exhibit, and partnering with the Northern New Mexico Network for Rural Education to reach over 30,000 students. The latter represents a significant broader impact as well as dissemination mechanism that goes beyond a few selected school districts or programs.

As the project moves into Year 2, the panel would encourage the team to document and report progress on publications, conference proceedings, poster/paper presentations by NM EPSCoR-affiliated scientists, students and other participants.

A new climate change exhibit to be developed in partnership with the New Mexico Museum of Natural History and Science will facilitate dissemination of research outcomes and is likely to have substantial impact in strengthening public climate literacy in the state. Importantly, there has been a conscious effort to invite input from variety of stakeholders in the community, including underrepresented populations, in the design and execution of this exhibit.

5. Outreach Strategy and Diversity

Excellent progress is being made in the implementation of the education, outreach, and diversity activities, which are very strong and well-integrated with the research components of the project. The program has developed strategic partnerships with non-profit organizations to develop a portfolio of very synergistic activities. There is clear evidence that the goal of broadening participation is viewed as a priority in both the management activities and the implementation of the education and outreach efforts. The numbers of students and educators participating to date have not been large, but the experiences are of very high quality and based on best practices. Evaluation activities need to be more formative and there needs to be an increased focus on outcomes, as well as outputs; effective strategies for tracking the progress of these students in the future are needed.

The geographic location of the field investigations has allowed education and outreach efforts to focus on a largely low income, Hispanic population at the K-12 level. A partnership with the Northern New Mexico Network for Rural Education is providing field-based summer professional development institutes, supported by academic year follow-up, for teachers from 27 school districts serving 30,000 students. These enrichment experiences, as well as the curricular resources developed by the teachers for their classrooms, are likely to have profound impact in an area where there may be only one multi-grade math/science teacher for the entire school. There is a lot of potential for leveraging existing climate and watershed resources developed by earlier programs (e.g., SAHRA, GLOBE) and disseminating teacher-produced resources more widely through the Tri-State Consortium network, the Digital Library for Earth System Education (DLESE), the National Science Digital Library (NSDL), or the AAAS BioSciEdNet (BEN).

Partnerships with institutions throughout the state are providing extended hands-on research experiences for undergraduate students, with strong mentoring components. Use of field-based research experiences, including hands-on deployment of instrumentation, is viewed as a strength of the program. Emphasis is being given to recruiting minority students from smaller institutions, and there has been success in attracting a significant proportion of female and minority

students. The program has shown good flexibility in accommodating the particular needs of non-traditional students, but may need to think more strategically about scale-up. The heavy reliance on one faculty member to manage the outreach and recruitment for the UROP program is a vulnerability that should be addressed. Additional resources to support the participation of students/educators with disabilities (e.g., NSF Facilitation Awards for Scientists and Engineers with Disabilities, FASED) should be explored.

Graduate student education programs are focused on development of interdisciplinary science and modeling skills, which appropriately leverages the research activities and other resources available through the Tri-State Consortium. There have been some challenges in building a core graduate student cohort at the smaller, predominantly undergraduate institutions. There have also been institutional barriers to facilitating cross-institution articulation agreements, which could help to solve this problem. A new graduate seminar series on climate change that will be offered via distance learning coordinated through the Tri-State Consortium and a semester long course offered via distance learning in 2010 may also alleviate this problem.

Faculty leadership programs focused on project management, communication, mentoring, and grant-writing skills should catalyze additional research success in the state. The current hiring freeze caused by budget shortfalls should be used as an argument for breaking down institutional barriers to sharing of faculty expertise and leadership development among graduate students.

6. Evaluation and Assessment

New Mexico EPSCoR has engaged Kirk Minnick of Minnick and Associates as the external evaluator. New Mexico's strategic planning is based on the Kellogg Foundation logic model, with assumptions, resources, activities, deliverables, outcomes, and impacts. A centralized survey site for collecting inputs has been established to survey faculty, leadership, students, and teachers. In addition, the project has an external advisory committee (which hasn't met yet) and has engaged the AAAS to provide forward-looking guidance based on a strategic review to be conducted in Years 2 and 4. These efforts, while valuable and positive and highly structured, did not appear to be integrated into a coherent evaluation and assessment approach that would provide timely formative and summative feedback and help the New Mexico EPSCoR team both improve its execution and demonstrate and maximize impact.

The Panel commends New Mexico for having Minnick conduct a session on research program evaluation in the professional development workshop held for faculty (faculty leadership fellowships).

7. Sustainability

NM appears to have significant commitment to the activities in the project through the state Science and Technology plan and the research infrastructure provided with state funding. The core area of Energy, Environment and Water encompasses the climate change focus of the RII and the investment in the supercomputer Encanto is a substantial contribution to the cyberinfrastructure capacity for research and education. Further, the state recently established a "Research Application Center" to oversee the S&T plan which includes overseeing various coordinated statewide STEM initiatives. While these administrative and capacity building components are helpful, there were some concerns with regard to infrastructure and leadership efforts on various aspects of the project. The long-term support for meteorology instrumentation and how this will transferred and sustained by other agencies was not clear in the strategic plan. In particular, the reliance on the work of primarily one faculty member for the UROP effort is of concern, especially given the tenure-track status of the individual. The matter of succession planning with regard to scientific and education leadership on the participating campuses and outside of the EPSCoR Office management was also a concern. Clearly this is a state-wide / well dispersed program at many levels. This not only fits with the general goals of EPSCoR, but increases the base of interest so that there will be broad popular support for sustaining the program locally when the EPSCoR funding ends.

8. Management Plan

The overall management structure is deemed appropriate. The 14 member EPSCoR Management Team convenes by conference call at least quarterly to respond to relevant problems, and make decisions on science and education issues of import to the project. A state advisory committee has met and the external advisory committee has been formed but needs to meet. The panel strongly recommends a succession plan be put in place to mitigate any future loss of senior personnel.

9. Fulfillment of Special Grant Conditions

The Cooperative Agreement includes five state-specific special grant conditions: a revised cyberinfrastructure plan; a detailed plan to address the socioeconomic impacts of hydrologic changes to acequias; a revised diversity plan focused on (a) faculty and leadership, and (b) regional and tribal colleges; and not to spend more than $3 million in year 1. All have been accomplished, except that the revised diversity plan should be more aggressive and proactive in increasing the participation of women and underrepresented minorities on the faculty, especially at the research universities.

10. Progress Relative to Strategic Plan

The general consensus of the committee was that the team was right about where they should be at this point in the project. Most of the year one goals are on schedule with only three delayed and a few of the year two goals are already in progress.

11. Other

The New Mexico EPSCoR team had a very well organized and clear presentation.

Feedback to Project Team

Summary

How effective has the leadership team been in addressing barriers and challenges?

The team has a good sense of the challenges and barriers. Plans are in place for dealing with some of these, for example training students in use of HPC and over-coming distance barriers between team members. While other challenges such as sustainability or cross-registration are recognized, solutions are not presented. The team is acknowledging and developing plans to address these issues.

As noted earlier, the state acquisition of the super-computer array was a major benefit to the EPSCoR project. There seems to be a good relationship between the state science and technology plan and the EPSCoR project. The team is encouraged to keep channels of communication with stakeholders open.

Is there sufficient integration of research and education?

There is good integration of education and research through all aspects and levels of the project even though the human resource component is modest. The panel finds this to be by design and not an after-thought. Given the investment in instrumentation and technology, the engagement of engineering disciplines is encouraged.

Appropriateness of Investments to Increase Research Capacity

The purchase of the various field and laboratory instruments for water quality analysis seems to be entirely related to the project goals. Furthermore, acquiring all of these instruments at the beginning of the field campaign makes good sense so that they will be available for the duration of the program.

Specific Recommendations

1. Enhance the diversity of faculty at the PhD degree granting institutions. Recognizing that hiring decisions are the prerogative of the various universities, the panel encourages the NM EPSCoR team to do some creative thinking about mechanisms to inform the universities of the diversity goals of the RII program.

2. Develop mechanisms to follow-up with the summer workshop participants, especially students, so that long-term outcomes can be tracked, quantified and reported.

3. Develop a succession plan to grow junior staff, with the added benefit of increasing institutional diversity in leadership roles over the course of the project. Leadership should understand all aspects of the project to ease transitions while vacancies are being filled.

4. Develop a plan for scientific synthesis across the interdisciplinary research projects.

5. Consider working with pre-service teachers at the undergraduate institutions as a means of further impacting K-12 students in New Mexico.

6. Consider additional dissemination of the Spanish translated educational resources and other educator-produced resources through DLESE, NSDL and Windows to the Universe, which has a multilingual web site.

