University Participation in Energy Parks

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Outline

- University Mission
- An Industry Asset
- UNLV Case Study
Mission

The mission of universities is EDUCATION.

• The motto of research universities:
  Teaching
  Research
  Service

• Public research universities are typically:
  Non-profit
  Serve industry through undergraduate education
  Survive and thrive on graduate research
  Abide State requirements set up for academia
Mission

The UNLV Research Foundation

• An affiliated foundation of UNLV and a 501(c)(3) not-for-profit corporation chartered in the state of Nevada.

• The mission of the foundation is to support UNLV research and to support economic development in Southern Nevada by developing and maintaining UNLV research and technology parks as perpetual assets to enhance intellectual, scientific, and financial growth for the university.
Universities are Industry Assets

- Workforce pipeline
- Incubate and grow skill sets
- Strength of research programs tied to local industry
  UNLV – Hotel Administration and Radiochemistry
- University-appropriate research:
  Time frame of a MS or PhD thesis
  Basic research-oriented (low cost, high payback)
  Fills in where state funds are sorely lacking
  (graduate students, post-docs, research faculty)
- Large community of diverse experts (think-tank)
UNLV Case Study

Nuclear Programs

- Originated with DOE-EM in 1995 (Test Site cleanup)
- Large-scale programs developed via DOE-NE starting in 2001
- Current growth with NNSA and DARPA
- Expected growth with DHS, FBI, and DoD
- Industry ties with fuel cycle and nuclear medicine
- National laboratory/federal facility ties with fuel cycle and national security
- Vibrant collaborations with other universities and developing virtual shared nuclear course catalog
- Large investment into laboratory infrastructure (mainly DOE but building modifications by UNLV)
UNLV Case Study: Nuclear Programs

• 4 faculty with clearances (Q and TS)
  6 more in process (offered recently through NSTec)
• Radiochemistry identified as niche area in 2003
  Regents approved PhD in 2004
  Currently 4 academic and 4 research faculty
  18 PhD students (17 are U.S. citizens)
UNLV Case Study: Hot Dry Rock Energy
UNLV Case Study: Hot Dry Rock Energy

The Future of Geothermal Energy

(MIT, 2006)

An Evaluation of Enhanced Geothermal Systems Technology
Geothermal Technologies Program

(DOE-EERE, 2008)
Motivation to go Green

- Increased population
- Increased electrification
- U.S. capacity currently more than 1000 GWe
- 2020 to 2030: 50 GWe coal will be retired
- Solar and wind cannot take up the demand without storage (e.g., batteries)
- Biomass better served to replace transportation fuel
- Hot Dry Rock systems are versatile, inherently modular, and scalable from 1 to 50 MWe.

(Conca, 2008)
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Why Hot Dry Rocks?

- Large and well-distributed national energy resource
- *Green* because low emissions
- One of few green energy resources that can provide continuous base-load power with a small footprint, and low emissions
- Tested around the world and technology improving steadily
- Potential to be cost-competitive but need Research & Development investment
- No major barriers or limitations on the technology (i.e., no insurmountable technology problems)
- Found significant progress in France and Australia
- Extractable amount in U.S. can be 20,000 times annual U.S. energy use.
UNLV Case Study: Hot Dry Rock Energy

Initial Concerns
• Flow short-circuiting
• A need for high injection pressures
• Water losses
• Geochemical impacts
• Induced seismicity

*Fully resolved or manageable*

Research-drive Improvements
• Drilling technology
• Power conversion technology
• Reservoir technology

(MIT 2006 Study)
UNLV Case Study: Hot Dry Rock Energy

Recommendations

- $300M to $400M RDD investment over 15 years is needed
- Have a number of different sites compete.
- Work on positive policies (accelerated permitting and licensing, loan guarantees, depletion allowance, intangible drilling write-offs, accelerated depreciations, production tax credits, renewable credits, and portfolio standards)
- Participate in international field projects
- Update economic analyses
UNLV Case Study: Hot Dry Rock Energy

A Hot Dry Rock Geothermal Energy Project was conducted at Fenton Hill, New Mexico from 1974-1998.
David Duchane, Ph.D., Project Manager
Flow Testing has shown –

- Stable, Predictable Production Rates
- Outstanding Load-Following Performance
- Sustainable Fluid Temperatures
- Low and Declining Water Consumption
- Dynamic Reservoir Flow Paths
- Resistance to Flow Concentrated near the Production Well
- Favorable Reservoir Productivity Changes can be Induced

and –

- Simple, Consistent Fluid Geochemistry
- Net Energy Production
- Straightforward Operation

ROUTINE HDR HEAT MINING IS FEASIBLE!

Duchane, 2009
HDR Technology

1970

- Idealized Concept
- A Few Proponents
- A Single Vision of all Resources
- Speculative Ideas Only
- Simply an Extension of Oil and Gas Technology

Today

- Demonstrated Technology
- A Diverse Community of Experts
- Recognition that Each Reservoir is Unique
- A Large Amount of Practical Knowledge, Experience and Theory
- Both Derived and Entirely New Tools and Techniques

The Essential Elements of a "Heat Mining" Industry Have Now Been Put in Place

Duchane, 2009
UNLV Case Study: Hot Dry Rock Energy

- UNLV partnership with Nye County
- Support by Nevada Test Site M&O contractors
- Follow-on to Fenton Hill
- 5 MWe demonstration plant
- Scientific Research and Educational Center
UNLV Case Study: Hot Dry Rock Energy

Proposal in Development

Phase I: Initial Site Selection and Planning Studies
Phase II: Site Specific Field Studies
Phase III: Injection Well Development
Phase IV: Production Well Development
Phase V: Facility Development
Phase VI: Initial Operations and Test Operations
Phase VII: Technology Transfer
Phase VIII: Turn Over Commercial Operations
UNLV Case Study: Hot Dry Rock Energy

Proposal in Development

• Take advantage of the remoteness and the long history of drilling holes (~4000) and testing that caused seismic activity at the Nevada Test Site.

• Establish a Hot Dry Rock Geothermal Energy Educational and Scientific Research Center at the Nevada Test Site. Strong support from UNLV and Great Basin College.

• Issues: stakeholder buy-in, academia/industry/government teaming, scope in EIS, water, and control over surface and subsurface at site.
Concluding Remarks

- Students are in a developmental state
- State-sponsored faculty are eager to conduct industry-sponsored research
- Internships and the virtual classroom can provide connectivity with national labs and industry
- Developmental research at a university is low-investment and high-payoff (IP is university goal)
- These assets can leverage the “Energy Park” concept
- The “Energy Park” concept is being implemented between UNLV, Nye County, and industry.