NEVADA INDUSTRY AND COMPETITIVENESS ANALYSIS

IDENTIFICATION OF INDUSTRY OPPORTUNITIES

November 14, 2011

CONTENTS

I. INTRODUCTION AND EXECUTIVE SUMMARY

A. PURPOSE AND GOALS FOR THIS STUDY

The State of Nevada stands at a critical juncture, chastened by serious economic challenges but in reach of real opportunity.

The state's recent economic volatility, its causes, and its impacts have been well-documented and thoroughly discussed over recent months, as state leaders and stakeholders have begun to coalesce on the need to put the state on a sustainable growth path. The strategy and actions to achieve this new course are yet to be determined and require careful, data-informed analysis and strategy-setting. What is clear is that Nevada has considerable economic opportunities, and the assets and potential to harness them to spark an economic renewal.

The time has come for the state to act on the basis of known facts.

To this end, SRI International has been commissioned by the State of Nevada to work with the Brookings Institution and Brookings Mountain West to conduct rigorous, objective industry research/analysis and to assist in crafting a new economic growth and target industry development agenda for the State of Nevada and its major metro areas.

With significant bipartisan agreement in place among state leadership about the need for economic renewal in Nevada, this study is intended to provide a comprehensive, authoritative analysis of the composition, performance, and prospects of Nevada's key and emerging industries. The analysis is employing a data- and market research-driven approach – thereby establishing an objective basis upon which to develop widespread, shared understanding of current economic realities. This interim report has been created to obtain feedback from the project steering committee before a final message report that recommends an action-oriented strategy is published in November 2011. The analysis presented here, combined with collaborative input from key stakeholders in the public and private sectors, will form the basis for devising a strategy to address the deep challenges that Nevada and its metro areas face, and will also provide a foundation of guidance for the new state-level Advisory Council, Board, and Office of Economic Development (currently being formed under the auspices of AB 449).

Within this interim technical document, the project team has identified a series of leading opportunities for meaningful near-term and medium-to-long-term industry development and job creation opportunities in the State of Nevada and its two metro areas.

There have already been a number of notable, broad-based efforts at the state level to assess Nevada's ongoing challenges and to lay out new plans and priorities.[1] In addition, industry analyses and plans have been developed in different regions of the state to guide regional economic development efforts.[2] This study has benefitted from the information, insights, and findings from those studies, and it aims to support those efforts and to provide state-level coherence in the industry development priorities and strategic economic direction for the State's economic leadership.

Central to the report's work is a clarification of the key challenges facing the State of Nevada and the implied goals it should embrace, as well as the identification high-potential industry growth opportunities. On the first point, the realities and implied necessary responses engulfing the state remain stark. Through extensive data analysis, research, and stakeholder consultation (combined with a review of other major state and regional studies), the SRI/Brookings team has identified four overarching challenges and goals for the State of Nevada and its metro and rural regions. These goals are highlighted in the box on the following page, and they provide an important framework for identifying the highest-potential industry opportunities for Nevada to nurture and develop as pillars of the state's economic future. Along those lines, previous investigations for this project have concluded that the State of Nevada urgently needs to:

- Restore growth and jobs
- Diversify its economy
- Catalyze innovation in core and emerging industries
- Build new pillars of growth

In short, the research conducted to date has provided an up-to-date baseline of data for better understanding those goals (and the challenges they address). More importantly, this research has also provided the groundwork for identifying considerable assets and opportunities that the State of Nevada can build upon to identify new pillars of economic growth, catalyze innovation, and renew and reposition its core industries.

[1] Notable studies/strategies that have informed this initiative include: ***Envisioning Nevada's Future: Goals & Strategies for Advancing Our Quality of Life*****,** Nevada Vision Stakeholder Group and Moody's Analytics (September 2010); ***New Nevada Taskforce Report on Initiatives*** (March 2011); ***The Silver Spark for Nevada: Sustainable Innovation Leading a Vital Economic Renaissance***, Nevada Institute for Renewable Energy Commercialization, commissioned by the Nevada Commission on Economic Development (March 2011); and ***Technology Strategy for Nevada***, Battelle Memorial Institute (December 2000).

[2] Regional studies/strategies include: ***Target2010 Reports,*** Economic Development Authority of Western Nevada (2006); ***Targeted Industry Study Update,*** City of Henderson Economic Development Department (June 2005); ***South Nevada Regional Economic Study***, Southern Nevada Regional Planning Coalition (November 2006); ***Regional Economic Development Study: Strategic Recommendations for Cluster Development***, Southern Nevada Regional Planning Coalition (March 2008).

Statewide Goals Guiding the Identification of Industry Opportunities

1. **Restoring growth and jobs.** Following the recent period of extreme economic volatility and recession, Nevada must restore growth and jobs in a strategic and future-oriented way, especially in order to maintain and improve quality of life for the state's citizens. Given that the state's two major metro areas account for around 94% of the state's jobs, pursuing appropriate targets of opportunity in Las Vegas and Reno/Carson City will make great strides towards catalyzing a new growth trajectory for the entire state.
2. **Diversifying the economy.** Consumption-oriented industries (construction/real estate, tourism/gaming, and retail trade) have traditionally been the core drivers of growth in Nevada's economy. While these strengths have served the state well in periods of economic expansion, they have also made the state more susceptible to extreme volatility and recession (as evidenced by the massive job losses over the last several years). In looking to the future, Nevada needs to support development of a more diversified economy, in order to spur long-term growth and provide a cushion against future economic cycles.
3. **Catalyzing innovation in core and emerging industries.** Nevada's reliance on its core consumption-based industries has meant that its technology- and knowledge-based industries have not always received the attention and support offered by many other states around the nation. As a result, Nevada's performance on a number of indicators of innovation activity has lagged most states and the national average. Nevada needs to step up its policies and programs supporting the development of critical high- tech and knowledge-based jobs, industries, and entrepreneurship in order to build the innovation ecosystem necessary to be competitive in the future economy. Innovation is critical for the future competitiveness of *all* industries (not just those typically labeled "high-tech").
4. **Building new pillars of growth.** Nevada's economy is already starting to recover from the recent downturn, and future growth projections for the state are solid (and well above national averages). However, the extremely high growth figures achieved in the last decade are no longer viable, and the state's traditional industries can no longer serve reliably as the primary drivers of job growth and expansion. Job gains in the coming years are likely to come from a broad cross-section of industries, and Nevada needs to think strategically about how it can cultivate these new industries – simultaneously building off of its traditional economic strengths and pivoting toward new high-potential drivers of growth.

B. SUMMARY OF INDUSTRY OPPORTUNITIES FOR NEVADA

NEVADA COMPETITIVENESS SWOT

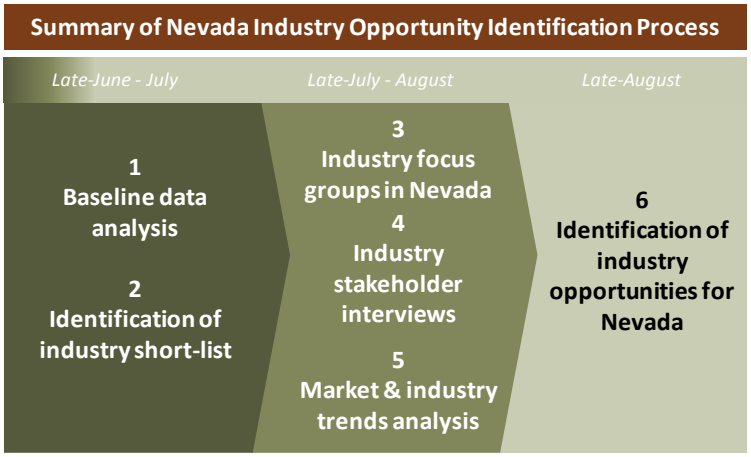
SRI/Brookings compiled a summary SWOT (strengths, weaknesses, opportunities, and threats) analysis for Nevada's economy to establish the background and context for identifying strategic industry opportunities in the state. This SWOT analysis synthesizes the qualitative and quantitative inputs gathered by the SRI/Brookings team through a series of research efforts, including: stakeholder interviews, focus groups, economic foundations benchmarking of the Las Vegas and Reno metro areas, and a quantitative innovation systems analysis.