7. Increase the leadership diversity and include senior faculty from the lead institutions in the working group on diversity.

8. Schedule a meeting of the advisory committee.

9. Prepare and implement a coherent, evaluation and assessment plan that utilizes qualitative and quantitative approaches to provide both formative feedback and summative assessment. Evaluation results should be used systematically to guide program improvement.

10. Develop a plan to sustain the meteorological stations at the end of EPSCoR funding. Sustainability of SNOTEL and SCAN network stations seems to be well addressed in the proposal by planning for their incorporation into other programs.

New Mexico EPSCoR Response to Reverse Site Visit

Specific Recommendations:

1. Enhance the diversity of faculty at the PhD degree granting institutions. Recognizing that hiring decisions are the prerogative of the various universities, the panel encourages the NM EPSCoR team to do some creative thinking about mechanisms to inform the universities of the diversity goals of the RII program. [Response should consist of a revised diversity plan to increase the participation of women and underrepresented minorities on the faculty.]

The three major research institutions in New Mexico have made significant strides with respect to enhancing the diversity of faculty and students at their campuses. The University of New Mexico and New Mexico State University both have comprehensive equity and inclusion plans, and New Mexico Tech is in the process of revising its plan. Within the past two years, the University of New Mexico hired a new Vice President for Equity and Inclusion. An initial review of data compiled in the October issue of the Chronicle of Higher Education indicate that Hispanic and Native American faculty diversity at both the University of New Mexico and New Mexico State University exceed that of their peer institutions in the western U.S. and nationally. Nevertheless, New Mexico EPSCoR recognizes that there remains room for significant improvement. Consequently, our immediate plan for action is to: (1) complete an environmental scan of institutional diversity at colleges and universities in New Mexico and at peer institutions within our region; (2) compile pointers to existing diversity plans at New Mexico institutions and highlight exemplary plans within and outside our state; and (3) convene a diversity workshop as part of our New Mexico EPSCoR State Committee meeting that will be held Monday October 26th in Albuquerque (the first meeting to be attended by our recently-appointed Co-Chair—Dr. Viola Flores who is the Secretary of Higher Education in New Mexico). The information that is prepared for this meeting as well as the outcomes of this workshop will be used to further fashion a best practices diversity plan for New Mexico's research universities that highlights EPSCoR diversity goals, builds on key EPSCoR programs such as the Faculty Leadership Program, and provides recommendations and approaches for increasing the participation of women and underrepresented minorities on the faculty. The Plan will be researched and presented for review at the spring meeting of the New Mexico EPSCoR State Committee. Pending approval of the State Committee, the final Plan will be presented to the Council of University Presidents at their fall 2010 meeting.

2. Develop mechanisms to follow-up with the summer workshop participants, especially students, so that long-term outcomes can be tracked, quantified and reported.

EPSCoR evaluator Kirk Minnick will conduct and maintain longitudinal data on participants in the two EPSCoR summer programs; undergraduate students in the Undergraduate Research Opportunities Program (UROP) and secondary school teachers in the Teacher Summer Institute. E-mail and postal addresses were collected from student and teacher participants in summer 2009. The UROP student's emails were verified through the collection of baseline data using an online survey tools. The

evaluator will follow up with both sets of workshop participants in the spring using the email addresses and the postal addresses as a backup. We intend to contact student participants yearly to track long-term outcomes from their participation in EPSCoR activities. Data tracked will include not only academic progress and career decisions, but also assessment of attitudes, involvement, and knowledge of climate change science issues. The teacher data tracking focuses on the success of curriculum implementation in the classroom.

3. Develop a succession plan to grow junior staff, with the added benefit of increasing institutional diversity in leadership roles over the course of the project. Leadership should understand all aspects of the project to ease transitions while vacancies are being filled.

The succession plan for New Mexico EPSCoR encompasses several elements. First, the EPSCoR Management Team comprises a mixture of senior and more junior faculty from the institutions involved In the RII project. The intent is to involve more junior faculty in a collaborative leadership group along with more "seasoned leaders" so that they may understand and contribute to leading a large multi-institutional research, education, and outreach enterprise. It is anticipated that Management Team members, because of their understanding of all aspects of the project, can ease transitions while vacancies are being filled and be well-poised to apply for leadership positions within their institutions or in the State EPSCoR office should openings occur. Second, the Faculty Leadership Program provides leadership training to young faculty and post-doctoral fellows at institutions throughout New Mexico, many who exhibit significant leadership potential and who are envisioned to assume leadership positions within their respective institutions. Third, our plan for growing junior staff in the State Office focuses on developing career ladders, which will provide a planned progression to a new job and advancement within the Department and the University system. There are three steps in the career ladder program:

a. The Manager completes a Pre-Approved Career Ladder form containing the education, experience, distinguishing characteristics and job responsibilities required for the progression to a higher classification.
b. An agreed time-line for completing the acquisition of the necessary skills and/or knowledge and the proposed salary increase will be agreed upon by individual staff and Manager. HR approval is required.
c. Develop requirements such as completion of education, professional certification/licenses and/or specific experience to be completed by staff and assist the employee in meeting these requirements.

We have just advanced two individuals in the State Office to higher-level positions (Morrato and Danzillio) and are working to provide career advancement opportunities for two other individuals (Gomez and Arguelles).

4. Develop a plan for scientific synthesis across the interdisciplinary research projects.

The New Mexico EPSCoR RII project was conceived of initially as a highly

interdisciplinary research program that would entail integration and synthesis across scales of time, space, and discipline. With additional funding provided by Los Alamos National Laboratory's Institute for Advanced Studies, EPSCoR annually supports one intensive scientific synthesis workshop entitled: "Bridging Disciplines and Scales." The first year's workshop was held in July 2009 and focused on scientific synthesis of climate data and models across an array of scales from global to regional to state and local scales. Scientists and students involved in the New Mexico EPSCoR program worked with each other as well as nationally recognized experts (including Dr. Ruby Leung who is on the NM EPSCoR External Advisory Committee) to resolve many of the complex scale challenges faced by climate scientists. Subsequent planned "Bridging Disciplines and Scales" workshops are designed to: (1) synthesize data and models across the climate and hydrologic sciences; and (2) bridge data and models between the geosciences and the socio-economic sciences.

In addition to the "Bridging Disciplines and Scales" workshop, researchers may propose and be supported to participate in Innovation Working Group (IWG) activities whereby participants focus intently for a week on integration and synthesis of science concepts, data, and models. Our first IWG effort was recently successfully concluded (led by Sam Fernald of New Mexico State University), focusing on hydrology and New Mexico's acequias (i.e., the historic water management systems). It was envisioned that current and future IWG science activities will include groups that focus almost exclusively on integrating and synthesizing data generated within New Mexico (and by EPSCoR scientists and others as appropriate) as well as groups that would focus on regional data such as those data that are common among scientists that are associated with our tri-state western consortium (i.e., Idaho, New Mexico, Nevada).

Finally, scientific synthesis across the interdisciplinary research projects is enabled through work sessions at the annual EPSCoR All Hands' Meeting as well as virtual meetings supported through our collaboration technology (VTC and wiki).

5. Consider working with pre-service teachers at the undergraduate institutions as a means of further impacting K-12 students in New Mexico.

The University of New Mexico and New Mexico State University have the largest undergraduate secondary teacher preparation programs in New Mexico and members of NM EPSCoR's management team have long-standing professional associations with both institutions' Colleges of Education. NM EPSCoR will collaborate with UNM and NMSU education faculty to incorporate materials using EPSCoR-generated data and resources into secondary science methods courses for pre-service teachers. In addition, NM Highlands University is located in the region of EPSCoR study; opportunities to include pre-service education teachers from NMHU into the Teacher Summer Institute will be pursued. EPSCoR partner The Northern New Mexico Network coordinates and delivers the EPSCoR K-12 education program including the Summer Institute. The Northern Network has a long-standing relationship with NMHU, and has worked with NMHU to improve secondary teacher preparation in math and science in northern New Mexico. We will seek to strengthen and develop existing Northern

Network – NMHU connections, and to integrate EPSCoR climate change research into these efforts. Finally, Eastern NM University is currently seeking funding for a secondary math and science post-Bachelor's teacher preparation program that will draw upon New Mexico professional development providers for a portion of the program's instruction. If the ENMU program receives funding, EPSCoR will work to establish a partnership through which EPSCoR resources can be disseminated.

6. Consider additional dissemination of the Spanish translated educational resources and other educator-produced resources through DLESE, NSDL and Windows to the Universe, which has a multilingual web site.

