

The Solar Energy-Water- Environment Nexus in Nevada

Presented to AWMA

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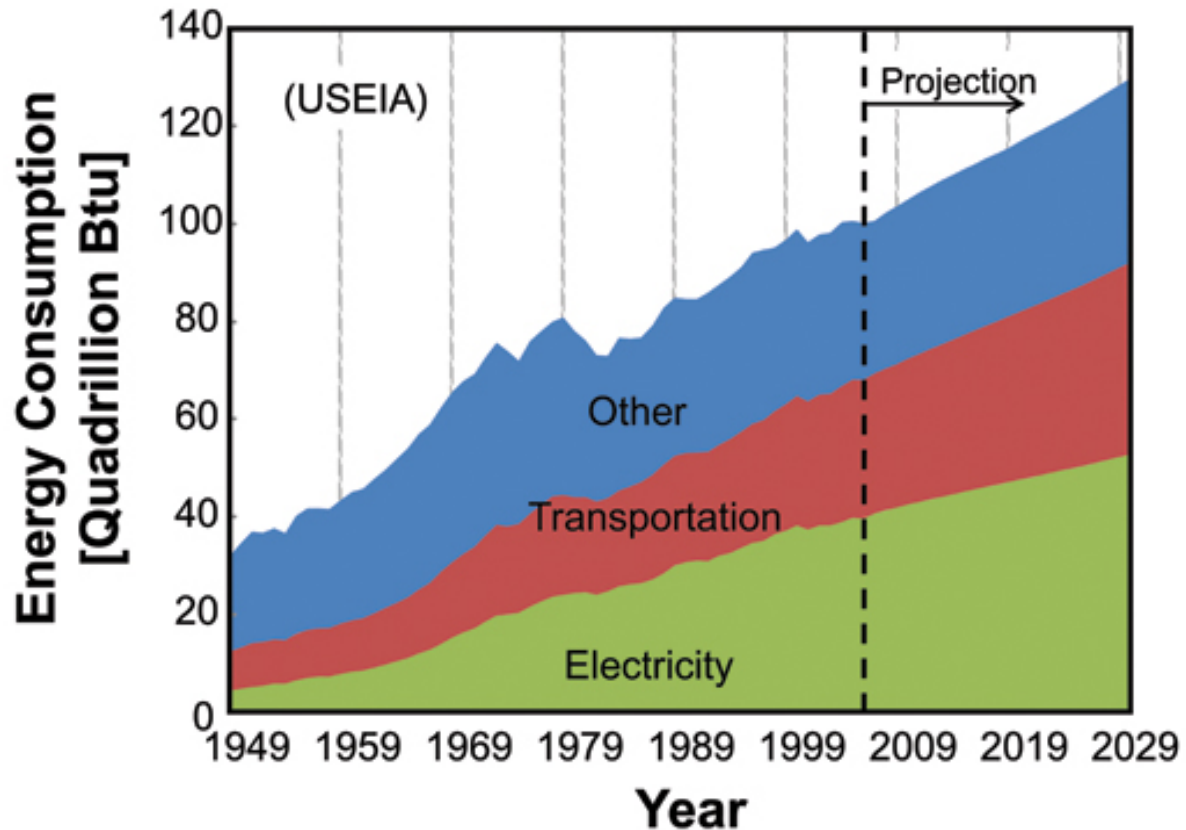
Desert Research Institute



