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Education and energy innovation: NSHE’s central role in transforming Nevada’s economy

James Croce
McDonald Carano Wilson

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Education and Energy Innovation:  
NSHE’s Central Role in Transforming Nevada’s Economy  

2009 Renewable Energy Symposium  
University of Nevada - Las Vegas  
August 11, 2009  

Jim Croce  
President and CEO  
jim.croce@nirec.org
Presentation Agenda

1. NIREC Overview
2. Higher education and Nevada’s economy
   – How do we stack up?
3. Renewable energy production exports
   – A strong foundation for Nevada’s economy
4. The energy innovation imperative
   – An essential element of Nevada’s prosperous future
5. NIREC’s energy technology commercialization model
6. Parting thoughts
What is NIREC?

- 501(c)(3) nonprofit public-private partnership
- Mission is to enable and accelerate the transformation of ideas into sustainable enterprises in the energy sector
- Focused on renewable energy, energy conservation and energy efficiency
- Today, we do this through:
  1. Funding pre-commercialization development activities
  2. Entrepreneur-In-Residence (EIR) Education Program
  3. Strengthening and leveraging the region’s Innovation Ecosystem
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Executive Director
Harry Reid Center for Environmental Studies, University of Nevada, Las Vegas

Kent Hoekman, PhD
Research Professor, Division of Atmospheric Sciences, Desert Research Institute

Travis Johnson
Manager, Substation Construction & Maintenance Groups, NV Energy; President, Travis Johnson Enterprises, Inc.

Lou Peoples
Former Vice Chairman of the Board and CEO, Orange and Rockland Utilities, Inc.

Peter Williams, PhD
CTO, Big Green Innovations, IBM
Partnerships

Education - Government - Private Equity - Industry
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Good News ... Nevada’s Recent Prosperous Growth (2001-2007)

<table>
<thead>
<tr>
<th>%Change in Tot Empl 2001-07</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Change in Total Wages 2001-07</td>
<td>2</td>
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<td>%Chg in LowEd Ind Wages 01 07</td>
<td>2</td>
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<td>%Chg in HiEd Ind Wages 01 07</td>
<td>1</td>
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<tr>
<td>2007 Per Capita Personal Inc. (PCPI)</td>
<td>18</td>
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</table>

Higher-educational-attainment (knowledge-based industries)
-- Proportion of employees with bachelors degrees or more is at least of 30%

Examples:
Higher-educational-attainment industries - IT, finance, professional & technical services, healthcare, education

Lower-educational-attainment industries - manufacturing, construction, retail, hospitality

Data Source: www.michiganfuture.org
Educational Attainment and Employment: Recent Employment Trends (National Data)...

During the current recession (December 2007 – January 2009):

- Lower-education-attainment industries have suffered job losses of 3,735,000
- Higher-education-attainment industries have added 163,000 jobs


- Lower-education-attainment industries employment rose 15.7 %
- Higher-education-attainment industries employment rose 32.4 %
Some Hard Truths

Nevada’s predominant industries and its historically high-wage jobs will continue to be threatened

• Competition
• Next expansion will almost certainly be void of two important sources of “artificial wealth”: housing bubble and highly leveraged financial services

Over the recent past (2001-2007), Nevada’s highly prosperous economy seemed to have “beat the odds” (i.e. data indicates significant anomalies relative to much of the country)

Nevada’s high concentration of jobs in lower-educational attainment industries is a significant risk to our economic future
Educational Attainment & Prosperity:
How do we stack up against the most prosperous states? (2007)