Nevada Competitiveness SWOT Summary

Strengths	Weaknesses
• Low taxes • Business friendly regulatory climate • Historically has been a high-growth economy • Good quality of life (although this is under-recognized) • Extensive entertainment and recreation assets • Proximity to West Coast population centers, markets, transportation routes, and ports • Excellent airport infrastructure (in both Las Vegas and Reno) • Excellent natural and physical resources (for mining, energy, etc.)	• Economy is heavily oriented toward consumption-based industries • Lack of proactive, coherent economic development strategy and structures • Workforce skill level is low (esp. at higher education levels, although this has been improving) • K-12 educational system is underperforming • Healthcare system is underperforming • Energy costs are expensive (relative to other Western states) • Land transportation connections can be challenging (in some parts of state) • Innovation inputs and outputs are weak (and there has especially been underinvestment in innovation capacity in Southern Nevada) • Lack of risk capital and investor networks to invest in start-ups/innovation (although capital availability is improving) • Real estate bust (devastating to construction)
Opportunities	**Threats**
• Political leadership closely engaged in revamping and renewing economic development activities • Ease and cost of living is attractive compared to neighboring California • Relatively affordable residential real estate and high vacancy rates (residential and commercial/industrial) • Growing urban/arts districts in Las Vegas and Reno • Large number of tourists/visitors/conventions – an opportunity to "sell" Nevada for future workforce/residents/businesses • Infrastructure for innovation is in place (at UNR, DRI, UNLV), but not at its full potential • Relatively strong Science & Engineering (S&E) workforce and students in Reno • World-class Internet connectivity opportunities (such as the Switch data center in Las Vegas)	• Extreme economic cycles and volatility • Projected growth in the core consumption-based industries will not be sufficient to drive recovery • Limited state economic development resources dispersed through fragmented regional efforts • High unemployment • Underinvestment in higher education and lack of a top-tier Carnegie-ranked research university • Existing image issues can be a barrier in attracting higher-skilled workforce • Federal land ownership can hinder land usage/development in much of the state • Water shortages

METHODOLOGY FOR IDENTIFYING NEVADA'S INDUSTRY OPPORTUNITIES

SRI/Brookings has used a step-by-step, iterative process to arrive at a set of seven recommended high-potential industry opportunities for the State of Nevada. Key inputs to this process included: on-the-ground insights from Nevada stakeholders (through interviews and focus groups); review of Nevada's existing capacity and competitive advantages; research on national and global market trends; quantitative analysis of Nevada's past and projected industry trends; and review of existing regional studies and analyses. The goal through this process was to arrive at a list of recommended industry opportunities for Nevada that are ***future-oriented*** and ***growth-oriented***, but also ***reality-based*** (i.e., they are grounded in the unique assets/advantages that Nevada already possesses or can feasibly nurture).[3] In short, the recommended industry opportunities must answer a number of key requirements that link with the key statewide goals outlined above:



- Can the industry drive job-creation and recovery from the effects of the recent recession?
- Over the longer-term, can the industry generate economic diversification (reducing Nevada's dependence on its three core consumption-based industries, and ramping up production-oriented activities in the state)?
- Does the industry opportunity support innovation-based development, thereby enhancing Nevada's future competitiveness?
- Does Nevada have the competitive advantages and locational assets necessary to compete in this industry (or, if not, can Nevada build up the necessary assets over the longer term)? As such, can the industry realistically serve as a new future pillar of economic growth in the state?

The seven industry opportunities recommended in this report (and summarized below) represent a broad range of possible development and growth paths – some of which can generate short-term, immediate results, while others will require significantly longer-time frames and larger investments. In addition, the industry opportunities will require different development approaches – some are primarily industry attraction efforts, while others require focusing on start-ups and company growth from within the state. As such, these opportunities are expected to generate varying impacts within

[3] More details about the industry identification process and the research inputs utilized are provided in *Section III* of this report.

Nevada – some can support significant job creation, while others represent opportunities for diversifying into emerging, higher-tech and innovative sectors (but may yield limited jobs in the short-term). Each of these factors should be taken into consideration when prioritizing and setting out strategies to pursue these industry opportunities moving forward.

SUMMARY OF RECOMMENDED INDUSTRY OPPORTUNITIES FOR NEVADA

Tourism, Gaming, & Entertainment

Target Opportunities

- Nevada as the U.S. online gaming center (should Congress move to legalize it)
- Las Vegas as the intellectual capital of global gaming
- Gaming manufacturing
- Diversifying into niche tourism markets
- Retirees and second home owners
- Film and media

Industry Advantages and Business Case

- A dominant exporter, employer, and anchor industry for other sectors
- A strong brand to capture projected growth markets
- Highly competitive infrastructure, assets, and financial resources
- Strong human resources and innovation capacity

Industry Constraints

- Current U.S. law prohibiting online gambling
- Uncertainty in online gaming legality and regulatory environment
- Onerous U.S. tourist visa procedures for international visitors
- Land transport congestion discouraging visitors from California
- Lack of tax credit to attract film production

Health & Medical Services

Target Opportunities

- Surgical specialties
- Geriatrics and related services
- Disaggregation of medical service delivery, creating new opportunities for middle-skill jobs
- Leveraging a strong medical/health sector to build other emerging industries

Industry Advantages and Business Case

- Large industry cluster with rising demand aligned with demographic trends
- Capturing market leakage and reversing the import of health services
- New institutions have brought increased patient care and research capabilities
- Increased investment in and attention on the health/medical workforce
- Improving quality of life for Nevada residents

Industry Constraints

- Inadequate medical education and research activities in the state's largest medical market
- Vertically integrated market with a dominant, single payer
- High percentage of Medicare patients and low reimbursement rates
- The uncertainty of the legality of the PPACA going forward
- Gaps between graduates and the workforce needs of the industry

Business IT Ecosystems

Target Opportunities

- Call centers/customer service and Back office/BPO/shared services
- E-commerce operations/headquarters
- Data centers
- Cloud computing/high-performance computing
- Cyber security

Industry Advantages and Business Case

- Strong and growing base of moderate-skill business services and IT-related activities
- Strong (but under-marketed) IT industry anchors
- World-class Internet infrastructure and other locational advantages

Industry Constraints

- Nevada has lagged other states in building this industry
- Need to improve the state's image and assets for attracting a creative class and high-tech workforce
- Relatively small (but growing) high-tech workforce
- Additional support for entrepreneurship and startups is needed

Clean Energy

Target Opportunities

- Renewable component manufacturing
- Expanding transmission capacity
- Advancing and internationalizing geothermal development
- Energy efficiency upgrading

Industry Advantages and Business Case

- Nevada is at the epicenter of geothermal energy development in the United State
- High level of incident solar energy
- Good potential for wind energy capture
- Nevada's renewable manufacturing has attracted foreign investment to the state
- Nevada is proximate to a large amount of energy demand
- Dormant construction industry

Industry Constraints

- Renewable projects require a lengthy and onerous licensing process
- Incentives for renewable power generation have not been very predictable
- Limited transmission capacity has constrained renewable development
- Difficulty in obtaining financing for geothermal projects

Mining, Materials, & Manufacturing

Target Opportunities

- Expanding participation in upstream mining activities
- Medium-value mineral supply chain development
- Manufacture of advanced composite materials
- Organizing and marketing of manufacturing base

Industry Advantages and Business Case

- The presence of significant mineral resources in the state
- Strong geosciences knowledge base
- Nevada has demonstrated manufacturing strengths in several areas, such as gaming, food, metals, and plastics

Industry Constraints

- State and Federal land-use policies hinder the growth of the mining industry
- Fragmented manufacturing industry
- Limited pool of high-skilled workforce
- Limited water resources

Logistics & Operations

Target Opportunities

The overarching opportunity is to serve as a West Coast hub of operations for the following segments:

- Warehousing and distribution
- Advanced logistics
- Air cargo
- Integrated manufacturing-distribution, assembly manufacturing, and food processing operations
- Freight transportation (ground and rail)

Industry Advantages and Business Case

- Locational and geographic advantages, including easy access to major West Coast markets
- Strong existing infrastructure, including airports, road and rail connections, and available land for industrial/warehouse space
- Cost and regulatory advantages