The NMMNHS held a facilitated stakeholder input workshop in October, at which it was decided that all the exhibit materials for the Climate Change in New Mexico exhibit would be bi-lingual in English and in Spanish. We anticipate approximately 250,000 people will see the exhibit during its first year. Most of the exhibit materials are integrated into the exhibit display. However, the museum is currently seeking funds for additional handout materials; these would also be available in Spanish. We have discussed the possibility of further dissemination with the Museum Climate Change Educator, a position partially funded by EPSCoR, and the working group on the Climate Change Exhibit will ascertain the feasibility of this idea. Classroom curricula materials are being developed by and for secondary teachers from northern New Mexico rural schools through our partner organization, the Northern Network, and the Summer Teacher Institute. Bi-lingual production of these materials was not included in the original proposal. EPSCoR coordinated a meeting of the Northern Network, the NMMNHS, Earth's Birthday, and the NM State Math and Science Bureau last August aimed at initiating an informal partnership among the 3 education non-profits. These organizations will be better equipped to solicit external grant funding for climate change education in a collaborative partnership than as individual entities. EPSCoR will continue to promote and assist the development of this non-profit partnership, and will propose that the creation and dissemination of Spanish language education materials be included as one of their funding goals.

7. Increase the leadership diversity and include senior faculty from the lead institutions in the working group on diversity.

Marnie Carroll, a senior faculty member from Dine College, and Mike Pullin, an Associate Professor from New Mexico Tech, currently provide the leadership for the Diversity Committee. They have also recently been awarded an Innovation Working Group project that focuses on enhancing the STEM pipeline from New Mexico's Tribal and regional colleges and universities to the major research universities. This workshop is scheduled to occur in January 2010 and provides an opportunity to identify and engage additional senior faculty from the lead institutions in the working group on diversity. The expansion of the diversity committee, discussion on how to advance diversity goals in Year 2, and integration of diversity activities across research scientists and research activities, will be a priority activity at our annual All Hands Meeting that is being held in November 2009.

8. Schedule a meeting of the advisory committee. [Provide date and agenda for advisory committee meeting as well as the date for EPSCoR statewide meeting to be held in 2009.]

The External Advisory Committee is scheduled for Monday evening thru Wednesday morning, January 11-13, 2010.

The agenda includes:

January 11, 2010 – arrivals, tour of State Office, dinner and introductions to key EPSCoR staff and project participants, State Committee members, and university officials.

January 12, 2010 – full day of reports and review activities by component and topic:

- Research infrastructure improvements – equipment, laboratories, modeling, Innovation Working Groups, Seed Grant program, etc.
- Cyberinfrastructure improvements – web portal, interoperability, supercomputer based modeling, integration and synthesis, metadata, etc.
- Human infrastructure – UROP, Faculty Leadership Program, Graduate training, diversity, outreach (museum exhibit, statewide seminar series, science cafes, etc.)
- Progress in meeting project milestones, challenges and opportunities
- Next steps

January 13, 2010 – writing and final discussion and report-back, departures

The EPSCoR statewide All Hands Meeting is scheduled for Monday November 23, 2010.

9. Prepare and implement a coherent, evaluation and assessment plan that utilizes qualitative and quantitative approaches to provide both formative feedback and summative assessment. Evaluation results should be used systematically to guide program improvement. [Response to consist of revised evaluation plan.]

The evaluation and assessment plan has been updated to reflect comments from the RSV and changes that have occurred during Year 1 (see Appendix A). The evaluation is multi-tiered and includes linking appropriate assessment methods and personnel to specific objectives. Project staff are responsible for the day to day assessment of implementation of the strategic plan and using the project database to track deliverables. The external evaluator is responsible for providing formative assessment of project activities through observations, meeting attendance and participant feedback surveys. The external evaluator is also responsible for ensuring the project database is collecting the kinds of data needed for assessing intermediate and long term outcomes of project activities. The external advisory committee provides oversight and evaluation of progress on project objectives, through the lens of external experts who have struggled with the same or similar goals, but who are not constrained by the day to day

hindrance of project researchers and managers. The AAAS provides the project with an evaluation perspective based on nationally known experts in the project content areas. Finally, NSF provides review through its reverse site visits and feedback from the program officer.

The following summarizes the metrics to be tracked and reported annually.

- People: Participant demographics of faculty, postdocs, undergrads, K-12, collaborators, institutions; diversity of all the above
- Material Infrastructure: Equipment purchased & installed, models developed and cyberinfrastructure acquired (number, type, use, results);
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Discovery Learning: data collected, observations and research (number, type, kind, availability)
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Outreach/Public Dissemination: Scientific literacy and outreach efforts, curriculum development, public outreach, public presentations, policy and policy makers impacted

The evaluation uses both qualitative and quantitative approaches to provide feedback for program improvement. Project participant feedback on events is provided back to the project within 2 weeks of the event. Computer software for collecting, organizing, managing and reporting are used to provide the project with assessment and evaluation data, these include an assessment and evaluation reporting database, online survey software and activities logic model database.

10. Develop a plan to sustain the meteorological stations at the end of EPSCoR funding. Sustainability of SNOTEL and SCAN network stations seems to be well addressed in the proposal by planning for their incorporation into other programs.

In Year 1 of the award, 3 weather stations have been purchased and 2 have been installed in the Rio Grande South Valley area of Albuquerque. We are presently conducting farm visits to locate and install the third station, which we hope to have in place by mid-November. Second year funding will allow us to purchase 17 more weather stations. Five (of the 17 will be located on the Navajo Nation in Northwestern New Mexico. We will work with the Navajo Nation Department of Water Resources and the Navajo Agricultural Products Industry (NAPI) to establish the location of these stations. The remaining 12 stations will be strategically placed in gaps that exist in our present weather station network. All weather stations will remain property of the NMSU Climate Center. Telemetry for the stations in the Rio Grande South Valley will run through the Middle Rio Grande Conservancy District (MRGCD) hydrology weather station network. MRGCD has several weather stations and we were allowed to tap into their radio system. Data will be collected from an FTP site and uploaded on the NMSU Climate Center website. Telemetry for the 17 new stations will be through the NRCS NWCC meteor burst system. We will establish an MOU with NRCS to transmit the meteorological data from our stations through their system. Using the NRCS NWCC

system is more efficient and cost-effective. The NMSU Climate Center receives sustained support from annual state appropriations.

During Year 2 we will winterize and upgrade 10 US Forest Service Remote Automated Weather Station (RAWS) sites located at high elevations in the EPSCoR northern NM study area. These sites are on US Forest Service land. Like the USDA/NRCS SNOTEL and SCAN sites, the USDA/Forest Service will take ownership and responsibility for the RAWS sites. The sites will become part of their meteorological data collection network.

[11. Also provide a plan for collaboration between the water quality researchers at New Mexico Highlands University and New Mexico Tech, specifically addressing data compatibility and calibration issues.]

The Year 2 plan for water quality research has improved collaboration among New Mexico Tech and New Mexico Highlands researchers by addressing the following: 1) adding a breakout session to the All Hands Meeting in November dedicated to this group of researchers, 2) increasing the frequency of phone and VTC communication with routinely scheduled (4 to 6 week) tele- or video-conferences, and 3) implementing a water quality wiki site housed and managed by NMT with subscription by every water quality research team member. In addition, a new cohort of water quality research graduate students, all at the Masters level, is being coordinated and formed. They will meet at the November All Hands Meeting, will participate in quarterly VTC meetings, and will meet face-to-face semiannually (e.g., before and after summer field season).

Data collected by instrumentation installed in the field are calibrated on a routine maintenance schedule with the laboratory instruments housed at NMHU (Martinez aquatic chemistry lab) and New Mexico Tech (Pullin environmental chemistry lab). Data from both field and lab instrumentation are statistically compared to determine whether field instruments are functioning properly and within an acceptable error range. Cross-validation of field and lab instrument calibration is done before and during field season by delivering samples collected and analyzed at NMHU to the NMT laboratory, and vice versa.

APPENDIX A. NM EPSCoR Evaluation and Assessment Plan

Evaluation Plan for New Mexico EPSCoR RIII: 2008-2013
(Revised October, 2009)

The overarching goal for NM EPSCoR RII3 is:

> "Provide the critical infrastructure, computational support, and educational and outreach opportunities to foster excellence in climate change research and collaboration".