Energy - We all use it



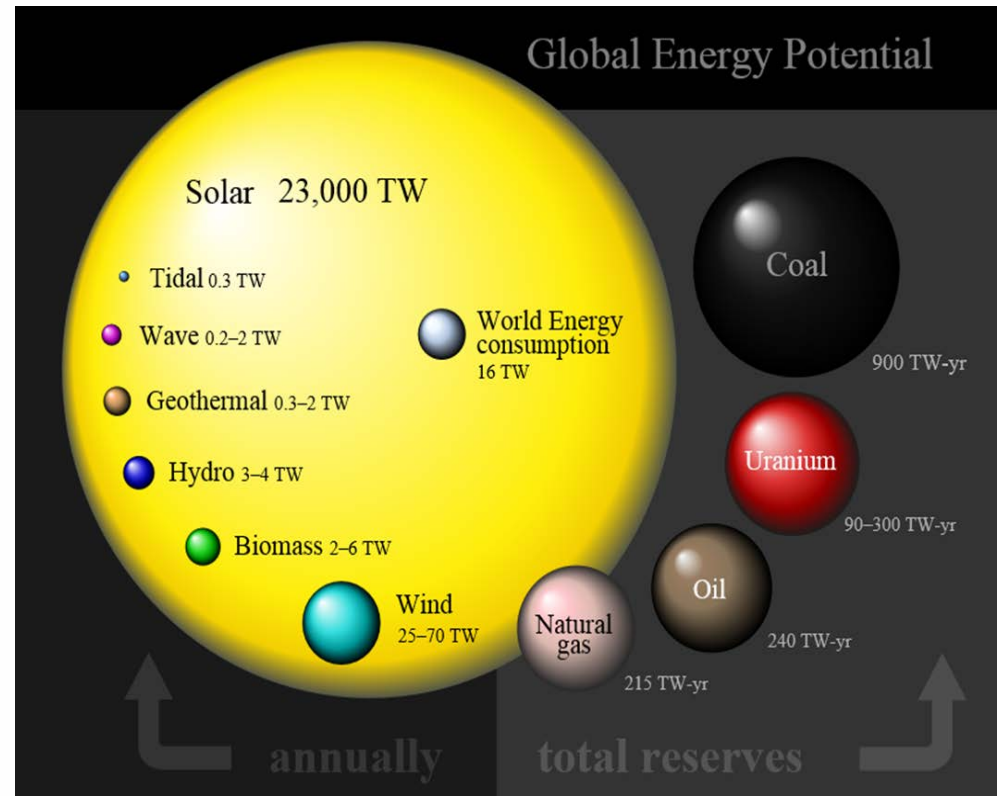
US Energy consumption will continue to rise