<table>
<thead>
<tr>
<th>Top 11 States</th>
<th>Per Capita Income</th>
<th>% of Pop with Bach+ Degree</th>
<th>% of Wages from HiEd Ind's.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ranking</td>
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</tr>
<tr>
<td>District of Columbia</td>
<td>$61,397</td>
<td>47.48%</td>
<td>1</td>
</tr>
<tr>
<td>Connecticut</td>
<td>$54,984</td>
<td>34.66%</td>
<td>5</td>
</tr>
<tr>
<td>New Jersey</td>
<td>$49,238</td>
<td>33.86%</td>
<td>6</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>$49,142</td>
<td>37.90%</td>
<td>2</td>
</tr>
<tr>
<td>Wyoming</td>
<td>$47,038</td>
<td>23.35%</td>
<td>41</td>
</tr>
<tr>
<td>New York</td>
<td>$46,664</td>
<td>31.71%</td>
<td>10</td>
</tr>
<tr>
<td>Maryland</td>
<td>$46,646</td>
<td>35.25%</td>
<td>3</td>
</tr>
<tr>
<td>California</td>
<td>$41,580</td>
<td>29.50%</td>
<td>14</td>
</tr>
<tr>
<td>Virginia</td>
<td>$41,561</td>
<td>33.56%</td>
<td>8</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>$41,444</td>
<td>32.51%</td>
<td>9</td>
</tr>
<tr>
<td>Washington</td>
<td>$41,062</td>
<td>30.27%</td>
<td>12</td>
</tr>
<tr>
<td>Nevada</td>
<td>$39,649</td>
<td>21.77%</td>
<td>45</td>
</tr>
<tr>
<td>US Average</td>
<td>$38,564</td>
<td>27.46%</td>
<td>58</td>
</tr>
</tbody>
</table>

With very few exceptions, a state’s prosperity (high per-capita personal income) is directly correlated with the proportion of adults with bachelors degrees or higher.

Nevada (and Wyoming) seem to have “beat the odds” … at least, for now

Data Source: www.michiganfuture.org
Educational Attainment & Prosperity:
Comparing Nevada to Another Low Educational Attainment State (in Decline) (2007)

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<td>$49,238</td>
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<td>63.45%</td>
</tr>
<tr>
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<td>$49,142</td>
<td>37.90%</td>
<td>66.42%</td>
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<tr>
<td>Wyoming</td>
<td>$47,038</td>
<td>23.35%</td>
<td>44.78%</td>
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<tr>
<td>New York</td>
<td>$46,664</td>
<td>31.71%</td>
<td>69.98%</td>
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<td>21.77%</td>
<td>41.84%</td>
</tr>
<tr>
<td>Michigan</td>
<td>$34,342</td>
<td>24.72%</td>
<td>51.29%</td>
</tr>
</tbody>
</table>

Although Michigan’s low-educational-attainment economy generated prosperity for several decades, the loss of manufacturing to global competition led to a sharp economic decline (metro Detroit region dropped from 15th to 25th from 2005 to 2007 – just 2 years!)

How long can Nevada “beat the odds”?

Data Source: www.michiganfuture.org
Below average educational attainment levels 
... significant variations in economic outcomes

<table>
<thead>
<tr>
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<th>Nevada</th>
<th>Michigan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 Per Capita Personal Inc. (PCPI)</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>%Change in PCPI 2001-07</td>
<td>17</td>
<td>51</td>
</tr>
<tr>
<td>%Change in Tot Empl 2001-07</td>
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<td>51</td>
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<td>%Chg in HiEd Ind Wages 01 07</td>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td>% of Pop. with Bach+ Degrees</td>
<td>45</td>
<td>35</td>
</tr>
</tbody>
</table>

Despite significant efforts to diversify Michigan’s economy over the past 20+ yrs, its relatively low educational levels stifled prosperity … once the “golden goose” (manufacturing) left to other states (e.g. Alabama) & regions (e.g. Asia)

What is the fate of Nevada if we don’t increase the educational attainment levels of our population?

Data Source: www.michiganfuture.org
Below average educational attainment levels ... similar economic outcomes

<table>
<thead>
<tr>
<th></th>
<th>Nevada</th>
<th>Wyoming</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5</td>
</tr>
<tr>
<td>%Change in PCPI 2001-07</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>%Change in Tot Empl 2001-07</td>
<td>1</td>
<td>3</td>
</tr>
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<td>1</td>
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<tr>
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<tr>
<td>%Chg in HiEd Ind Wages 2001-07</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>% of Population with Bach+ Degrees</td>
<td>45</td>
<td>41</td>
</tr>
<tr>
<td>% Wages from HiEd Attainment Ind's.</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>% of Population with Assoc Degrees</td>
<td>33</td>
<td>3</td>
</tr>
</tbody>
</table>

Wyoming’s lower-educational-attainment economy has benefited from a boom in the production of fossil fuel energy resources.