The strategic plan identified 14 overarching objectives organized under three broad areas. These are:

I. Research Infrastructure

- Enhance climate and hydrology research infrastructure
- Improve water quality monitoring in high altitude streams
- Develop interdisciplinary acequia research capacity
- Critical gap infrastructure for New Mexico Highlands University
- Innovation working groups
- Critical infrastructure gap seed awards

II. Cyberinfrastructure

- Data acquisition, processing, and storage models
- High performance computing
- Interoperability
- Collaboration technologies
- NM climate change web portal

III. Human Infrastructure:

A. Education Plan

- Teacher professional development institute
- Undergraduate Research Opportunities program
- Graduate research training opportunities
- Faculty leadership fellowship program
- NSF Days

B. Outreach and Communication Plan

- Climate change exhibit
- Climate change seminar Series
- Climate change science cafes
- Town Hall meeting

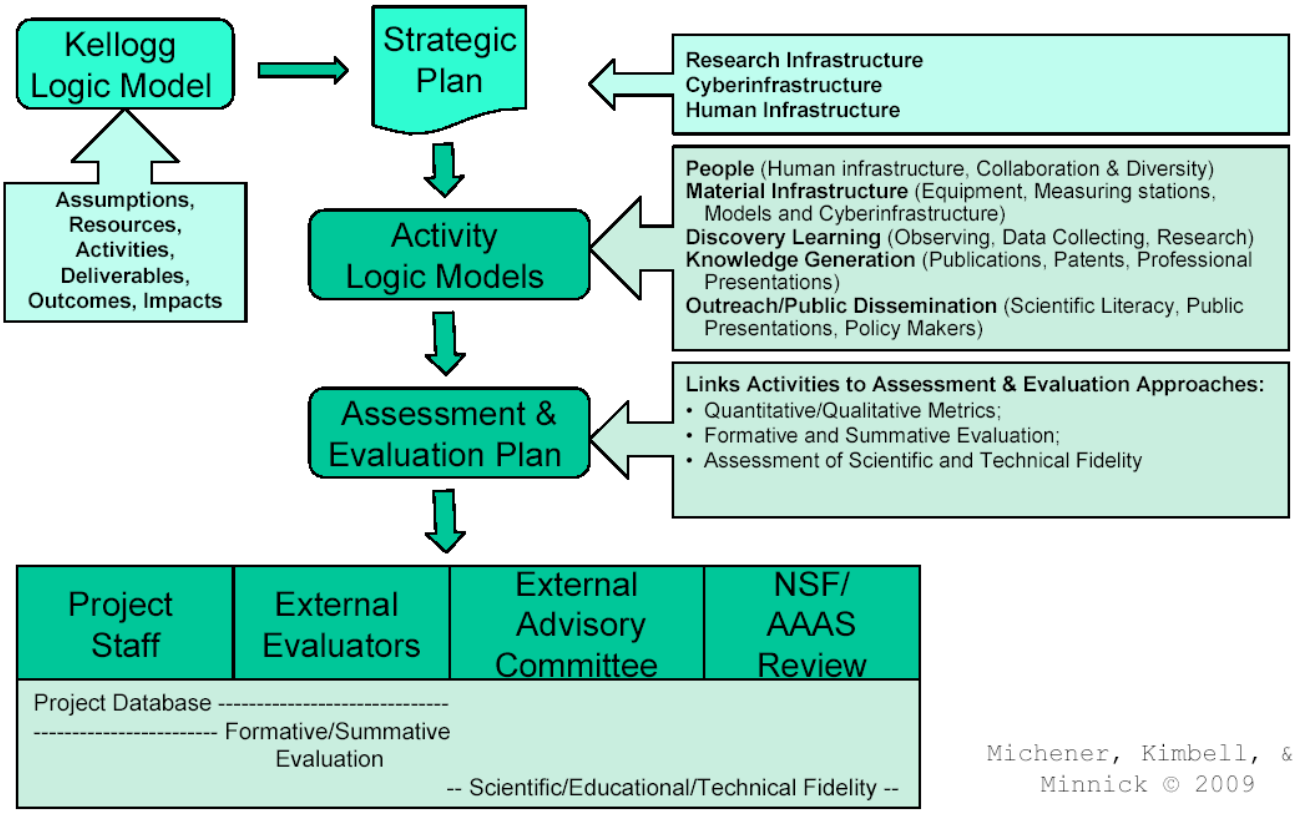
C. Diversify the Human Infrastructure

- Place-based, locally relevant science education
- Strategic student recruitment (BS, MS, PhD)
- Diversity approach embedded throughout
- Programmatic collaboration and networking

Figure 1 presents the overview of the evaluation which is multi-tiered and includes linking appropriate assessment methods and personnel to specific objectives. Project staff are responsible for the day to day assessment of implementation of the strategic plan and using the project database to track deliverables. The external evaluator is responsible for providing formative assessment of project activities through observations, meeting attendance and participant feedback surveys. The external evaluator is also responsible for ensuring the project database is collecting the kinds of data needed for assessing intermediate and long term outcomes of project activities. The external advisory committee provides oversight and evaluation of progress on project objectives, through the lens of external experts who have struggled with the same or similar goals, but who are not constrained by the day to day hindrance of project researchers and managers. The AAAS provides the project with an evaluation perspective based on nationally known experts in the project content areas. Finally, NSF provides review through its reverse site visits and feedback from the program officer.

Figure 1

Assessment and Evaluation Process



All members of the evaluation team need both quantitative and qualitative data to assess the progress of the EPSCoR climate change project objectives and to provide feedback for improving the project activities. The assessment and evaluation plan is designed to match the

type of data collected with the objective being evaluated to inform the RII3 whether the outcome is being reached. The formative evaluation will focus on project development and implementation, including the policies and procedures that enable or hinder the research faculty to conduct their research; the public outreach group being able to produce a kiosk for the public that is understandable and scientifically correct, and the cyber-infrastructure group working team being inclusive of all the affected parties in the state. The time spent on assessing the formative evaluation will result in fewer missteps, better adherence to timeline and a more successful implementation.

The external evaluator will collect and evaluate formative data to assist NM EPSCoR leadership in assuring quality of program management and effective project development and implementation. An effective formative evaluation is essential to identifying organizational and structural areas that may enable or inhibit progress towards project goals. Data such as meeting minutes, communications/ correspondence, project documentation, interviews/observations and participant feedback will help inform the formative evaluation.

The following questions are modeled after those presented in the NSF User-Friendly Handbook for Project Evaluation (1998:7) and will help form the inform the formative evaluation:

- Is the project component being implemented as planned?
- Are the appropriate staff/faculty/partners involved and working together towards the component goals(s)?
- Are there adequate resources/materials/equipment available?
- Are the appropriate participants selected and involved in the planned activities?
- Do the activities/strategies match those described in the plan/proposal? If not, are the changes in activities justified and described?
- Are activities being conducted according to the proposed timeline? By the appropriate personnel?

The external evaluator will attend a sampling of NM EPSCoR activities under all project initiatives, including research initiatives, cyperinfrastructure, diversity, education and outreach and communication. The focus of the observations will be on collecting evaluation data that will assist the management team in improving the implementation of the activities, documenting the outputs, and gaining a better understanding of the process involved in implementation of the proposed components.

The progress evaluation questions begin to assess whether the strategy is resulting in progress towards the stated goals and whether there are activities that are working better than others. It is critical during these formative assessments that the strategy leaders are kept informed of the evaluation results so that the RII3 strategies can be modified as needed. As timely communication of findings is critical a formal report is not the best method for sharing findings. Instead information will be conveyed to strategy leaders and project leaders through email and during project team meetings. A more formal rendition of the formative results and actions taken by strategy leaders will be provided to the EAC and other external review teams.

The progress evaluation will be based on agreed upon metrics with each of the strategy leaders, in consultation with the principal investigator. These will include collecting quantitative and qualitative data that measure the research production; research portfolio quality; human

resources development; research investments and materials; research collaboration and networking; research climate, culture and communications; and diversity. An example of some of the metrics are: number of publication; patents; number and nature of successful awards from NSF and other funding sources; number of large research centers awards, number of faculty/staff/students supported, success rate for research proposals, number and nature of collaborative research, amount of state funding for research, number of women and under-represented faculty and students involved in research. The outcome metrics will include the assessment of teacher inclusion of scientific research in their classroom, URO and RTG students becoming science majors and hopefully, graduates. Public outreach metrics will be more difficult to assess, although we can measure behavioral attitudes and changes in perception of museum goers, we will also include the tracking of requests to the EPSCoR office for research presentations from community groups and newspaper coverage of activities.