Industry Constraints

- Workforce availability is weaker at higher skill levels
- Need to improve business retention and expansion support for companies investing in Nevada
- High energy costs and water availability issues

Aerospace & Defense

Target Opportunities

- Unmanned Aerial Vehicle (UAV) supply, assembly, and testing
- Maintenance, Repair & Overhaul (MRO) of aircraft systems

Industry Advantages and Business Case

- Existing base of defense expertise
- Existing test ranges and infrastructure required to test aerospace systems
- Nevada's geography and low population density are well suited for A&D system testing

Industry Constraints

- Tough competition from established, larger defense contractors
- Limited collaboration amongst A&D companies, or with Nevada universities, on workforce training and research
- Tax-related barriers for aircraft and components

C. ABOUT THIS REPORT

This interim technical report, *Nevada Industry and Competitiveness Analysis – Identification of Industry Opportunities*, provides an in-depth analysis of seven broad-based industry opportunities that have been identified by the SRI/Brookings research team as having especially strong potential to drive the vitality, dynamism, and diversification of the state's economic future. The report is organized as follows:

- ***Section II*** presents a summary SWOT analysis for Nevada's economy, to establish the background and context for identifying strategic industry opportunities in the state. The SWOT analysis synthesizes the qualitative and quantitative inputs gathered by the SRI/Brookings team through the preliminary data-gathering phases of this study, as well as through extensive stakeholder consultations.
- ***Section III*** provides details on how the various research tasks and analytical components in this study have been distilled, through an iterative process, to identify the seven industry opportunities recommended in this report.
- ***Section IV*** is the "core" of this report, providing detailed analysis for each of the seven identified industry opportunities. For each industry, the report highlights: a) Nevada's business case and advantages for developing the industry; b) high-potential sub-sectors and niches for Nevada to focus on developing within the industry; and c) possible constraints to industry growth in the future.
- The ***Appendix*** provides additional background data and research for each of the seven industry opportunities. This supporting analysis (combined with stakeholder consultation) was an important component of SRI/Brookings analytical process to narrow down the recommended industry opportunities for Nevada. For each industry, the following information is provided: a) an industry "profile" that provides a quantitative baseline of size and growth trends for the overall industry and its sub-sectors (both in Nevada and in the state's two key metro areas); and b) a market trends analysis that distills the national/global industry size and key trends/drivers for the overall industry, and also for key identified sub-sectors that are relevant to Nevada's opportunities.

The industry opportunities recommended in this report will be vetted and finalized with input from the state's economic leadership, and will then build toward a final report that will provide recommendations on a set of strategic actions to strengthen and develop the identified industry opportunities, as well as the state's competitive foundations for supporting these industries.

II. NEVADA COMPETITIVENESS SWOT

This section presents a summary SWOT (strengths, weaknesses, opportunities, and threats) analysis for Nevada's economy to establish the background and context for identifying strategic industry opportunities in the state. This SWOT analysis synthesizes the qualitative and quantitative inputs gathered by the SRI/Brookings team through a series of research efforts, including: stakeholder interviews, focus groups, an extensive quantitative economic foundations benchmarking of the Las Vegas and Reno metro areas, and a quantitative innovation systems analysis.[4]

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[4] The benchmarking and innovation systems analysis were presented in the first SRI/Brookings report, *Nevada Industry and Competitiveness Analysis – Preliminary Assessment and Benchmarking*, November 14, 2011.

Key findings from the SWOT analysis are distilled and summarized below.

ECONOMIC GROWTH AND DEVELOPMENT CONTEXT

While Nevada's dependence on consumption-based industries (primarily tourism/gaming, construction, and retail) served the state well during the economic boom, it also contributed to the excessive volatility and devastating job losses suffered during the recent recession. From 2007-2011, Nevada's economy lost nearly 170,000 jobs; however, the projected job gains for Nevada's three core industries – construction, tourism/gaming, retail trade – represent only 43,500 new jobs over the next 5 years. To make significant strides in regaining jobs and lowering unemployment, Nevada will need to look to a broad cross-section of other sectors to drive economic growth and establish a more diversified economic base for the future.

Stakeholders throughout the state have noted that Nevada has not historically taken a proactive or well-organized approach to economic and industry development, either at the state or regional levels. Economic development and investment attraction activities tend to take place through fragmented regional efforts and organizations, and have not been particularly well-funded (especially relative to the economic development/marketing budgets of other states around the nation). Importantly, Nevada's political leadership has coalesced to set a new course for the state's economic development approach, and this has led to the recent passage of AB 449, designed to establish an entirely new structure for organizing and funding economic development in the state.

Nevada's core strengths for economic development have traditionally been its overall business-friendly environment, including its low taxes, relatively low costs, low regulations, and ease of business start-up/permitting. These advantages will continue to be at the center of Nevada's value proposition for business investment and economic development moving forward. At the same time, they are not likely to be sufficient to drive the kind of economic growth and investment that Nevada will need and want, as national and global competitiveness has become increasingly driven by knowledge, technology, and innovation. This is true across *all* industries, not only those that are considered to be "high-tech." Therefore, if Nevada is going to pursue growth of a broad cross-section of industries, the state will need to make a concerted effort to cultivate and market the assets and characteristics that are required by the businesses of the future. Key areas of concern include workforce, infrastructure and geographic assets, and resources to support innovation. Nevada has a number of strengths across all of these areas, but also significant room for improvement, as elaborated below.

WORKFORCE/HUMAN CAPITAL/EDUCATION

Nevada's primary workforce-related asset has been its rapidly-growing population, fueled by both domestic in-migration and international immigration. In the past, someone with a high school education could move to Nevada and easily secure a good job (perhaps in a casino hotel or in construction) as well as an affordable place to live. Prior to the recession and real estate collapse,

population growth (along with tourism growth) and consumption-based business growth fueled each other in a mutually-reinforcing cycle.

However, largely because of this phenomenon, Nevada has not cultivated a strong workforce base at the higher-skilled end of the spectrum. The majority of the Nevada businesses interviewed by the SRI/Brookings team indicated that they frequently hire out-of-state to fill highly-skilled and technical positions because of the difficulty of finding these workers locally. In order to attract and grow robust, globally competitive businesses, Nevada will need to address this knowledge workforce deficit. The key challenges and issues cited by private sector leaders for workforce development and attraction include the following:

- Nevada's existing workforce is suffering from ongoing extremely high unemployment levels. A huge share of these unemployed workers were in the construction industry (at least 55% of the 170,000 jobs lost in Nevada from 2007-2011 were in construction and real estate), and many do not have the right skills or experience to move into jobs in other sectors without significant retraining.
- Nevada's K-12 education is underperforming and ranks quite poorly when stacked against other states/regions on standardized educational assessments. Not only does this lead to a lower skill level among the state's existing and future workforce, but it also presents a challenge for attracting high-skilled workers to move into the state (as they are concerned about whether their children will receive a good education).
- Nevada's under-investment in its higher education system (especially in the Las Vegas region) is a barrier to promoting high-tech, innovation- and knowledge-based economic development. With $558.9 million of state funding for higher education in FY2010-2011, Nevada provided the lowest amount of public support for higher education among states of a similar size (2-3 million people)[5], and it ranked 35th among all 50 states for its level of state higher education funding per capita ($211.44).[6] Unlike in other states, Nevada's community colleges receive little funding from their local communities. In addition, Nevada is the only state of over 2 million people that does not have a top tier Carnegie-ranked doctoral research university.[7] The weak position of the Las Vegas metro area in its innovation assets and performance, as compared to Reno-Carson

[5] Other states in this size range (2-3 million people) and their FY2010-2011 state funding levels for higher education are: Mississippi ($932.5 million), Arkansas ($901.8 million), Kansas ($754.8 million), Utah ($714.8 million), and New Mexico ($874.7 million). Nevada's funding level ($558.9 million) is even worse than some of these states because there is no state lottery in Nevada funneling extra monies into the higher education system (state lottery monies are not counted in these totals).
[6] James C. Palmer, Ed., "Summary Tables, Fiscal Year (FY) 2010-11," *Grapevine: An Annual Compilation of Data on State Fiscal Support for Higher Education*, http://grapevine.illinoisstate.edu/tables/index.htm.
[7] The Carnegie Foundation's "basic classification" for doctorate-granting universities provides three levels of rankings, the highest being "Research Universities (very high research activity)", and 108 institutions nationwide are ranked in this category. In Nevada, UNR and UNLV are both ranked in the second tier as "Research Universities (high research activity)". By contrast, most of Nevada's neighboring states (Arizona, California, Colorado, New Mexico, Utah) all have at least one research university in the top-tier Carnegie ranking. For more information, see: http://classifications.carnegiefoundation.org/.