Harnessing and exporting Nevada’s vast renewable energy resource base has the potential to sustain our prosperity (for a while)... but, knowledge-based (innovation) jobs must be created too (Renewable Energy provides both!)

Data Source: www.michiganfuture.org
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Nevada’s Vast Renewable Energy Endowment
Significant New Transmission Investment Potential

Legend
- Renewable Energy Zones
- Geothermal
- Biomass
- Wind
- Solar
- Federal Ownership
  - Bureau of Land Management
  - US Forest Service
  - National Park Service
  - US Fish and Wildlife Service
  - Bureau of Indian Affairs
  - Department of Defense

Routes of Major Transmission Proposals
- Frontier
- Navajo Transmission Project
- Gateway West
- Gateway South/West Express
- TransWest Express (original proposal)
- Northern Lights Island Express MT and WY
- High Plains Express
- Mountain States Intertie
- SunZa Southwest Transmission Project
- Southwest Intertie
- Wyoming Colorado Intermountain Project (TOT3) dashed line = possible extension
- Wyoming Colorado Intermountain Project (TOT3) dashed

Sources
- Data on file at Western Resource Advocates.
- 2 Phase 1, Figure 2a, Colorado: Report of the Colorado Senate Bill 07-091 Renewable Resource Generation Development Areas Task Force (2007).

Western Resource Advocates
- Date: 07/16/08
- Created By: M. Wood
Nevada’s Clean Energy Production Export Opportunity: A Significant Role for NSHE’s Community Colleges

### Wind Energy

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Median Salary</th>
<th>Mean Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team assemblers*</td>
<td>$21,620</td>
<td>$26,640</td>
</tr>
<tr>
<td>Laborers &amp; freight, stock &amp; material movers, hand*</td>
<td>$10,45</td>
<td>$12,95</td>
</tr>
<tr>
<td>Computer-controlled machine tool operators, metal &amp; plastic</td>
<td>$24,710</td>
<td>$32,320</td>
</tr>
<tr>
<td>Cutting, punching, &amp; press machine setters, operators &amp; tenders, metal &amp; plastic</td>
<td>$11,88</td>
<td>$15,54</td>
</tr>
<tr>
<td>Drilling &amp; boring machine tools setters, operators &amp; tenders, metals &amp; plastic</td>
<td>$12,76</td>
<td>$14,34</td>
</tr>
<tr>
<td>Customer service representatives*</td>
<td>$13,70</td>
<td>$16,81</td>
</tr>
<tr>
<td>Welders, cutters, solderers &amp; brazers*</td>
<td>$29,020</td>
<td>$30,080</td>
</tr>
<tr>
<td>Production, planning, &amp; expediting clerks*</td>
<td>$20,500</td>
<td>$40,370</td>
</tr>
<tr>
<td>Machinists*</td>
<td>$14,74</td>
<td>$17,72</td>
</tr>
</tbody>
</table>

### Energy Efficiency

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Median Salary</th>
<th>Mean Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction laborers*</td>
<td>$21,210</td>
<td>$26,670</td>
</tr>
<tr>
<td>Sheet metal workers*</td>
<td>$10,24</td>
<td>$12,82</td>
</tr>
<tr>
<td>Insulation workers, floor ceiling &amp; wall*</td>
<td>$23,660</td>
<td>$36,570</td>
</tr>
<tr>
<td>Cement masons &amp; concrete finishers*</td>
<td>$11,37</td>
<td>$13,67</td>
</tr>
<tr>
<td>Heating &amp; air conditioning &amp; refrigeration mechanics &amp; installers*</td>
<td>$12,66</td>
<td>$16,24</td>
</tr>
<tr>
<td>Hazardous materials removal workers*</td>
<td>$12,88</td>
<td>$16,62</td>
</tr>
<tr>
<td>Carpenters*</td>
<td>$13,58</td>
<td>$17,39</td>
</tr>
<tr>
<td>Plumbers, pipefitters, &amp; steamfitters*</td>
<td>$13,64</td>
<td>$18,38</td>
</tr>
<tr>
<td>Electricians*</td>
<td>$14,76</td>
<td>$16,10</td>
</tr>
</tbody>
</table>

National wage data for selected middle-skill occupations in turbine and power transmission equipment industry, which includes producers of critical component parts for wind turbines, such as generators and gearboxes.