The following summarizes the metrics to be tracked and reported annually:

- People: Participant demographics of faculty, postdocs, undergrads, K-12, collaborators, institutions; diversity of all the above
- Material Infrastructure: Equipment purchased & installed, models developed and cyberinfrastructure acquired (number, type, use, results);
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Discovery Learning: data collected, observations and research (number, type, kind, availability)
- Knowledge generation: presentations, publications, proposals and awards, products and patents
- Outreach/Public Dissemination: Scientific literacy and outreach efforts, curriculum development, public outreach, public presentations, policy and policy makers impacted

The last level of evaluation will be summative or outcomes based. This takes place after a project component has been implemented and had the time to have its intended impact. The summative evaluation explores a component's strengths and weaknesses, effective parts, impacts on participants and institutions, and whether the component is cost effective and worth keeping. Individual components will transition to this evaluation step at different times during the five years of the initiative. Some components may not reach the point of being able to be assessed with a summative evaluation during the five years. However, because the summative evaluation builds upon the progress evaluation data being collected through out the project, we will be able to make some tentative judgments regarding the worth or value of all the components by the end of the five years.

Assessment and Evaluation Databases

The size of the project and the number of people, activities and objectives involved require the use of technology for tracking and assessing the results. There are three levels of software that will be used to conduct the evaluation: assessment and evaluation reporting database, online survey software and activities logic model database.

The assessment and evaluation reporting database is designed to collect the data from project participants on the people, material infrastructure, discovery learning, knowledge generation and outreach/public dissemination activities that have been accomplished. These data are to be entered by either the participant themselves or a designee who will enter the information every six months. This information is used for completing the NSF Annual Report and providing information on the project to the external advisory committee and AAAS. It is also used by project staff for tracking adherence to the strategic plan and early identification of problem areas. The external evaluator also used this database to conduct followup with project participants and report project outputs and outcomes as they relate to the various components. The data are collected by objective and is linked to project year, participant, component, and institution.

Online survey software is used to collect and store participant feedback on project activities. We are currently using SurveyMonkey, which allows export to statistical software, so that results can be summarized and imported into the assessment and evaluation reporting database to be linked with the reporting of project activities. Event satisfaction surveys will be collected from participants in the following programs: undergraduate research opportunities, teacher professional development, faculty leadership, innovation working groups, graduate research training opportunities and others as appropriate. Although some project participants will compete surveys off-line, these will be input into the online database for ease of tracking and analysis. The surveys will contain a common set of core item, plus question specific to the goals/objectives of the specific program. This will allow for cross-program comparisons.

The online survey software will also be used to conduct follow-up with workshop participants so that long term outcomes can be tracked. Email addresses will be exported from the assessment and evaluation reporting database and a survey invitation sent electronically to the workshop or project participant. The results of followup surveys for tracking student outcomes will be able to be imported into the assessment and evaluation reporting database by individual so that these outcomes can be linked to component.

The third software tool is an activities logic model database which stores the strategic plan activities by component . This data is currently stored in FileMaker Pro and allows for the electronic generation of activities. Outputs and outcomes by component, as outlined in the strategic plan. This database will evolve as plans change, however, the outcomes should remain the same. This database can be linked to the assessment and evaluation reporting database to identify gaps between the strategic plan activities and those reported in the assessment and evaluation reporting database.

The external evaluator will be assisted by a graduate student who will provide data collection support as well as by the NM EPSCoR IT support person who will assist in the reporting database used for tracking proposals, publications, awards, patents, people, participants, education and outreach activities, and other types of outputs generated by the EPSCoR participants. The database will provide the contact information for tracking undergraduate and graduate students involved in the RII research efforts for conducting longitudinal evaluation of impact.

Table 1 provides a summary of the implementation evaluation questions, sources of information, data collection methods and reporting process and timeframe. This process will apply to each component detailed on page 1 and include each of the specific research infrastructure

improvement programs; cyperinfrastructure program components and human infrastructure. As previously stated, the focus of the formative evaluation process is to assess the effectiveness of the implementation of the various components and to inform the management team in a timely fashion of any problems in resources, inhibiting policies or other challenges to an effective implementation of the RII3 strategies. Evaluation methods will include conducting interviews, surveys, document reviews, observations, document reviews, and maintaining project data on activities and outputs.

Table 2 provides a summary of the output evaluation questions, data collection strategies, and evaluation metrics. The output evaluation questions are focused on capturing the numbers of people, things, activities, etc. that have been proposed by the various RII3 components. The next table on progress evaluation details the expected outcomes.

Table 3 provides a summary of the progress evaluation questions, data collection strategies, and evaluation metrics. The evaluation questions cover the major areas of Research Production, Research Portfolio Quality, Human Resource Development, Research Investments and Materials, Research Collaboration and Networking and Research Climate, Culture and Communication. The progress evaluation assess the outcomes that have resulted from the activities and outputs generated by RII3.

Table 4 provides a summary of the summative or outcomes evaluation questions, data collection strategies, and evaluation metrics. The questions and data collected in the progress evaluation are not repeated here, although these data will be included as part of the summative evaluation. What has been added are the additional evaluation questions related to judging the worth of a component. These questions are applicable across components and therefore are not repeated by area.

Table 1: Implementation Evaluation Questions and Data Collection Process

Evaluation Question	Data Sources	Data Collection Process	Frequency
1. Is the project component being implemented as planned?	Component leaders Selected researchers Project staff Progress reports Attendance at project activities	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
2. Are the appropriate staff/faculty/partners involved and working together towards the component goals(s)?	Component leaders Selected researchers Project staff Progress reports	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
3. Are there adequate resources/materials/equipment available?	Component leaders Selected researchers Project staff Progress reports	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
4. Are the appropriate participants selected and involved in the planned activities?	Component leaders Selected researchers Project staff Progress reports	Interviews, document review	Continuous collection but rotating among components. Reviewed and reported every 6 months
5. Do the activities/strategies match those described in the plan/proposal? If not, are the changes in activities justified and described?	Component leaders Selected researchers Project staff Progress reports Attendance at project activities	Interviews, document review, observations	Continuous collection but rotating among components. Reviewed and reported every 6 months
6. Are activities being conducted according to the proposed timeline? By the appropriate personnel?	Component leaders Selected researchers Project staff Progress reports Attendance at project activities	Interviews, document review, observations	Continuous collection but rotating among components. Reviewed and reported every 6 months

Table 2: Outputs Evaluation Questions and Metrics

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	1. To what degree have the climate stations been upgraded/expanded in northern NM?	Bathke, Rango, Martinez, Pullin	Progress reports & document review	Bi-Annual	Type of expansion/upgrades to climate monitoring system
Research Infrastructure Programs	2. To what degree have technology developed for other environments been developed/deployed in the 3 study basins?	Dahm,Crossey ,Bowman,Pullin	Progress reports & document review	Bi-Annual	# of sensors deployed and type of innovation
	3. How many seed grants and dollars have been awarded to regional university/tribal college faculty?	Project staff	Progress reports& document review	Annual	# of grants, dollars awarded, # undergrads students involved
	4. How many PhD students are involved in University-National Lab Fellowship Program on multi-scale and multi-disciplinary model development?	Project staff	Progress reports & document review	Annual	# of students involved
	5. How many innovation working groups have been held involving how many scientists/educators on which topics?	Project staff	Project reports & document review	Annual	# of working groups, topics, # and type of people involved
Cyberinfrastructure	1. To what degree is the data generated from remote sites and other project sources being processed into a uniform data model within the project?	EDAC (Benedict),Researchers, project staff	Progress reports & document review	Continuous, annual	# of data sites being captured, # of different formats being integrated, # of scientists able to access central data system
	2. Degree of use of HPC computing by tRIBS modeling researchers?	Gatewsky, Ringler, Vivoni, tidwell, NMCAC	HPC logs, progress reports, document review	Annual	# of models generated, # of HPC cycles used
	3. Degree of development of interoperability open standards and client interfaces for accessing and interfacing with project data?	EDAC Researchers, project staff	Progress reports document review	Annual	# and type of standards developed and interfaces provided
	4. Degree of development of collaboration technologies; including web-based online meetings with screen sharing, video & audio, record & replay capability and project portal for knowledge sharing of documents, data	EDAC, project staff	Progress reports, document review, website	Annual	# and type of web-based meetings, # and type of threaded discussions, # and type of documents and data on portal, # of researchers &