City and other peer cities, is also likely linked to the low level of investment in higher education and research capabilities in the Southern Nevada region.

In the past Nevada's higher education system has produced a relatively good supply of educated workers, and the output of science & engineering graduates has especially been strong in the Reno/Carson City area. However many programs, courses, and centers have been slashed as Nevada's higher education budget was cut by almost 30% since 2009, while tuition has risen rapidly in the current strained economic environment, creating a sense of near-crisis among students, faculty, and researchers.[8]

- Nevada's healthcare system is also considered to be weak compared to that of other states, especially for specialized care. This has been mentioned as a quality of life issue by businesses as another barrier to attracting knowledge workers to the state, as well as a more general concern for maintaining the long-term health and productivity of the state's workforce (since unhealthy workers raise the labor-related costs for businesses).

- Stakeholders emphasized that Nevada truly does have an excellent quality of life, but also emphasized that this quality of life is not widely recognized and is not well-marketed outside the state. Key quality of life assets in Nevada include: relatively low living and housing costs, low traffic and congestion, abundant outdoor/recreation assets, and abundant entertainment assets. Recent transplants from California to Nevada especially raved about these assets and suggest that these could be strong draws to attract higher-skilled workers – and businesses – away from neighboring California (which is significantly more expensive and congested).

- Many stakeholders suggested that Nevada has an image problem when it comes to attracting knowledge workers to the state. This is part reality (i.e., the weak educational and healthcare systems) and part perception (i.e., inadequate marketing of the state's assets). Many business leaders believe that the ubiquitous image of Nevada as a place for libertine and adult entertainment (e.g., the Strip, casinos, etc.) is a hindrance when it comes to attracting well-educated workers, especially those with a family. Many stakeholders emphasize how critical it is to physically bring prospective workers to the state, and show them the quality of life assets beyond the Strip, in order to "sell" Nevada as a great place to live and work. For example, Las Vegas's Fremont East District is a growing urban arts district that is increasingly being recognized as a "hip" place for young professionals to go out (and the efforts to build this new urban core will be significantly ramped up when Zappos.com moves its headquarters to the neighborhood in 2013). Reno is making similar efforts at downtown revitalization – such as building up the arts and recreation amenities along the downtown riverfront – and is marketing itself as a "green city." These kinds of initiatives will need to be continued, expanded, and better marketed in order to build up an atmosphere that will support and attract knowledge-based workers and companies to Nevada's metro areas. There is also a more general need to reconsider how the

[8] Eric Kelderman, "In Nevada, Harsh Reality Hits Higher Education," *The Chronicle of Higher Education*, 28 August 2011, http://chronicle.com/article/In-Nevada-Harsh-Economic/128806/.

state's brand image is being promoted from an economic development and business perspective.

INFRASTRUCTURE/GEOGRAPHY

Nevada posts a number of unique strengths and weakness in terms of its infrastructure and geography-based characteristics. Its foremost advantage is Nevada's position at the center of the West Coast region, in close proximity to major economic and population centers in California. Stakeholders across many industries emphasized this geographic advantage – coupled with Nevada's business-friendly climate (as discussed above) – as a real opportunity to attract and grow businesses that are seeking to serve West Coast markets (and/or that are seeking to escape higher-cost/higher-regulation West Coast locations). Other key infrastructure and resource-based assets and challenges include the following:

- From both qualitative information (stakeholder perspectives) and quantitative data, airport infrastructure is considered to be excellent in both Las Vegas and Reno. Both cities have world-class airports – with Las Vegas's McCarran Airport boasting superb passenger traffic infrastructure, and Reno-Tahoe Airport boasting excellent passenger and air cargo facilities (as well as extensive room to grow). On the other hand, land transportation access was cited by some stakeholders as a challenge in some parts of the state – in particular, ground/rail freight connections can be a challenge in rural areas and also around the Las Vegas region (while these were less of a concern in Northern Nevada), and are also considered by some stakeholders to be fairly expensive.
- Following the real estate bust, residential real estate has become significantly less expensive in Nevada, and vacancy rates for commercial/industrial/office real estate are quite high.[9] This situation can provide Nevada with an additional competitive advantage, in terms of easy access to existing real estate for businesses and low-cost housing for residents.
- Nevada boasts a wide array of important natural and physical resources that support economic and industry development, including its mineral and precious metal deposits (supporting its long-standing mining/materials industry); its physical assets that support renewable energy production (geothermal, solar); its extensive undeveloped land assets (which, among other things, provide a testing ground for defense and aerospace-related activities); and its unique natural assets and beauty that support tourism and recreation (Lake Tahoe, Lake Mead, Death

[9] Based on data from Grubb & Ellis, in Q2 2010, the industrial space vacancy rate was at 15.6% in Las Vegas and 15.4% in Reno, ranking these cities at 5th and 6th among 60 U.S. metros/regions for having the highest vacancy rates. The suburban office real estate vacancy rate was at 23.1% in Las Vegas (ranking 9th among 63 U.S. metros/regions). Interestingly, these high vacancy rates are not necessarily translating into low rental rates for industrial and office space. For both, Las Vegas's average rental rates actually rank among the top 1/3 of the metros/regions assessed (although Reno does rank among the bottom 1/3 cheapest cities for industrial real estate rental rates). For more information, see: http://www.grubb-ellis.com/SitePages/GetFileFromDB.ashx?type=9&id=1100 and http://www.grubb-ellis.com/SitePages/GetFileFromDB.ashx?type=9&id=1100.

Valley and Great Basin National Parks, Red Rock, etc.). Challenges cited by stakeholders regarding Nevada's natural resources and infrastructure include the following:

- The significant share of lands that are owned by the federal government (around 85% of Nevada's land area) poses a number of constraints in developing natural resource-based industries, such as mining and energy.
- Water supply challenges and predicted future shortages (especially in Southern Nevada) are a future natural threat that will need to be addressed, and also can inhibit the future attraction/growth of industries that are highly water dependent.
- Energy prices are considered to be high in Nevada (relative to other Western states and to the national average) – largely because the state depends heavily on imported natural gas to generate power.

- When looking solely at quantitative benchmarking data, Nevada's technology infrastructure and Internet connectivity appear to be average to below average. However, the business stakeholders interviewed for this study had no complaints about Internet connectivity and believe that the technology infrastructure overall is quite good in both the Reno and Las Vegas metro areas. According to one stakeholder, an advantage for Nevada is that much of the infrastructure in the state is relatively new (as compared to other states) due to the construction/housing boom of the last decade (especially around Las Vegas), so fiber optic cable is more prevalent and there are often multiple service providers available. Las Vegas also has a particular asset in the Switch SuperNAP data center, which boasts Internet connectivity, speed, and reliability that, it claims, is second to no other data center in the world, with more than 20 Internet service providers on-site. This service also allows Switch to offer an aggregated telecom purchasing/pricing approach for its customers that is highly competitive against any other region in the country – a significant asset that could potentially be extended to other businesses in Nevada.

INNOVATION SYSTEMS

Innovation is critical for all businesses to maintain and expand their competitiveness – this is true not only for "high-tech" businesses, but also for businesses in "traditional" sectors such as mining, tourism, and distribution. Both quantitative data and stakeholder inputs suggest that Nevada significantly lags other states in innovation activities; in fact, Nevada lagged the national average for every quantitative indicator of innovation activity measured by the SRI/Brookings team.[10] These data do not suggest that Nevada is not an innovative state, but that the innovation activities that take place are very fragmented, not widely known, and not connected with broader support structures to help these activities grow into commercial, job-creating ventures.