Nevada is in a unique position to help meet the nation's energy needs

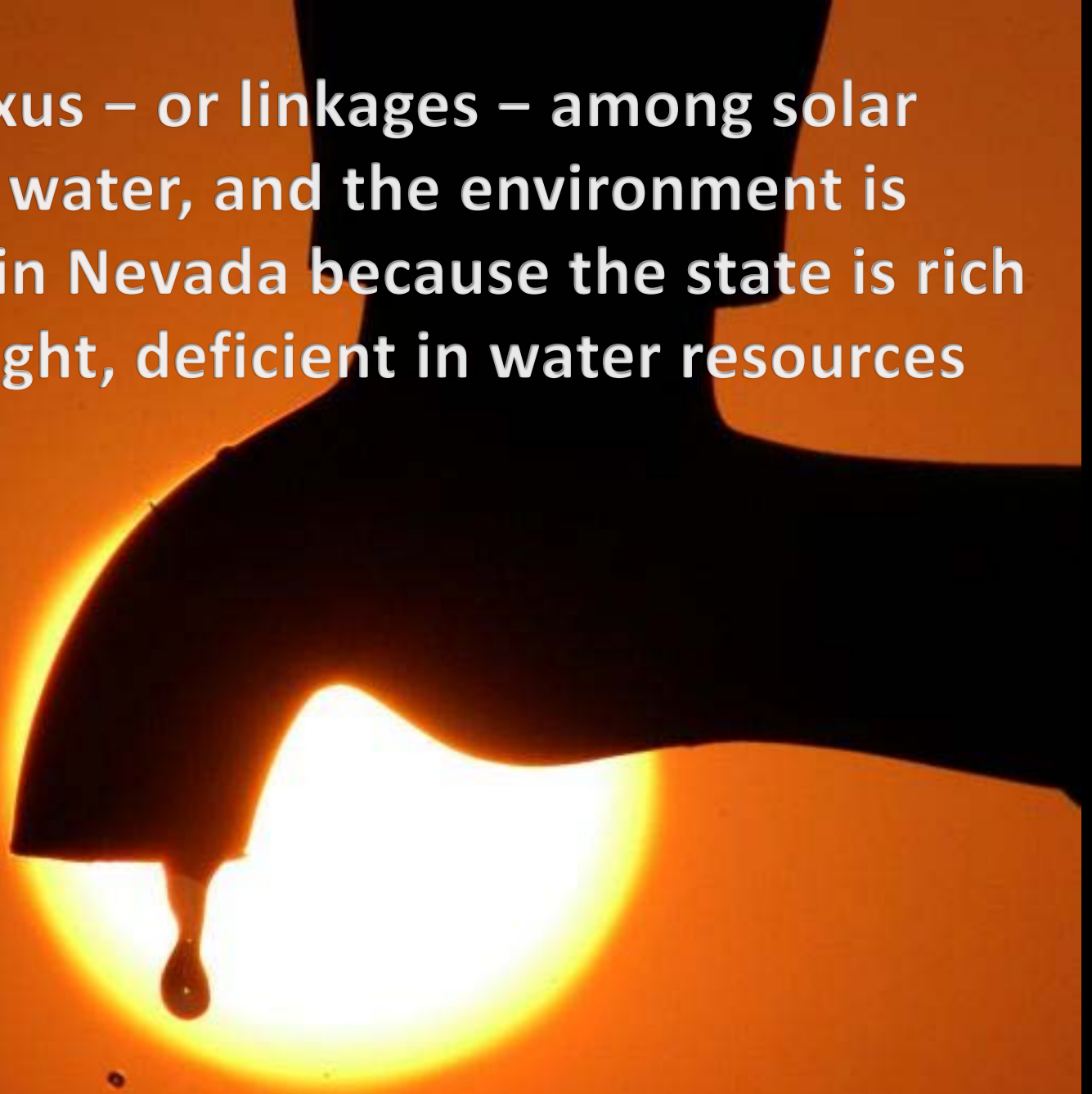
Solar flux is abundant and open land is plentiful in Nevada.

Utilizing solar energy has the potential to significantly diversify the economy of the state.



Source: Perez et al., 2009, "A Fundamental Look At Energy Reserves For The Planet", p.3, PDF (archived). Licensed under Public Domain via Wikimedia Commons

The nexus – or linkages – among solar power, water, and the environment is strong in Nevada because the state is rich in sunlight, deficient in water resources



.....and located in a sensitive desert environment.



The Goal



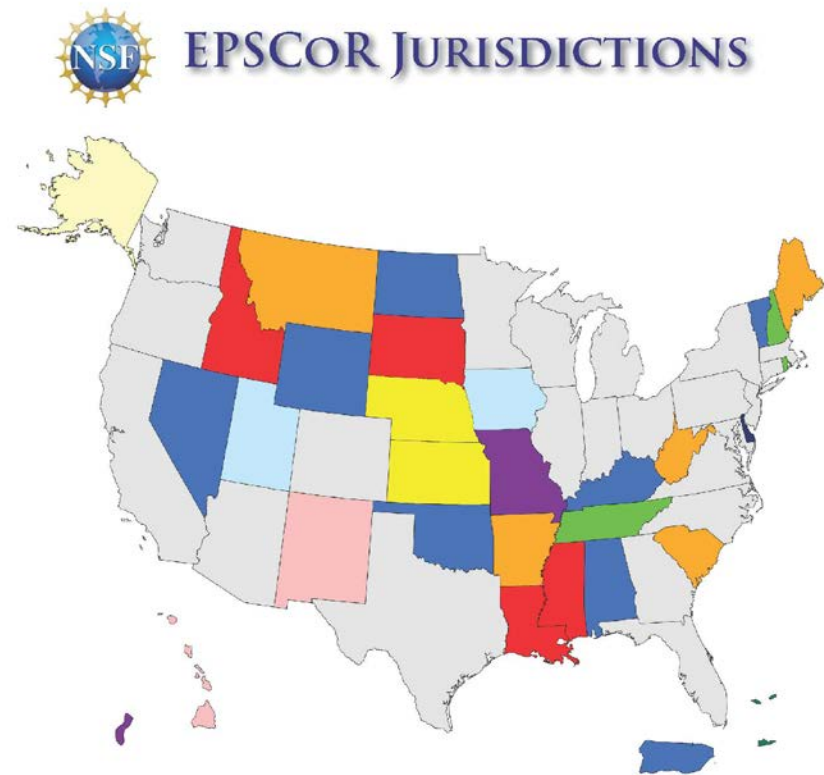
To harvest solar energy with minimal water use and minimal environmental impact