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	and threaded discussions?				decision makers involved in different collaboration CI strategies
	5. To what degree has the climate change portal development been used to access project info, etc. and is it able to emulate the quick information access of other science portals?	EDAC	Progress reports, portal access statistics	Annual	# of individual ip addresses accessing site by month, type of material being accessed (news, project info, documents/publications, data and services.
Education	1. To what extent is the Summer Institute for Teachers involving teachers from target school districts and involving project scientists?	Project staff, RII3 component leaders	Progress reports, project database	Annual	# and makeup of school teams, # of school teams applying, geographical distribution and extent of team member participation, # and role of research scientists
	2. To what degree is the Undergraduate Research Opportunities Program (UROP) involving students from non-PhD institutions?	RII3 component leaders, project database	Progress reports, project database	Annual	# of undergrad students involved and their institutions, # of applicants
	3. To what extent is the Climate Change Research training Group (RTG) promoting linkages, creating cadre of scientists and engaging MS and PhD students and faculty from all NM degree granting institutions and NM national labs?	RII3 component leader, project staff	Project database, Document review	Annual	# of courses developed, # and institution of scientists and students enrolled in seminars, # and type of
	4. To what degree is the Junior Faculty Leadership Training workshop involving faculty from across the state in communicating science to different audiences, diversity, assessment & evaluation, cyberinfrastructure and improving productivity?	RII3 component leaders, project staff	Project database, agendas, document review	Annual	# and institution of faculty attending, # and time spent on stated subjects
	5. Is NSF Days involving faculty from all NM universities/ colleges?	Project staff	Project database	Year 2	# and institution of attendees

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
Outreach and Communication	1. To what degree is the NMMNHS Science on a Sphere being visited and receiving publicity?	NMMNHS, news media	Project database	Annual	# of museum visitors, news articles/stories
	2. To what degree is the urban public attending climate change seminar series and receiving publicity?	Project staff, news media	Project database	Annual	# of attendees, new articles/stories
	3. To what degree are the Science Cafe reaching rural New Mexican and receiving publicity?	Project staff, news media	Project database	Annual	# of attendees, news articles/stories
	4. To what degree does the Town Hall meeting engage New Mexicans in public policy discussions about climate change and decreased water supply?	Project staff	Project database	Year 4 & 5	# of attendees, publicity before & after, # and type of pubic policy efforts resulting
	5. To what extent is the public using the Climate Change Web Portal?	EDAC	Web site statistics, online survey	Annual	# of web site hits, web survey on location of visitor
Diversity	1. To what extent are under-represented faculty and graduate students involved in RII3 research efforts 1-5?	RII3 component leaders, project staff	Project database, document review	Annual	# and racial/ethnic background of participants and their roles in research efforts
	2. To what extent are under-represented faculty/staff involved in cyberinfrastructure development objectives 1-5 and content on web portal?	RII3 component leaders, progress reports	Project database, document review	Annual	# and racial/ethnic background of CI participants and inclusion of content relevant to under-represented
	3. To what degree are under-represented students, faculty, teachers and schools serving underrepresented involved in RII3 education objectives 1-5?	RII3 education component leaders, progress reports	Project database, document review	Annual	# and racial/ethnic background of participants and their roles in education efforts
	4. To what extent are the public outreach activities involving children, youth and adults from under-represented groups in the communication and outreach objectives 1-5?	RII3 outreach component leaders, progress reports	Project database, document review	Annual	# and racial/ethnic background of outreach participants and inclusion of content relevant to under-represented

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	5. To what degree is the RII3 management team, AAAS, EAC, CUP, SEC members of under-represented groups and addressing issues of diversity?	Project management, agendas, progress reports	Project database, document review	Annual	# and racial/ethnic background of management committees and inclusion of issues of diversity

Table 3: Progress Evaluation Questions and Metrics

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
Research Infrastructure Programs	1. Are researchers increasing their R&D capacity and competitiveness as compared to the US?	NSF BIIS, university grants and contracts	NSF/university contracts & grants	Annual	Increase in number, size and success rate of research proposals
	2. Are faculty maximizing the state R&D capacity through collaboration?	University Faculty	Web Survey and interviews	Years 1, 3 and 5	Increased collaboration between/among faculty at different universities/labs
	3. To what degree is the research investment from federal, state and private sources increasing?	NSF, state budgets, university contracts & grants	Internet data	Years 1, 3 and 5	Total research $ for STEM research
	4. Are researchers increasing their professional standing and recognition by peers?	Peer review journal citations	Review of citation index	Years 1, 3 & 5	Increased # of publications and citations in major journals
	5. To what extent are local and regional policymakers incorporating RII3 research findings and models in water management deliberations?	Water policy makers in state	Surveys & interviews	Years 1, 3 and 5	Increased knowledge and use of RII3 research findings
Cyberinfrastructure	1. To what extent is the cyberinfrastructure able to provide for the computing & storage needs of researchers?	Research faculty	Surveys & interview	Annual	Increased use of EDAC by researchers
	2. Degree to which collaboration technologies have led to increased research collaboration and enhanced research competitiveness?	Research faculty	Surveys & interviews	Annual	Increased collaboration and research funding via EDAC tools

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	3. To what extent is the climate change portal being accessed and referenced by local and regional water planers and other researchers?	Local & regional planners, links from other portals	Survey, interviews, web searches	Years 1, 3 & 5	Increased use and links to portal
Education	1. Is there evidence that the Summer Institute for Teachers has increased interest, knowledge and achievement in science in participating schools?	K-12 teachers and schools	Survey, interviews, achievement data	Years 2,3,4 & 5	Increase in teacher/student interest, content and achievement in science
	2. Are NM K-12 students closing the gap with students nationwide on a nationally administered test in science?	NCES	Internet	Annual	Overall increase in state NAEP science scores and
	3. To what degree are UROP students increasing their interest and knowledge of STEM research careers?	UROP students	Web survey, interviews	Years 2, 3, 4 & 5	Interest & knowledge of STEM careers
	4. To what extent has the Climate Change Graduate Seminar and Regional Climate Modeling courses impacted students?	CCGS & RCM students	Web survey	Years 2,3,4 &5	Increased interest in climate research field
	5. How has the Junior Faculty Leadership Training increased communication skills, knowledge & promotion of diversity and how to run a research lab?	JFLT faculty	Web survey & interviews	Annual	Increased knowledge, confidence and skills in training areas
Outreach and Communication	1. Are NM citizens increasing their literacy regard science and water issues?	Natural History Museum	Survey	Annual	Increase in science literacy of New Mexicans
	2. Are NM citizens increasing their monetary support of science research?	State legislature web site	S&T Budget allocations	Annual	Increase monetary support for science research
	3. Are NM citizens supportive of policy changes that enhance science research and private/public partnerships?	State legislature web site	Policy changes and memorials	Annual	Increased support for science research private/public
	4. To what extent are Science Cafe attendees increasing their understanding of climate change impacts?	Science Cafe attendees	Survey	Annual	Increased knowledge of climate change in NM

	Evaluation Question	Data Sources	Data Collection	Reporting Frequency	Evaluation Metrics
	5. To what extent is the Science on a Sphere exhibit changing museum goers attitudes and knowledge of climate change?	Museum goers	Survey	Annual	Changing attitudes & knowledge of climate change and local impacts
Diversity	1. Are under-represented K-12 students closing the gap with white students on state administered test in science?	NMPED	NMPED	Annual	Decrease in science score gap between white, Hispanic and Native students
	2. Are under-represented K-12 students closing the gap with white students on nationally administered test in science?	NCES	Internet	Annual	Decrease in NAEP science score gap between white, Hispanic and Native students
	3. Are under-represented undergraduate and graduate students closing the gap in declaring their intention to major in science?	University institutional research offices		Annual	Increase in percentage of women and other underrepresented groups in undergraduate/graduate science majors
	4. Are under-represented faculty closing the gap in their percentage representation in science departments?	ADVANCE	ADVANCE	Annual	Increase in percentage of women and other underrepresented groups in science faculty

Table 4: Summative/Outcomes Evaluation Questions and Data Collection Process

Evaluation Question	Data Sources	Data Collection Process
1. Was the project component successful? What were its strengths and weaknesses?	Component leaders Selected researchers, Project staff Progress reports, Attendance at project activities	Interviews, document review
2. To what extent did the component meet its overall goals?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review
3. What aspects of the component were most effective?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review

4. Were the results worth the cost of the component?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review
5. Did the component meet all its stated goals and objectives?	Progress evaluation (see Table 3)	Document review
6. What unanticipated outcomes resulted from the component activities?	Component leaders, Selected researchers, Project staff Progress reports	Interviews, document review