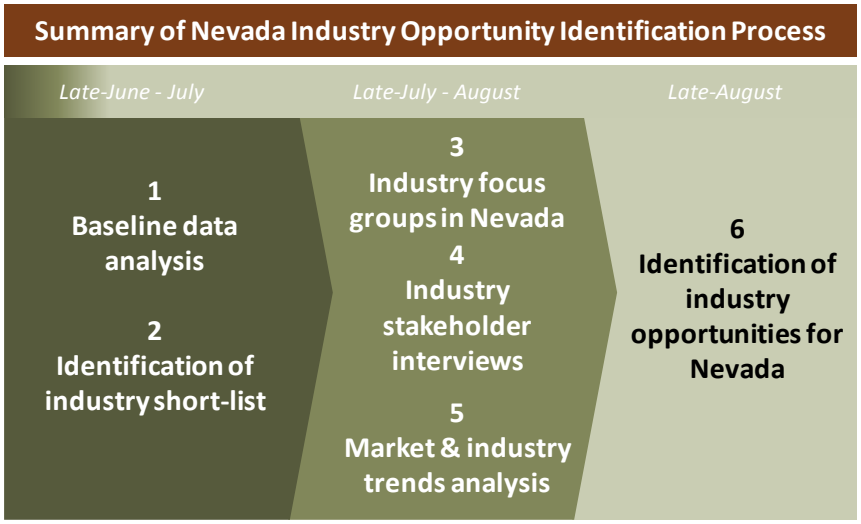
[10] An extensive, data-based innovation systems analysis for the State of Nevada and for the Reno and Las Vegas metro areas was provided in the first SRI/Brookings report, *Nevada Industry and Competitiveness Analysis – Preliminary Assessment and Benchmarking,* November 14, 2011.

- While there are many companies in the state conducting cutting-edge, world-class, and highly innovative activities, stakeholders emphasized that there are limited support structures in Nevada to nurture and fund these activities – especially in comparison to the extensive support provided to researchers and entrepreneurs in states such as Utah, Ohio, Georgia, Texas, North Carolina, and elsewhere.
- Quantitative data indicate that venture and risk capital funding is quite limited in Nevada, and some stakeholders reiterated this concern. However, anecdotal evidence also suggests that there is not entirely a dearth of startup capital in the state, and that ventures with especially strong potential and good connections/networks are finding the capital they need – and are even tapping into funders from California and Wall Street. The key challenge lies in the lack of strong networks and support structures for entrepreneurs to connect them to funding sources and the capital they need to launch and grow a successful commercial venture.
- There are significant pockets of R&D and technology-development activity taking place in universities and research institutions in both the Reno and Las Vegas metro areas (although these activities are stronger and more heavily concentrated at UNR and DRI than at UNLV, and recent budget cuts are taking a toll on these activities across the board). Based on quantitative innovation indicators, significant research strengths seem to exist in fields related to environmental sciences, geosciences, and water resources. However, these research strengths are not well connected with private sector businesses working in related fields. Businesses interviewed for this study indicated that there are limited research partnerships occurring between the private sector and universities in the state (though it should be noted that this is a challenge that is not unique to Nevada and is a concern in regions across the country). Additionally, technology commercialization mechanisms – to translate academic R&D into commercial, job-creating ventures – also need to be improved at Nevada's universities (although these processes are currently stronger at UNR than at UNLV).

III. IDENTIFICATION OF INDUSTRY OPPORTUNITIES FOR NEVADA

The task of identifying strategic industry opportunities for Nevada is not a linear process and does not lend itself to quantitative criteria or easy-to-read decision matrices. SRI's approach to this process is to gather and synthesize a wide variety of analytical inputs for the specific industry clusters under consideration, and then to glean from those inputs a realistic assessment of Nevada's prospects for developing and growing those clusters. Key inputs to this process include: on-the-ground insights from Nevada stakeholders; review of Nevada's existing capacity and competitive advantages; research on national and global market trends; quantitative analysis of Nevada's past and projected industry trends; and review of existing regional studies and analyses. The goal through this process is to arrive at a list of recommended industry opportunities for Nevada that are ***future-oriented*** and ***growth-oriented***, but also ***reality-based*** (i.e., they are grounded in the unique assets/advantages that Nevada already possesses or can feasibly nurture).

The step-by-step process used by SRI/Brookings to arrive at the recommendations made in this report included the following steps:



1) SRI/Brookings conducted a baseline data analysis for Nevada's economy and industries, which included in-depth assessment of industry cluster trends, review of innovation activities, and benchmarking of regional economic foundations. These assessments were conducted for the State of Nevada, the Reno/Carson City metro area, and the Las Vegas metro area.

2) Based on the initial data analysis, SRI/Brookings identified a short-list of high-potential industry opportunities that, from the data alone, appeared to hold promise for Nevada and its metro areas to support future economic development, growth, and diversification efforts. Criteria for identifying short-listed clusters included: growth trends (regionally and nationally), critical mass (is there a foundation to build upon?), job quality (wages and skill levels), tradability (does the

cluster bring in revenues from outside the region/state?), and potential sub-cluster/niche strengths. The purpose of winnowing down to a cluster short-list was to provide additional focus for ongoing in-depth industry research and analysis. The list of initial short-listed clusters included: *Tourism & Gaming*, *Energy & Environment*, *Mining & Materials*, *Financial Services*, *Business Services*, *IT Services*, *Transportation/Logistics/ Distribution/Wholesale Trade*, *Medicine & Life Sciences*, *Research & Engineering*, *Advanced Manufacturing*, and *Aerospace & Defense*. These industry labels and groupings were necessarily broad and inclusive at the early stage, to facilitate a vetting process by industry stakeholders in July 2011.

3) Seven industry focus groups were held in Reno and Las Vegas (on July 25-26, 2011) with Nevada stakeholders who are actively working in the short-listed industry clusters, and an additional focus group was held with public sector leadership in Carson City. These focus groups were used to: a) validate/refine findings from the industry data analysis; b) gather "on-the-ground" perspectives about trends, niches/subsectors, growth potential, and key assets/challenges in specific industry clusters; and c) gather additional insights about general assets/challenges in the metro areas and state that may affect cluster development.

4) Following the industry focus groups, SRI/Brookings conducted extensive one-on-one telephone interviews with more than 40 Nevada private sector stakeholders working in the short-listed high-potential industries (during August 2011). The interviews were used to gain deeper insights about specific regional assets and challenges for these industries and sub-sectors, and to collect stakeholder inputs on future opportunities for industry growth and development.

5) Simultaneous with the interviews, SRI/Brookings also conducted in-depth research on market and industry trends in each of the short-listed industry clusters, to gain additional insights about the forces driving and shaping these industries in the future, the broader market potential for growth, and how these dynamics shape Nevada's opportunities for strategic industry development.

6) Drilling down from all of the above steps, SRI/Brookings is recommending (in this report) seven broadly-defined industry clusters that represent strong opportunities for future industry growth and development in Nevada. Within each of the seven industries, a number of specific high-potential sub-sector and niche opportunities are also presented. The screening and analytical process behind these recommendations is necessarily iterative, requiring the distillation of a wide range of stakeholder and data-based inputs. In short, the recommended industry opportunities must answer a number key requirements that link with the key statewide goals outlined in *Section I.A* of this report:

   - Can the industry drive job-creation and recovery from the effects of the recent recession?
   - Over the longer-term, can the industry generate economic diversification (reducing Nevada's dependence on its three core consumption-based industries, and ramping up production-oriented activities in the state)?

- Does the industry opportunity support innovation-based development, thereby enhancing Nevada's future competitiveness?
- Does Nevada have the competitive advantages and locational assets necessary to compete in this industry (or, if not, can Nevada build up the necessary assets over the longer term)? As such, can the industry realistically serve as a new future pillar of economic growth in the state?

The seven industry opportunities recommended in this report represent a broad range of possible development and growth paths – some of which can generate short-term, immediate results, while others will require significantly longer-time frames and larger investments. In addition, the industry opportunities will require different development approaches – some are primarily industry attraction efforts, while others require focusing on start-ups and company growth from within the state. As such, these opportunities are expected to generate varying impacts within Nevada – some can support significant job creation, while others represent opportunities for diversifying into emerging, higher-tech and innovative sectors (but may yield limited jobs in the short-term). Each of these factors should be taken into consideration when prioritizing and setting out strategies to pursue these industry opportunities moving forward.