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Energy, Innovation, and Education – Our National Imperative

“Energy and innovation, healthcare, and education – these are the pillars of the new foundation we have to build. “

“In no area will innovation be more important than in the development of new ways to produce, use, and save energy.”

-- President Barak Obama, August 5, 2009

“I firmly believe that the Nevada System of Higher Education will be at the forefront in leading the State out of this recession to a better economic future.”

-- Chancellor Daniel J. Klaich, July 28, 2009

⇒ NSHE is central to Nevada’s infrastructure of innovation (knowledge economy) and our future prosperity!
Unprecedented Federal Government Commitment

American Recovery and Reinvestment Act of 2009

Over $40 billion of the $787 billion recovery plan is allocated for clean energy

Investment focus:
- $16.8 billion for EERE
- $14.0 billion for electric power transmission grid infrastructure, storage and deployment
  - incl. $6 billion for loan guarantees
- $9.6 billion for other energy programs
- Expanding workforce training
- Promoting Mass Transit Systems

New and modified clean energy tax incentives are estimated at $20+ billion

Breakdown of Clean Energy Funding

- $11.0 B - Grants - State and Local Government
- $5.0 B - Energy Efficiency Improvements in Federal Buildings and Facilities
- $2.4 B - Grants - Energy Technology and Facility Development
- $14 B - Electric Power Transmission Grid Infrastructure, Storage and Deployment
- $8.0 B - Energy and Other R&D

Funds are supplemental to annual appropriations

DOE’s Technology Funding Approach the Role of NSHE

Deployment Barriers and Solutions

- Private Cost-Share:
- OCE Cost-Share:
- Project Timeline:
- Development Stages:
- Unexpected Cost:
- Risk Mitigation:

EPA Act 2005 932(d)
Commercial Demonstration Solicitation
Loan Guarantees

Private Sector Investment
(Balance Sheet, Venture, and/or Institutional)
Spurred by Risk Mitigation through Validation

First Commercial Plant
Project Completion
Attainment of performance criteria

- Basic R&D:
  - 100%/0%
- Technology Development:
  - 60%/20%
- Proof of Concept:
  - 50%/50%
- Commercially Viable Demo:
  - <50%/>50%

Permitting & Engineering
Construction
Operation
Loan Guarantee Program Risk Mitigation Pool

NSHE Universities & Research Institutes
NSHE Community Colleges

NIREC Focus
To compete, Nevada needs a robust process for commercializing energy technologies
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Energy Technology Commercialization Stages

Commercialization Activities

ETAP Step 5
Commercial build-out:
Further capacity building

ETAP Step 4
1st commercial ("Serial #1") placement:
Formation of permanent management team
with primary focus on building scale

ETAP Step 3
Demonstration scale pilot plant development:
Team expands beyond PI & EiR to address
further scale up, cost minimization, and market
development initiatives

ETAP Step 2
Prototype development (1st level scale up):
PI teams w/ EiR to develop Business Package

ETAP Step 1
Proof of concept (lab scale) development:
PI teams w/ EiR to develop Commercialization Roadmap

Pre-Commercialization Activities

Financial Capital Providers

• Commercial Banks
• Private Equity
• Venture Capital
• Federal Grants (DOE, DOD)
• Venture Capital
• Angel Funds
• Federal grants (DOE, various SBIR)
• NIREC Funding Sources*
• Pre-seed/Angel Funds
• Federal grants (DOE, various SBIR)
• NIREC Funding Sources*
• Personal savings