2008 Data	University of New Mexico [1]	New Mexico Institute of Mining and Technology [2]	New Mexico State University [3]	New Mexico Highlands University [4]	Northern New Mexico College [5]	Eastern New Mexico University [6]	San Juan College [7]	Navajo Technical College [8]	Western New Mexico University [9]	Southwestern Indian Polytechnic Institute [10]
Website	http://www.unm.edu/~oir	http://www.nmt.edu	http://www.nmsu.edu/	http://www.nmhu.edu	http://www.nnmc.edu/index.html	http://www.enmu.edu/	http://www.sanjuancollege.edu/pages/1.asp	http://205.242.219.103/newntc/index.html	http://www.wnmu.edu	http://www.sipi.edu/
Source	2008 - 2009 UNM Fact Book	Institutional Research at New Mexico Tech - Common Data Set 2008-2009	Fall 2008 Fact Book	2008 - 009 Fact Book	NCATE Institutional Report	2008 Fact Data	Office of Institutional Research; San Juan College 2008 Fact Book	Inormation profided by Roy Tracy and Tom Davis from NTC via email on 10/08/09)	(Accessed on 10/06/09)	(Accessed on 10/06/09)
Demographics										
Total Faculty Reported	3,454	151	705	145	49	176	231	68	0	0
Females	1,761	29	341	69	23	81	155	27	0	0
Males	1,693	122	364	76	26	95	76	41	0	0
African American/Black	51	0	7	0	0	3	12	3	0	0
American Indian	97	0	10	1	0	3	0	34	0	0
Asian/Pacific Islander	237	18	45	0	2	8	0	0	0	0
Hispanic	452	7	76	41	21	7	14	0	0	0
White, non-Hispanic	2,496	115	567	94	24	151	187	26	0	0
No Response	121	0	0	9	0	0	2	0	0	0
Other	0	11	0		2	4	16	5	0	0

[1]Office of Institutional Research, University of New Meixco, 2008 - 2009 UNM Fact Book, <http://www.unm.edu/~oir>.

[2]Office of Institutional Research, New Mexico Institute of Mining and Technology, Common Data Set 2008-2009, <http://www.nmt.edu/>.

[3]Office of Institutional Research, New Mexico State University, Fall 2008 Fact Book, <http://nmu.edu/>.

[4]Office of Institutional Effectiveness and Research, New Mexico Highlands, NMHU Fact Book, 2008-2009, <http://www.nmhu.edu/>.

[5]College of Education, Northern New Mexico College, NCATE Institutional Report April 5, 2009, <http://www.nnmc.edu/>.

[6]Office of Institutional Research, Eastern New Mexico University, Fall 2008 Fact Book, <http://www.enmu.edu/>.

[7]Office of Institutional Research, San Juan College, 2008 Fact Book, <http://www.sanjuancollege.edu/>.

[8]Data Assessment, Navajo Technical College, NTC Facts provide by R. Tracy and T. Davis, <http://205.242.219.103/newntc/index.html>.

[9]Data not published or available, Western New Mexico University, <http://www.wnmu.edu>.

[10]Data is not available to the public, POLICY STATEMENT - INDIAN PREFERENCE POLICY: Preference in is given to qualified Indian candidates in accordance with the Indian Preference Act of 1937 (Title 25, USC, Section 472). Verification Form BIA-4432 must be submitted if claiming Indian Preference. <http://www.bie.edu/home.aspx> Southwestern Indian Polytechnic Institute, > http://www.sipi.edu/

The State of New Mexico has a historically diverse population, and today stands as one of four states in the U.S. that can claim minority/majority stats – is that where the minority population of the state outnumbers the non-minority population. Moreover, our state is one in which diversity and cultural richness has been recognized through the centuries, and the universities throughout the state recognize that diversity needs to be expressed, cultivated and made meaningful. New Mexico has unique traditions, languages and multi-cultural heritages which can provide inspiration to cultivate an important model for university diversity efforts.

As a comprehensive research university, the University of New Mexico includes diversity in its values and mission statements, and commits to educating students to functions and thrive in a multicultural and global society. We also acknowledge that to have community credibility, we need diversity at all levels – from our student body, to our accomplished graduates, to our faculty, staff and administrative ranks.

It is through this commitment that we strive to recruitment and retain minority and women faculty, provide faculty development to support diversity, equity and inclusion.

Efforts include:

- Best practices to diversify applicant pools when vacancies occur.
- Strengthening fiscal resources for minority faculty hiring and retention.
- Develop and provide guidelines and support for equity funds and other retention incentives.
- Develop and implement curriculum to meet diversity competencies for faculty.
- Foster faculty-to-faculty mentorship programs
- Provide incentives for research and publication for promoting success of diverse students.
- Support research/service projects to develop diversity expertise

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It is the mission of Navajo Technical College and Southwestern Indian Polytechnic Institute; to provide technical and higher education opportunities that meet the needs of federally recognized tribes. The colleges' values and support diversity within its structure and within the individuals and communities that they serve. They are committed and adhere to the following values and goals within their respective institutions.

- Respect for tribal sovereignty, self-determination, self-governance and recognized for treaty obligation.
- They strive to deliver culturally, socially, and economically relevant education, training and services that will offer long- term solutions and encourage life-long learning.
- Their missions are to promote enchantment and excellence for all American Indians and Alaskan Natives.

Project Summary

Introduction. The Western U.S. faces daunting challenges. Populations are increasing; demand for fresh water exceeds the available supply; and regional and global climate change and variability affect natural resources, disturbance regimes, and the region's economies and citizens. In 2008, Idaho, Nevada, and New Mexico independently submitted NSF EPSCoR Track 1 Research Infrastructure Improvement (RII) proposals that shared a common theme and addressed a global challenge: climate change and its effects on water resources, ecosystems, and the environment. Following up on their Track 1 RII awards, the three states formed a Consortium to pursue cyberinfrastructure (CI) improvements that would leverage their resources so that the cumulative impact of NSF RII investments in the three states could exceed the sum of the parts. The impetus for this Track 2 proposal has been the recognition of the complexity and scale of the scientific challenge and subsequent ramifications for science, education, and economic development

Project Goal and Objectives. *The goal of this project is promote knowledge transfer to scientists, educators, students, and citizens within and beyond the Consortium by enhancing state CI, and to enable the community science that is required to address regional to global scientific and societal challenges.* To meet this goal, the Consortium proposes three high priority objectives:

1. Increase connectivity and bandwidth. Significant effort will focus on promoting communication and collaboration by improving connectivity infrastructure within the Consortium. Proposed and future Consortium efforts related to improving research competitiveness, STEM education, and economic development rely on this basic infrastructure.

2. Enhance data and model interoperability. The Consortium will promote discovery by supporting community-based climate change science through enhanced interoperability between models and other software components, improved access to and usability of Consortium data products through the adoption of standards-based data management and access models, and new data assimilation, analysis, and visualization capabilities.

3. Utilize CI to integrate research with education. The Consortium will enhance learning by focusing particularly on graduate student and postdoctoral researcher development; extending cyber-enabled science education into middle and high schools and extracurricular programs; and improving outreach to business and industry.

Project activities designed to enable the Consortium to achieve these objectives are described below.

Overarching Outcome. Track 2 investments will enhance the ability for our Consortium to better address 21st Century grand scientific and societal challenges related to climate change through increased competitiveness for research funding and sustained partnerships among our jurisdictions.

Activities designed to increase connectivity and bandwidth (Objective 1). The high speed networking connectivity activities in Track 2 will focus on improving communication and connectivity within and between the states. Each state in the Consortium is in a different phase of CI development and requires different CI to achieve Consortium goals.

Idaho: Idaho will upgrade infrastructure to deliver improved network connections to key university researchers' labs and desktops. Idaho will also work to connect difficult-to-access sites within Idaho by adding to, enhancing, and using the Idaho Regional Optical Network (IRON).

Nevada: The initial focus in Nevada is to increase the connectivity *into* the state network. The next step will be to improve connectivity *within* the state through several networking and video conferencing upgrades, as well as networking monitoring tools across the state.

New Mexico: New Mexico activities will enhance connectivity to academic institutions by establishing a distributed computing and collaboration infrastructure that consists of compute nodes at portals or gateways at Tribal colleges and Hispanic-Serving Institutions throughout the state.

Outcomes from increasing connectivity and bandwidth. EPSCoR Track 2 investments in connectivity will facilitate new data-intensive research, scientific collaborations, distributed experiments, grid-based data analysis, IP videoconferencing, social networking, and cyber-enabled learning. Network

improvements on Consortium campuses will remove bandwidth bottlenecks and allow faculty involved in climate-related research at each university to fully utilize available bandwidth for research and education.

Activities designed to achieve data and model interoperability in support of community science (Objective 2). Community science and virtual organizations are essential for addressing complex, large-scale challenges like climate change. The proposed collaborative CI development will overcome existing challenges by focusing on two closely related activities.

1. Creating a model and software interoperability framework: The team will establish a model and software interoperability framework based on emerging national and international standards, along with scenarios and applications that make use of that framework. The framework will allow users to specify, maintain and update—through a central user interface and a common methodology—a collection of software tools, and the interconnections between tools needed to accomplish climate research tasks.