The seven recommended industry opportunities for Nevada are summarized in the table on the following page. The remainder of this report then provides extensive details about the rationale behind these recommendations, Nevada's business case and possible development paths for growing these industries, and the data/analysis that supports these recommendations.

Summary of Recommended Industry Opportunities for Nevada

Tourism, Gaming, & Entertainment

- Nevada as the U.S. online gaming center (should Congress move to legalize it)
- Las Vegas as the intellectual capital of global gaming
- Gaming manufacturing
- Diversifying into niche tourism markets
- Retirees and second home owners
- Film and media

Clean Energy

- Renewable component manufacturing
- Expanding transmission capacity
- Advancing and internationalizing geothermal development
- Energy efficiency upgrading

Health & Medical Services

- Surgical specialties
- Geriatrics and related services
- Disaggregation of medical service delivery, creating new opportunities for middle-skill jobs
- Leveraging a strong medical/health sector to build other emerging industries

Mining, Materials, & Manufacturing

- Expanding participation in upstream mining activities
- Medium-value mineral supply chain development
- Manufacture of advanced composite materials
- Organizing and marketing of manufacturing base

Business IT Ecosystems

- Call centers/customer service and Back office/BPO/shared services
- E-commerce operations/headquarters
- Data centers
- Cloud computing/high-performance computing
- Cyber security

Logistics & Operations

- Warehousing and distribution
- Advanced logistics
- Air cargo
- Integrated manufacturing-distribution, assembly manufacturing, and food processing operations
- Freight transportation (ground and rail)

Aerospace & Defense

- Unmanned Aerial Vehicle (UAV) supply, assembly, and testing
- Maintenance, Repair & Overhaul (MRO) of aircraft systems

IV. RECOMMENDED INDUSTRY OPPORTUNITIES FOR NEVADA

A. TOURISM, GAMING, & ENTERTAINMENT

INDUSTRY ADVANTAGES AND BUSINESS CASE

Tourism, Gaming, & Entertainment is a core industry in Nevada that accounts for more than 350,000 jobs and 24% of total state employment. It includes services and activities in accommodations, food and beverage, gaming, recreation & sports, arts & culture, and entertainment. The industry has been traditionally concentrated in the Las Vegas metro area, employing an estimated 291,626 workers in that region (82% of the state's total jobs in this industry), and also yields an extremely high employment concentration ratio of 2.814 in the Las Vegas metro area.[11] Driven by consumer spending in the early 2000s, the boom of this sector (along with construction) was the engine for the phenomenal economic growth experienced in Nevada until in 2007. However, the dependence of this industry on consumer spending also meant significant contraction and job loss during the recent recession (see the *Appendix* for additional details on cluster employment trends).

The industry has already shown signs of recovery, with visitor volume in the first six months of 2011 rising 5% from the 2010 level. The largest industry segment, *Gaming*, is forecasted to have strong, steady U.S. revenue growth of 2.7% annually over the next five years. Globally, the most robust gaming markets and biggest opportunities have been in Asia-Pacific and Latin America, where the sector continued to post modest revenue increases during the recent global recession.[12] The expansion of companies such as Las Vegas Sands, Wynn Resorts, and MGM to Macau and Singapore is creating new revenue opportunities for the dominant gaming players while the domestic market has become saturated. Many of the dominant hotel-casino players have already reported rising occupancy, revenues, and earnings this year.[13]

Going forward, the *Tourism, Gaming, & Entertainment* cluster is not likely to see the dramatic investments in new properties and expansion of room capacity that characterized the boom cycle in 2001-2007. Rather, the focus will be on attracting visitors and businesses from diverse markets with renewed and diverse offerings, as well as leveraging the strong infrastructure, capabilities, and expertise that already exist in this industry to create new sources of competitiveness and growth. Las Vegas has already reinvented itself in the past 15 years. There is no reason that the city and the state cannot do it again by being innovative and pivoting on unique their strengths and advantages.

It is easy to argue that *Tourism, Gaming, & Entertainment* is a strategic industry that is vitally important to the economic health of Nevada in the coming decade, for the following reasons:

[11] SRI calculations based on EMSI data.
[12] PricewaterhouseCoopers, *Playing to Win*, 2010, http://www.pwc.com/gx/en/entertainment-media/pdf/pwc-playing-to-win.pdf.
[13] Danny King, "Hotel recovery suggests turnaround in Las Vegas," *Travel Weekly,* 22 August 2011, http://www.travelweekly.com/Travel-News/Hotel-News/Hotel-recovery-suggests-turnaround-in-Las-Vegas/.

It is a dominant exporter, employer, and anchor industry for other sectors. *Tourism, Gaming, & Entertainment* is a major exporter industry for the State of Nevada. In 2008, Las Vegas produced $7.3 billion in total exports (representing 7.7% of its gross metropolitan product or GMP), most of which can be attributed to its tourism/gaming sector firms.[14] In fact, Las Vegas generated a larger share of its GMP from services exports in 2008 than in any other major metro in the United States.[15] As U.S. consumer demand is expected to continue its sluggish recovery, international exports are likely to drive sustainable economic and job growth into the future.[16] In addition to being the largest exporter and employer in the state, *Tourism, Gaming, & Entertainment* is an anchor industry for many other sectors such as retail, construction, manufacturing, and business & IT services. It is also a labor-intensive sector that holds significant job creation potential in the short- to medium-term. Even as Nevada must look to emerging sectors to become new economic engines, a solid economic recovery will depend on Nevada's largest industry to stay internationally competitive and to leverage emergent opportunities and innovative capacity for recovery and renewal.

It has a strong brand to capture projected growth markets. Nationwide, the tourism industry is forecasted to grow at by 2.9% annually (in revenues), with international travel spending projected to grow at a 3.5% annual rate over the next five years. The rise of the middle class in emerging markets such as Brazil, China, India, and elsewhere in Asia – and their growing awareness of global tourism destinations – means that increasingly large numbers of people are traveling overseas for leisure. Nevada is particularly well-positioned to take advantage of this trend, with Las Vegas ranking as the 7th most visited city in the United States by international travelers (receiving 7.7% of all overseas visitors). By all measures, Las Vegas is a global destination with a strong, established brand image to attract international visitors. International visitors currently account for 18% of total visitation in Southern Nevada, and the Las Vegas Convention and Visitors Authority (LVCVA) would like to increase this share to 30% in the next decade.

Nevada offers highly competitive infrastructure, assets, and resources in this cluster. Specifically, Las Vegas boasts an unparalleled infrastructure for *Tourism, Gaming, & Entertainment*: flagship properties by all the major global casino and hotel players; the largest convention and hotel room capacity in the country; adjacent amenities including a high concentration of top quality restaurants and retailers; a world-class entertainment industry production base; excellent air links to major national and international markets; and unparalleled promotion resources from the private sector and the Las Vegas Convention and Visitors Authority (LVCVA). Elsewhere in the state, Nevada offers a wide array of outdoor recreation assets, including Lake Tahoe, Lake Mead, national parks, significant mountain ranges, scenic areas, and many other amenities.

[14] Metropolitan Policy Program at Brookings, "Profile for Las Vegas-Paradise, NV MSA," *Export Nation,* http://www.brookings.edu/~/media/Files/rc/reports/2010/0726_exports/0726_exports_profiles/LasVegasNV.pdf.
[15] Ibid.
[16] Mark Muro, Emilia Istrate, and Jonathan Rothwell, *Export West: How Mountain West Metros Can Lead National Export Growth and Boost Competitiveness*, Brookings Mountain West, July 2010.

Nevada has strong human resources and innovation capacity in this cluster. The strong infrastructure in the *Tourism, Gaming, & Entertainment* industry is support by a strong intellectual and human resource foundation. Las Vegas hosts the headquarters and major operations of global casino and hospitality companies, including Wynn, MGM, Las Vegas Sands, Caesars, Bally Technologies, Boyd Gaming Corporation, International Game Technology (IGT), etc. – companies that lead the global industry in innovation. The William F. Harrah College of Hotel Administration at UNLV offers a world-renowned hospitality management program that produces high quality professionals for the global hospitality industry. In recent years, the Harrah School has expanded its international presence by establishing a branch campus in Singapore.