EPSCoR States



- Nevada became an EPSCoR state in 1985
- <0.75% of NSF's funding
 - Nevada = 0.24%
 - California = 14%
- 28 states + 3 jurisdictions
 - Hold 20% of U.S. academics
 - Receive 10% of federal research dollars



1980	1985	1987	2000	2003	2009
Arkansas Maine Montana South Carolina West Virginia	Alabama Kentucky Nevada North Dakota Oklahoma Puerto Rico Vermont Wyoming	Idaho Louisiana Mississippi South Dakota	Alaska	Delaware	Iowa Utah
			2001	2004	2012
		1992	Hawaii New Mexico	New Hampshire Rhode Island Tennessee	Guam Missouri
			2002		
		Kansas Nebraska	U.S. Virgin Islands		

* Utah, Tennessee, and Iowa are no longer eligible.

The Solar Energy-Water Environment Nexus in Nevada (NSF EPSCoR Track-1)



- Research on solar energy generation technology, its environmental impacts and associated water issues, accelerated by cyberinfrastructure
- 5 years (2013-2018)
- \$20M

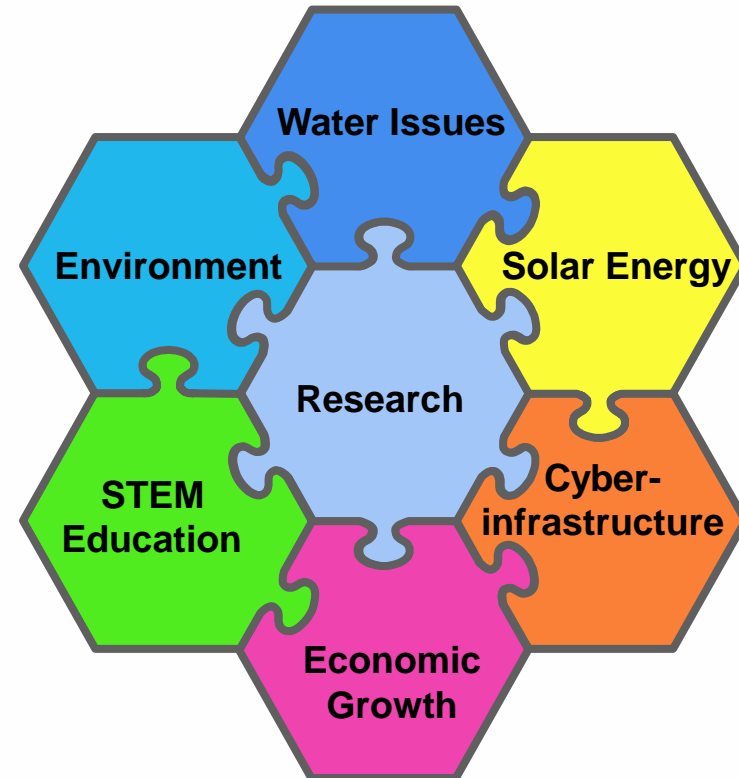


Mission



To advance knowledge and discovery through research on solar energy generation technology, its environmental impacts and associated water issues, and accelerate this research by developing new capabilities in cyberinfrastructure.