2. Building an interoperable data archive: The Consortium will implement a data archive model that is based upon open data and metadata standards and supports standard data interoperability models. The interoperable data archive will enable streamlined discovery of and access to data products generated by all three state EPSCoR programs. These activities will use web interfaces to communicate the availability of data, models, training, and activities of researchers; will leverage existing national/international resources; and will make any code that is developed available through open source outlets.

Outcomes from achieving data and model interoperability: EPSCoR Track 2 investments will provide new model and data interoperability solutions and an integrative software framework that will transform exploration, experimentation, and innovation in climate research. Project activities build upon existing resources within Idaho, Nevada, and New Mexico, and are designed to leverage other major NSF-supported initiatives (including CUASHI HIS, GEON, and CSDMS). The project will significantly reduce the difficulty in finding, accessing, and using the diverse data products available in the Consortium. Consortium results (data and models) and resources (archives) will become readily accessible to the broader community of environmental scientists, decision makers, students, and the public.

Activities utilizing CI to integrate research with education (Objective 3). The Consortium faces many challenges in helping to meet the national need for a 21st century workforce that is scientifically capable and CI-literate. Using climate change as the underlying theme, we propose three activities designed to expand CI awareness, enhance use of CI, and better integrate quantitative reasoning, data analysis, and climate change modeling with education.

1. CI training workshops: A series of training opportunities to develop CI capacity and hands-on experience with climate modeling and scientific information systems will be provided for students, postdoctoral associates, and faculty.

2. Cyberlearning materials: New cyber-enabled curriculum and education materials will be created and implemented for middle school and high school science education.

3. Industry CI Days: An Industry CI Days program will be piloted in NM with business and industry as a target audience to increase CI awareness and promote economic development opportunities.

Outcomes from increased integration of research and education: EPSCoR Track 2 investments in education and training programs will build human resources capacity in our Consortium by increasing awareness, skills, and knowledge in the areas of climate change and cyberinfrastructure. The activities will support a “students in STEM” pipeline approach that begins with middle and high school education, extends to professional training for graduate students, postdoctoral associates, and faculty, and promotes CI awareness to business and industry. These new investments will complement Track 1 resources that support undergraduate engagement in climate change research.

Communication and Dissemination. We will foster scientific literacy and improve educational and research capacity within the Consortium through three dissemination and communication activities: (1) establishing effective internal communications among the Consortium’s partners to enable efficient sharing of data and information; (2) creating coordinated mechanisms to communicate project results, benefits, and processes to scientists, citizens, and stakeholders within the Consortium and other EPSCoR jurisdictions; and (3) developing cyberlearning tools for educational outreach. A centerpiece for communication is an annual tri-state CI meeting that will include Track 1 and 2 members. Faculty,

graduate students, and postdoctoral associates will share ideas and present their work at the meeting. *These tri-state meetings represent an unprecedented leap in collaborations and information sharing between our states.*

Management, Coordination, and Evaluation. The Consortium's management and coordination plan draws on the strengths of each state's EPSCoR program structure. To ensure timely progress and long-term success, there are four primary elements in the CI management structure: (1) State Committees; (2) EPSCoR offices and Management Team; (3) CI Component Teams; and (4) external evaluation and assessment. The Management Plan also includes a postdoctoral mentoring plan. Communication mechanisms to support project management include the annual tri-state CI meeting, NSF EPSCoR Project Director and National meetings, and online video and/or teleconferences. The External Advisory Committee and External Evaluator will evaluate progress and provide the Management Team with input to help ensure successful attainment of the project's goals.

Diversity. The Consortium is committed to improving access to cyberinfrastructure for underrepresented groups and geographically disadvantaged populations and to increasing diversity in the 21st Century workforce. Three principal activities will help the Consortium to make meaningful progress in achieving diversity goals: (1) invest in the connectivity solutions and human resources that enhance access to CI; (2) maximize geographic, ethnic, cultural, physical, and gender diversity in Track 2 programs; and (3) develop realistic accountability metrics and mechanisms. Close coordination with and leveraging of Track 1 resources are central to our diversity plan.

Sustainability. Consortium CI development activities will be sustained by: (1) commitments to long-term support by individual states and institutions for Track 2 activities; (2) development of new proposals that make use of and provide continued CI support; and (3) creation of new partnerships and strengthened collaborations (e.g., CSDMS, NCAR, National Laboratories, state and federal agencies).

Intellectual Merit and Broader Impacts:

Intellectual Merit: Climate change affects all natural environments. In the Western U.S., climate change impacts may be especially pronounced due to the tight coupling between climate and regional hydrology, and its ramifications for the water supply, disturbance regimes (e.g., fire, drought), the region's economy, and quality of life. The proposed cyberinfrastructure developments will enable atmospheric scientists, climatologists, hydrologists, engineers, social scientists, economists, and others to more effectively share standardized and interoperable data and models, and to more easily develop regionally coupled atmosphere-land surface-hydrology-socioeconomic models. Consortium institutions and states will be linked to more than 200 other Internet2 universities, government research laboratories, companies, and many research facilities throughout the world, facilitating data-intensive research, collaborative development, distributed experiments, grid-based data analysis, and experimentation using high performance networking, social networking, and cyber-enabled learning. Improvements in connectivity and enhanced interoperability and accessibility of data and models will enable the Consortium to realize its community science objectives and transform the way our states do research. Moreover, Track 2 investments will support effective participation in national and international virtual organizations—e.g., National Ecological Observatory Network, the Consortium of Universities for the Advancement of Hydrologic Science, Inc.—that work to solve problems associated with global climate change.

Broader Impacts. The proposed CI investments in the Consortium will achieve broad impact and add value by leveraging existing resources and infrastructure within the institutions, jurisdictions, and regions. The institutions that will benefit from increased connectivity include rural institutions and those that serve Hispanic and Native American students and faculty. Open access to the data and models developed within the Consortium and made available through the data archive and the model interoperability framework ensure that scientific products can be broadly disseminated and readily used by scientists, engineers, and students throughout the world. Moreover, the project will make usable high-quality environmental data, information, and models available for STEM education and outreach. The Consortium's education programs are designed to have far-reaching impact by: (1) developing new CI skills and climate modeling expertise for graduate students, postdoctoral associates, and faculty; (2) integrating cyberlearning and climate change science into middle and high school science education, especially targeting rural schools and schools that reach Hispanic and Native American students; and (3) developing a Industry CI Days Program that promotes CI awareness in business and industry.

DOE EPSCoR Lab Partneship RFP June 5, 2009 Pre-Application submitted

	PI Last Name	PI First Name	PI School	PI Department	Lab	Lab Collaborator	Proposal Title
1	Vorobieff	Peter	UNM	Mechanical Engineering	LANL	Susan Kurien	Effects of global climate change on water stream meanderings and landscape evolution.
2	Han	Sang	UNM	Chemical and Nuclear Engineering	SNL	Jeffrey G. Cederberg	Nanoscale Heterojunction Engineering to Integrate III-V and Ge on Si for High-Efficiency Multijunction Photovoltaics.
3	Schaub	Tanner	NMSU	Chemical Analysis and Instrumentation Lab	LANL	Clifford Unkefer	Ultra-high Resolution FT-ICR Mass Spectrometry for the Characterization of Algal Biofuel and Feedstock
4	Shi	Feng	NNMC	College of Engineering	LANL	Joysree Aubrey Jose Martin Tacetti	Photonic Crystal Prismatic Ultra-high Efficiency Photovoltaic System
5	Kalugin	Nikolai G.	NMT	Materials and Metallurgical Engineering	SNL LANL	Eric A. Shaner Stephen K. Doorn	Brand Structure, electron relaxation properties, and Raman scattering in planar and nonplanar graphene nanostructures
6	Zhang	Peng	NMT	Department of Chemistry	SNL	Willie Luk	Investigating optical response from plasmonic nanostructures as SERS substrates
7	Bustamante	Camilla	NNMC	VP of Research	LANL	Lisa Henne Sam Loftin Mike Ebingger	Development and evaluation of Biochar for CO2 sequestration while managing organic waste and improving food prodcuction
8	Leseman	Zayd	UNM	Department of Mechanical Engineering	SNL	Ihab El-Kady	Manipulation of Phonons with Phononic Crystals
9	Hirschfeld	Deidre	NMT	Department of Materials and Metallurgical Engineering	SNL	Aaron Hall	Development of Novel Microstructures Utilizing Plasma Spray
10	Stone	Mark	UNM	Civil Engineering	SNL	Vince Tidwell Amy Sun	Integrating physical hydrology and climatology models into decisison support tools