[Color Key] Blue type represents primary NIREC services/capabilities
[*] NIREC Funding Sources refer to State and Federal R&D Grants, Foundation Funds and Corporate/Industry Support
NIREC’s Commercialization Acceleration Infrastructure

Pre-Commercial Activities

ETA Step 1
- NIREC Technology Selection Process
  - Stakeholders
    - TCAB
    - EIRs
    - DOE/Funders

ETA Step 2
- Develop Commercialization Roadmap
  - Stakeholders
    - EIRs
    - PI & Teams
    - Innovation Ecosystem

ETA Step 3
- Develop Business Package
  - Stakeholders
    - “Promoters”
    - PI & Teams

Commercial Activities

ETA Step 3
- Execute Commercialization Roadmap

Company-Promotion Program

Stage 1
- NIREC Technology Selection Process
- TCAB Selection Process

National Institute for Renewable Energy and Clean Energy (NIREC) Commercialization Acceleration Infrastructure

The EIR Process

- Phase 1: Project Setup
- Phase 2: Technology Validation
- Phase 3: Customer/Market Validation
- Phase 4: Iterative Process
- Phase 5: Validation of Business Package
- Phase 6: Implementation
- Phase 7: Organization and Talent Planning

The EIR (Expedited Industry Review) Process is an iterative process to validate the technology and business model.
NIREC’s Entrepreneur-in-Residence (EIR) Process

Phase 1: Project Set Up
Phase 2: Technology Validation
Phase 3: Customer/Market Validation
Phase 4: Technical Proof of Concept
Phase 5: Business Model Validation
Phase 6: Refinement of Business Package
Phase 7: Organizational and Talent Planning

Joint Responsibility: Green
EIR Responsibility: Yellow
PI Responsibility: Blue
Renewable Energy Innovation Ecosystem

- Intellectual Property
  - Major Research Institutions and Technology Companies

- Talent
  - Entrepreneurs and Business Experts

- Sustainable Enterprise

- Risk Capital
  - Public and Private Funder Network

- Key Influencers
  - Industry Incumbents, Policymakers/Regulators and Energy Consumers
NIREC Funding Program Overview

• NIREC awards up to $100,000 for commercialization of renewable energy technologies

• Awarded competitively through a stringent review process by NIREC’s Technology Commercialization Advisory Board

• Call for proposals are announced twice a year, in March and September

• Funds are currently intended for technology validation and technical proof of concept activities in ETA Steps 1 and 2

• Participation in the EIR Program to develop well grounded and compelling Commercialization Roadmaps and Business Packages
Projects Funded to Date

• Direct Conversion of Sugars, Cellulose, & Cellulosic Biomass into Fuels

• Utility Accountant – An Interactive Tool to Manage Utility Costs

• A Novel Dropwise Condenser for Geothermal Applications

Currently evaluating applications from March 09 RFP round
- 18 applicants, 7 shortlisted
- 4 awardees expected to be announced in Sep.
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Parting Thoughts ...

• Nevada’s continued prosperity is in question unless we make a significant step towards economic diversification
  ▪ Is our state’s competitive position like that of Michigan 20+ years ago?

• Renewable energy production exports offer an excellent source of short term skilled-trades jobs
  ▪ NSHE’s community colleges has a significant role in preparing the required workforce

• The production or attraction of higher-educational-attainment (knowledge-based) industries are critical to Nevada’s future prosperity
  • Proportion of adults with a bachelors degree is a significant predictor of future prosperity*

• What distinguishes successful regions is their high concentration of talent – knowledge, creativity, and entrepreneurship – critical to Nevada’s future*

• Significant investments are needed to strengthen Nevada’s RE Innovation Ecosystem (e.g. NSHE, tech transfer, entrep., etc.)

*www.michiganfuture.org
“Best place to make a future Forbes 400 fortune? Start with this proposition: The most valuable natural resource of the 21st century is brains. Smart people tend to be mobile. Watch where they go! Because where they go, robust economic activity will follow.”

-- Rich Karlgaard, publisher, Forbes Magazine

Thank You!

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