Benefits include diversifying Nevada's economy, building its workforce, and developing innovative approaches to STEM education.



NEXUS PI and Co-PIs



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Desert Research Institute



Dr. Jaci Batista

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University of Nevada, Las Vegas



Dr. Robert Boehm

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Dr. Markus Berli

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Co-Principal Investigator
University of Nevada, Reno

NSHE Participants

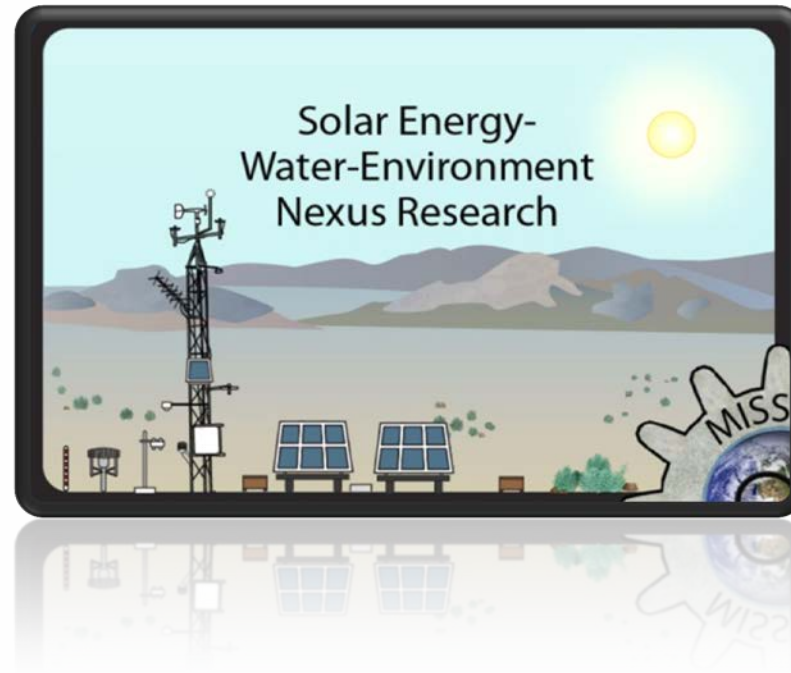
- 42 Faculty
- 1 Post-doc
- 21 Technicians and research associates
- 29 Graduate students
- 28 Undergraduate students
- 5 New faculty members
 - High temperature materials (UNLV)
 - Restoration ecology (UNLV)
 - Clean energy economics (UNR)
 - Advanced water technology (DRI)
 - Intelligent data mining (UNR)



NEXUS Research Themes

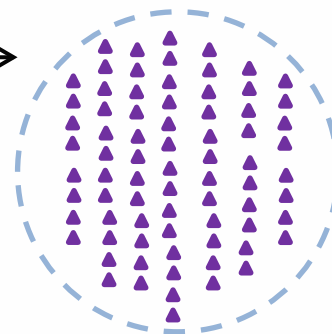


1. Minimize water use at solar facilities
2. Environmental impacts of solar projects
3. Sustainable and advanced water approaches for solar development
4. Solar economics and energy reliability
5. Advanced CI to accelerate NEXUS research



