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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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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

U.S. Department of Energy
UNLV University of Nevada Las Vegas
The Great Seal of the State of Nevada
DRI University of Nevada, Reno
UC Davis University of California
Sierra Nevada College
Sierra Angels
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6. Parting thoughts
Good News ... Nevada’s Recent Prosperous Growth (2001-2007)

<table>
<thead>
<tr>
<th></th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Change in Tot Empl 2001-07</td>
<td>1</td>
</tr>
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<td>2007 Per Capita Personal Inc. (PCPI)</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 %

Data Source: www.michiganfuture.org
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>
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<tbody>
<tr>
<td></td>
<td>Ranking</td>
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<tr>
<td>District of Columbia</td>
<td>$61,397</td>
<td>1</td>
<td>47.48%</td>
</tr>
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<td>Connecticut</td>
<td>$54,984</td>
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<td>34.66%</td>
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<td>$49,238</td>
<td>3</td>
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<td>$49,142</td>
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<td>37.90%</td>
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<tr>
<td>Wyoming</td>
<td>$47,038</td>
<td>5</td>
<td>23.35%</td>
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<tr>
<td>New York</td>
<td>$46,664</td>
<td>6</td>
<td>31.71%</td>
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<td>29.50%</td>
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<tr>
<td>Virginia</td>
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<td>33.56%</td>
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<td>30.27%</td>
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<tr>
<td>Nevada</td>
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<td>18</td>
<td>21.77%</td>
</tr>
<tr>
<td>US Average</td>
<td>$38,564</td>
<td>27.46%</td>
<td>58.00%</td>
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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

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</tr>
<tr>
<td>Michigan</td>
<td>$34,342</td>
<td>34</td>
<td>24.72%</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](http://www.michiganfuture.org)
Below average educational attainment levels ... significant variations in economic outcomes

<table>
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<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>
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<td>51</td>
</tr>
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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
<table>
<thead>
<tr>
<th></th>
<th>Nevada</th>
<th>Wyoming</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 Per Capita Personal Inc. (PCPI)</td>
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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>
<tr>
<td>%Change in Total Wages 2001-07</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
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<td>2</td>
<td>1</td>
</tr>
<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>
</tbody>
</table>

**% of Population with Assoc Degrees**

<table>
<thead>
<tr>
<th></th>
<th>Nevada</th>
<th>Wyoming</th>
</tr>
</thead>
<tbody>
<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
Nevada’s Clean Energy Production Export Opportunity: A Significant Role for NSHE’s Community Colleges

### Wind Energy

<table>
<thead>
<tr>
<th>Position</th>
<th>Median</th>
<th>Mean</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>$11,045</td>
<td>15,954</td>
</tr>
<tr>
<td>Computer-controlled machine tool operators in metal &amp; plastic</td>
<td>$24,710</td>
<td>29,330</td>
</tr>
<tr>
<td>Cutting, Punching, &amp; Press Machine Setters Operators &amp; Tenders in metal &amp; plastic</td>
<td>$25,270</td>
<td>29,850</td>
</tr>
<tr>
<td>Drilling &amp; Boring Machine Tools Setters Operators &amp; Tenders in metal &amp; plastic</td>
<td>$26,740</td>
<td>31,290</td>
</tr>
<tr>
<td>Customer Service Representatives*</td>
<td>$13,400</td>
<td>18,411</td>
</tr>
<tr>
<td>Welders, Cutters, Solderers &amp; Brazers*</td>
<td>$21,620</td>
<td>26,640</td>
</tr>
<tr>
<td>Production, Planning &amp; Expediting Clerks*</td>
<td>$24,500</td>
<td>30,370</td>
</tr>
<tr>
<td>Machinists*</td>
<td>$14,740</td>
<td>17,722</td>
</tr>
</tbody>
</table>

### Energy Efficiency

<table>
<thead>
<tr>
<th>Position</th>
<th>Median</th>
<th>Mean</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>$10,450</td>
<td>15,954</td>
</tr>
<tr>
<td>Insulation Workers: Floor Ceiling &amp; Wall*</td>
<td>$23,600</td>
<td>26,370</td>
</tr>
<tr>
<td>Cement Masons &amp; Concrete Finishers*</td>
<td>$11,570</td>
<td>17,520</td>
</tr>
<tr>
<td>Heating &amp; Air Conditioning Mechanics &amp; Installers*</td>
<td>$12,660</td>
<td>17,241</td>
</tr>
<tr>
<td>Hazardous Materials Removal Workers*</td>
<td>$12,880</td>
<td>17,621</td>
</tr>
<tr>
<td>Carpenters*</td>
<td>$12,580</td>
<td>17,392</td>
</tr>
<tr>
<td>Plumbers, Pipefitters, &amp; Steamfitters*</td>
<td>$13,640</td>
<td>18,083</td>
</tr>
<tr>
<td>Electricians*</td>
<td>$14,700</td>
<td>18,103</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

Funds are supplemental to annual appropriations

DOE’s Technology Funding Approach the Role of NSHE

Deployment Barriers and Solutions

- Private Cost-Share
- OEP Cost-Share
- Project Timeline
- Development Stages
- Unexpected Cost
- Risk Mitigation

- Pyrolysis and Gasification Solicitations
- University and USDA/DOE Solicitations
- Lab R&D
- Technology Validation at 10% of commercial scale
- Enzyme and Ethanologen Solicitations
- Pilot scale solicitation

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

- Loan Guarantees
- EPAct 2005 932(d)
- Commercial Demonstration Solicitation
- Emissions and Performance criteria

- First Commercial Plant
- Mechanical completion
- Commissioning
- Delay in attainment of performance criteria

- NSHE Universities & Research Institutes
- NSHE Community Colleges
- NIREC Focus

- 100%/0% 60%/20% 50%/50% <50%/>50%
- Permitting & Engineering
- Construction
- Operation
- Loan Guarantee Program/Risk Mitigation Pool
To compete, Nevada needs a robust process for commercializing energy technologies.
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Energy Technology Commercialization Stages

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

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

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

ETAP Step 5
Commercial build-out:
Further capacity building

Pre-Commercialization Activities

Commercialization Activities

Financial Capital Providers
- Commercial Banks
- Private Equity
- Venture Capital
- Federal Grants (DOE, DOD)
- Venture Capital
- Angel Funds
- Federal Grants (DOE, DOD)
- NIREC Funding Sources*
- Seed/Angel Funds (incl. Future NIREC Sidecar Fund)
- 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

<table>
<thead>
<tr>
<th>ETA Step 1</th>
<th>ETA Step 2</th>
<th>ETA Step 3</th>
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<tbody>
<tr>
<td>NIREC Technology Selection Process</td>
<td>Develop Commercialization Roadmap</td>
<td>Develop Business Package</td>
</tr>
<tr>
<td>Execute Commercialization Roadmap</td>
<td></td>
<td></td>
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Stakeholders
- TCAB
- EIRs
- DOE/Funders
- "Promoters"
- PI & Teams
- Innovation Ecosystem

Commercial Activities

Company-Promotion Program
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
EIR Responsibility
PI Responsibility
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!

www.nirec.org