Nevada also boasts strong research and innovation capacity in gaming. The Center for Gaming Research at UNLV is a widely recognized center of excellence in gaming-related research and innovation. The Computer Science and Engineering Department at UNR works very closely with IGT to train potential workforce and conduct R&D in the latest gaming technologies. These assets provide a strong intellectual and human resource foundation for innovation in this cluster.

Patent data confirm that Nevada is the leading developer of gaming technology in the world. In the past five years (2006-2010), Nevada-based firms – such as IGT in Reno, and Bally Gaming, Inc. and Shuffle Master, Inc. in Las Vegas – were awarded 793 patents in the two patent classifications related to gaming[17], more than 32% of all "amusement device" patents in the United States and nearly a quarter of the global total.

TARGET OPPORTUNITIES

After reviewing industry trends and developments, assessing Nevada's unique strengths, and gathering opinions from various stakeholders, the SRI/Brookings team has identified the following high-potential opportunities for Nevada in the *Tourism, Gaming, & Entertainment* cluster.

INTERNET GAMING

Online gaming is the new frontier of gaming, enabled by enhanced bandwidth, advanced web-based interfaces, and the proliferation of smart phones, and also spurred by the "anytime, anywhere" ethos of the emerging generation of gamers. While online gaming remains illegal in the United States, globally it is legal in approximately 85 countries and is estimated to be a $30 billion industry.[18] The American Gaming Association estimates that Americans spend $4 billion a year to gamble online, despite the fact that such operations are prohibited in the United States by the federal government.

[17] Gaming technology-related patents fall largely into two U.S. patent classifications: 463 and 273, both titled "Amusement devices: games." These patent classes describe technologies "wherein one or more players or participants engage in a competition or contest involving skill, ability, strategy, or chance" and "apparatus or means, such as games and sports, by which contests of skill or chance may be engaged in among two or more participants, where the result of such contests can be indicated according to definite rules."

[18] H2 Gambling Capital, *Quarterly Interactive Gambling*, April 2011.

Efforts are underway in the U.S. Senate to develop a bipartisan proposal to legalize online poker in the United States, under the argument that it will be a safer industry if regulated, and that significant industry operations, infrastructure, and economic impact (previously benefiting offshore locations) will be relocated to the United States. If online poker is legalized, the current estimated $1.37 billion outflow from the United States to offshore online poker sites will likely return to the country.[19] The American Gaming Association estimates that the legalization of online poker will generate as many as 10,000 high-tech jobs in the United States and an estimated $2 billion of annual tax revenues for state and federal governments.[20]

While it will be difficult to verify these estimates and exactly how much of the projected economic benefits of legalized online poker (including revenues, jobs, and tax revenues) will accrue to Nevada, the state appears to be one of best-positioned to take advantage of this development.[21] The version of the bill that has been drafted and supported by Senator Reid will not create a new federal regulator for the industry, but instead proposes using existing state gaming commissions to regulate online operators. The bill is also likely to suggest that operators base their Internet gaming operations in the state in which they are licensed and regulated. If that is the case, Nevada, as the state with the most sophisticated regulatory infrastructure, will be highly desirable and logical location for online gaming operations. Nevada is poised to take advantage of this opportunity, with the State Legislature passing AB 258 in 2011, giving the Nevada Gaming Commission the power to adopt regulations to implement online poker in the state if the federal government approves it.

Most industry leaders and researchers believe that Nevada is likely to reap enormous economic benefits from online gaming, with the possibility of creating thousands of jobs in this sector. The types of jobs may span from gaming designers and engineers to professionals in IT, marketing, financial services, management, auditing, and testing, to call centers and customer service. Additional high-skill jobs will be created to support the necessary regulatory infrastructure to effectively regulate online gaming. Importantly, professionals will be needed to create and operate a sophisticated technological infrastructure to block unlicensed operators from operating in the United States, in order to prevent money laundering, collusion, and participation of minors, and to ensure fair play and secure customer identification and transactions.

LAS VEGAS AS THE INTELLECTUAL CAPITAL OF GLOBAL GAMING

By most industry forecasts, the global market share of gaming will continue to shift to the emerging economies. Considerable publicity was generated when Macau, China overtook Las Vegas in 2007 as the largest casino gambling market in the world. Singapore is now expected to overtake Las Vegas by the end of 2011 as the world's second-largest gambling market, propelled by the success of its

[19] H2 Gambling Capital, *United States: Regulated Internet Gambling Economic Impact Assessment*, April 2010.
[20] David O. Stewart, "Online Gambling Five Years after UIGEA," *American Gaming Association White Paper*, 2011, http://www.americangaming.org/files/aga/uploads/docs/final_online_gambling_white_paper_5-18-11.pdf.
[21] Applied Analysis, *The Economic and Fiscal Impact of Authorizing Internet Poker in the State of Nevada*, presented to Regional Entertainment Enterprises, Ltd., January 2011.

two new casino resorts. This has led to certain perception that Las Vegas is being eclipsed as the global center of gaming. However, as its global share of casino revenues declines, Las Vegas has tremendous potential to orient its role as the intellectual capital of global gaming, much like Houston, TX has evolved into a business hub and intellectual powerhouse of the global energy market (a role that has become de-linked from the drilling and production of oil). Already, much of the success of Macau and Singapore's gaming industries can be attributed to the business model, industry knowledge and innovations, and operating expertise originating from Las Vegas. Las Vegas can build on its extensive gaming knowledge base, research, and innovation capacity (discussed previously) and leverage the dynamism of global gaming to become the prime business and knowledge hub of global gaming. The jobs associated with the development of such a hub will be of a different nature and more highly-skilled and highly-paid than in casino operations, including experts in gaming design, engineering, finance, consulting, market and consumer research, communications and policy advocacy, as well as in gaming/hospitality research and education.

GAMING MANUFACTURING

Gaming-related manufacturing is well-anchored in Nevada, with its largest companies (Bally's, IGT, and Aristocrat Technologies) dominating the world market share. Most of the cards, chips, gaming machines, accounting and payout systems, and hardware used in casinos worldwide are made in Nevada. Firms in this sector design, develop, and manufacture slot machines, card counters, chips, automatic card shufflers, transaction systems, and gaming displays. Even as manufacturing in many other sectors have moved offshore, gaming manufacturing continues to be highly competitive in Nevada because it is the nucleus of the global gaming knowledge base, and because gaming manufacturing is closely linked to both product innovations and regulatory compliance. Gaming manufacturers in Nevada will continue to be a very important part of Nevada's gaming industry and will be strengthened by the continued success and healthy market expansion of Nevada's gaming enterprises overseas.[22]

DIVERSIFYING INTO NICHE TOURISM MARKETS

From its traditional gaming focus, Nevada's tourism industry has evolved into a dynamic and diversified cluster in which visitor activities are broadly distributed among: Casino-Resorts (52.7% of Nevada visitors experienced this activity/location), Dining and Restaurants (44.3%), Gaming (38.5%), Live Performance (21.4%), Shopping Malls (18%),[23] and other activities. Going forward, the priority in Las Vegas will be to fill the room capacity already built up in its inventory, by creating demand in diverse tourist markets who would be interested in a variety of activities and experiences.[24]

[22] Association of Gaming Equipment Manufacturers press release, August 2011, http://www.einnews.com/pr-news/527523-association-of-gaming-equipment-manufacturers-agem-releases-august-2011-index.
[23] Nevada Commission on Tourism, April 2011.
[24] Danny King, "Hotel recover suggests turnaround in Las Vegas," *Travel Weekly*, 22 August 2011, http://www.travelweekly.com/Travel-News/Hotel-News/Hotel-recovery-suggests-turnaround-in-Las-Vegas/?source=sharethis.