1. Minimize water use at solar facilities

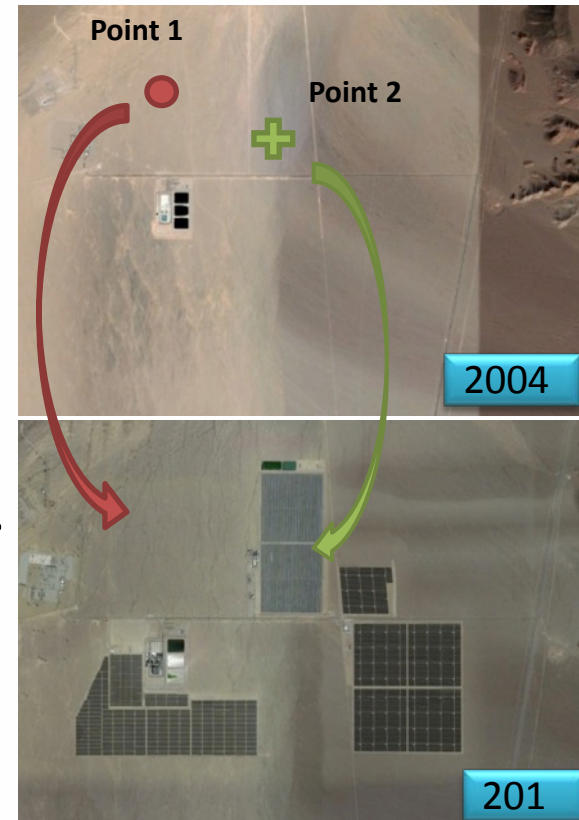
- Direct Minimization
 - Improve dry cooling technology
- Improve Plant Efficiency
 - Higher temperature operation
 - More efficient receiver designs
 - More efficient thermal cycle designs
 - More efficient heat exchanger designs
- Understand, mitigate dust accumulation on PV panels



Transparent nanoparticle arrays on solar panels for dust particle reduction and removal

2. Environmental impacts of solar projects

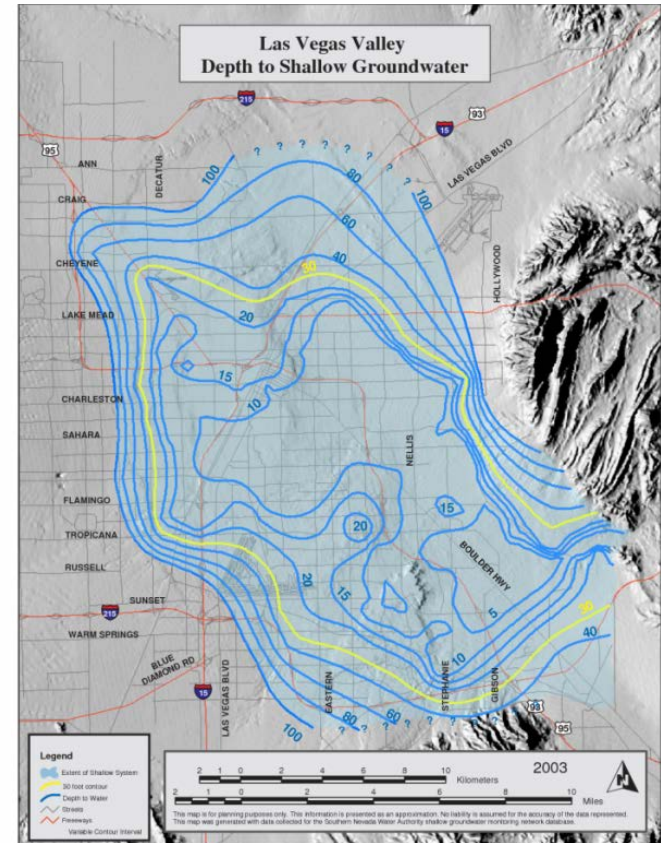
- Land cover changes
- Land fragmentation
- Biological soil crusts
- Arid soil hydrology
- Microclimate change - plant communities
- Animal population dynamics



Location of the two selected sites in NV Solar One facility area to track land cover change.

3. Sustainable and advanced water approaches for solar development

- Use lower quality groundwater in renewable energy
- Reduce energy consumption for transport and treatment of water
- Increase on-site reuse of solar cooling waters with membrane distillation



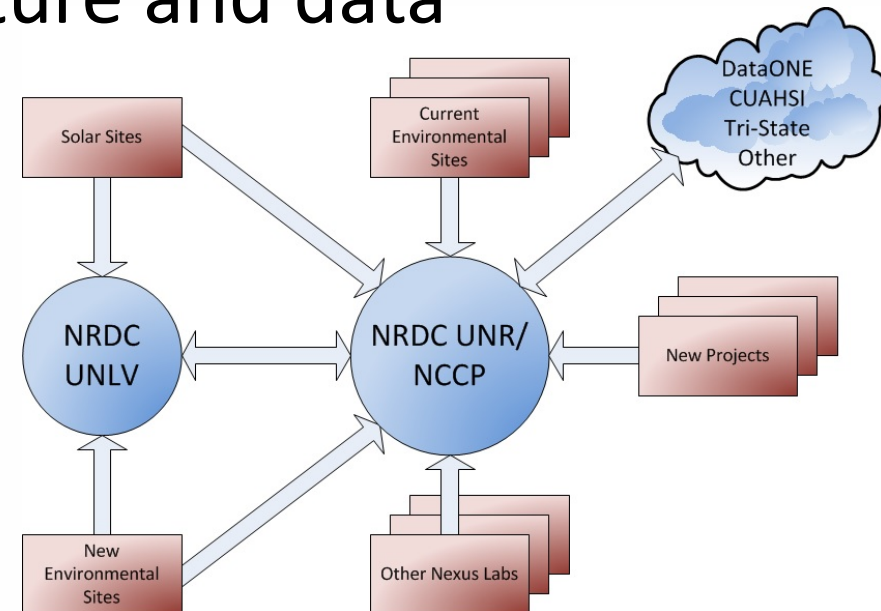
4. Improve reliability, economic modeling, and sunlight forecasting for renewable and solar energy supply

- Microgrid development to achieve high reliability and quality of power
- Solar irradiance forecasting to improve solar power generation, management, planning
- Economic analysis of solar/renewable energy projects



5. Advanced CI to accelerate Nexus research

- Data processing and analysis
- Software engineering and human-computer interactions
- Communication networks
- Database architecture and data management
- Data Center



Diversity Programs

- Bright Stars PUI Outreach
- Hands on Training (HOT)
- STEM Pipeline Website
- STEM Mentor Network
- New Faculty Leadership Training
- Application Writing Workshops
- Undergraduate Research for URM



Workforce Development and Education Programs



- Undergraduate Research Opportunities Program (UROP)
- Nevada Educators Really doing Solar (NERDS)
- STEM Career Investigation Program (SCIP)
- Summer Internships
- Student-created Bilingual Videos
- Green boxes



Photovoltaic systems located on the roof of the UNLV Engineering Building

External Engagement Program



- Stakeholder Outreach and Partnerships
 - Industry
 - Agencies
 - Scientific Communities
 - Public
- Communication and Media
 - External to NSHE
 - Internal to NSHE



Expected Outcomes



Increased intellectual assets and innovations that will improve development and reliability of renewable and solar energy supply.

A new archetype for cyberinfrastructure research and development.

Established relationships and partnerships with key stakeholders that strengthens Nexus research and supports economic development.

Advancement of a diverse pool of STEM graduates.

Increased knowledge of, and a ***pipeline*** of students pursuing, STEM careers.

NEXUS Opportunities

- NEXUS – A one Stop Shop on solar energy, water and environment research
- What can the NEXUS do for you as a stakeholder?
- Student internships available
 - Undergraduate and graduate students from UNR and UNLV
 - Funding available

How to find out about NEXUS and other Nevada EPSCoR opportunities:

Sign Up for Listserv:
www.epscor.nevada.edu

Nevada System of Higher Education Sponsored Programs



Contact the NEXUS



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Questions?