One potential niche market is **culinary tourism**; already, about one in six U.S. residents who travels for leisure enrolls in a cooking class, takes a food tour, or participates in some other culinary activity as part of their trip, according to the U.S. Travel Association[25] Las Vegas is particularly poised to leverage this opportunity, with its cluster of world-class restaurants on a two-mile stretch along Las Vegas Boulevard. Since Wolfgang Puck first opened Spago in 1992, Las Vegas has evolved into a "dining mecca," with a vibrant restaurant scene that has been recognized by food and wine experts/writers. Las Vegas boasts a long list of marquee names in its culinary roster, including Joël Robuchon, Guy Savoy, Alain Ducasse, Pierre Gagnaire, Le Cirque, and Circo, to name a few.[26] Some have argued that this asset has been under-utilized as a tourism draw; too often, Las Vegas's roster of world-class restaurants has been promoted as one tourism amenity among many (with the exception of annual events such as Uncork'd), and not as a key attraction in its own right. According to a 2010 visitor survey by LVCVA, the average Las Vegas visitor spent $256 on food during their visit, as opposed to $122 on shopping.[27] Culinary-oriented travelers are typically younger, more affluent, and better educated than non-culinary travelers. Las Vegas has always been attractive to the young and affluent set, whose spending has been less impacted than other groups in the current recession.[28] There is considerable potential for Las Vegas to add a restaurant-centered promotional campaign to attract this special segment.

Las Vegas is also adept at innovating and creating demand for new products. One recent example is the "**pool party**," a takeoff from the yacht parties in St. Tropez and Miami's South Beach, which has turned the big resort hotel swimming pools into daytime nightclubs (or day clubs) in the summer.[29] What started as a trend for the locals has gained momentum with younger out-of-towners, attracting significant investments from the major casino resorts and giving a lift to food and beverage revenues. After opening its $2.3 billion beach club, the Wynn Resort reported a 16% increase in food and beverage in the third quarter of 2010, making it the second highest earning department after the casinos. Similarly, the Gaming Control Board reported that beverage revenue rose 7% to $910 million in FY2010 for the 39 casinos with revenue exceeding $1 million, compared to a 2% in 2009.[30] The success of this new segment illustrates that Las Vegas's large and diverse tourism cluster can continue to innovate and cross-sell in ways that leverage existing assets, creating new surprises for both customers and shareholders.

Nevada's natural assets offer strong advantage in the **outdoor/adventure tourism** segment. In Northern Nevada, Lake Tahoe is an internationally recognized destination for scenic views and

[25] U.S. Travel Association, *Profile of Culinary Travelers 2006*, 1 January 2007. Culinary activities include: cooking classes, dining out for a unique and memorable experience, visiting farmers markets, gourmet food shopping, and attending food festivals.
[26] John Curtas, "Las Vegas has become a dining mecca, but where's the marketing?" *VegasInc.com*, 15 August 2011, http://www.vegasinc.com/news/2011/aug/15/restaurant-city/.
[27] Ibid.
[28] Laura Emerson, "Survey says Las Vegas has luxe of the draw," *Las Vegas Business Press,* 26 September, 2011, http://www.lvbusinesspress.com/articles/2011/09/26/news/iq_47475306.txt.
[29] Amanda Finnegan, "Pool party trend paying off big for Las Vegas resorts," *VegasInc.com*, 5 July 2011, http://www.vegasinc.com/news/2011/jul/05/bikini-economy-yes-please/.
[30] Ibid.

outdoor activities, from hiking, to mountain biking, to snow sports. Besides the Tahoe area, Nevada is also blessed with other formidable assets for recreation, wilderness exploration, and outdoor adventures, such as the Ruby Mountains (Ruby Crest National Recreation Area), Snake Range (Great Basin National Park and Mount Moriah Wilderness Area), the Toiyabe Range, the Toquima Range, and the Monitor Range in the Humboldt-Toiyabe National Forest. Lying just outside of Las Vegas, the trails of Charleston Peak and the Red Rocks National Conservation Area draw adventurous hikers and climbers from all over the United States. Charleston offers skiing from November to May and is about to expand to 50 slopes. Lake Mead to the east is one of the most visited tourist attractions in the United States and supports a large boating industry. The western shore of the lake also contains the Valley of Fire. Las Vegas is also the closest major city to major national outdoor attractions such as Zion National Park, Death Valley National Park, and Grand Canyon National Park.

RETIREES AND SECOND HOME OWNERS

Las Vegas has often been listed by various news outlets among the top ten retirement locations in the United States, due to a combination of nice weather, low taxes, affordable housing, and abundant recreational/entertainment opportunities. Las Vegas ranks third among ten key metro areas for the rate at which its age 65+ population has grown between 2000-2010.[31] With the decline in housing prices and the aging trend of baby boomers, Nevada should continue to target this segment, which tends to generate demand for local goods and services while having a smaller need for employment. An overlapping segment is the second home "tourism" market. The high quality of housing stock and Las Vegas lifestyle have always attracted foreign buyers looking for a second home. According to public records from the Clark County Recorder's Office, 10% of all real estate transactions in Southern Nevada are non-citizen buyers. Some real estate sources indicate that there has been a dramatic rise in home buyers from Canada (international snow-birds), in addition to the foreign buyers from China and other Asian countries.[32] The weakness of the U.S. dollar and historically low interest rates have further increased the attractiveness of Las Vegas and Nevada to the second home tourism market.

FILM AND MEDIA

Nevada has attracted an average of $80 million annually in TV/film production value for the last 12 years, and more than $102 million in 2011 alone, largely concentrated around Las Vegas.[33] This has been attributed to Las Vegas's proximity to Los Angeles, the infrastructure and skilled human resources embedded in the city's entertainment industry, sophisticated hospitality infrastructure, convenient air transportation, unique scenes such as the Las Vegas Strip, and (statewide) a minimum-bureaucracy permitting environment and the low cost of doing business. This is despite a

[31] Emily Brandon, "10 Fast-Growing Retirement Spots," *U.S. News & World Report*, 5 July 2011, http://money.usnews.com/money/retirement/articles/2011/07/05/10-fast-growing-retirement-spots_print.html.
[32] "Las Vegas high rise condo for sale popular with international investors according to lasvegasrealestate.org," *PRWeb*, 31 August 2011, http://www.prweb.com/releases/2011/8/prweb8761413.htm.
[33] Nevada Film Office, 2011.

fiercely competitive environment for attracting TV/film productions, in which Nevada is among less than a dozen U.S. states that do not offer any tax incentives or rebates to attract such productions. Film and TV production can often spur tourism after a project is finished, when fans become interested in visiting memorable sites and locations that appear in the film/show. There is potential for Las Vegas to host more production activities by enhancing its studio space and infrastructure, and there is opportunity to expand to adjacent post-production, value-adding, and creative-class services, such as design, animation, graphics, editing, media and communications, and others. There is also opportunity to capture a much larger share of the film production market if a competitive production tax credit is approved by the state legislature.

INDUSTRY CONSTRAINTS

- **Current U.S. law prohibiting online gambling.** The Unlawful Internet Gambling Enforcement Act of 2006 (UIGEA) prohibits any financial transaction in the United States that supports illegal online gambling, with the exception of horserace betting and state lotteries. The online gaming industry will continue to operate under a great deal of uncertainty until it becomes clear whether the U.S. Congress will pass a law to legalize it and authorize what type of regulatory structure it will operate under.
- **Uncertainty in online gaming legality and regulatory environment.** The regulatory environment for online gaming remains uncertain. Currently, online gaming is illegal in the United States; any financial transaction that supports online gambling, with the exception of horserace betting and state lotteries, is prohibited by the Unlawful Internet Gambling Enforcement Act of 2006 (UIGEA). Uncertainty will remain until the U.S. Congress legalizes online gaming and authorizes a specific regulatory structure for the industry. Meanwhile, the existing Nevada gaming regulatory framework – from testing and licensing to taxation and workforce – needs to catch up with the technological advances and digitization of the industry's technology and customer interface.[34] To position Nevada as the national platform and center if and when online poker becomes legalized, the state will need to take a hard look at its existing regulatory structure and infrastructure. The reactivation of the long-dormant Gaming Policy Committee by the Governor is a positive step and will have an important role to play.[35]
- **Onerous U.S. tourist visa procedures for international visitors.** The much stricter, post-911 U.S. tourist visa approval process and the procedures for entering the country (finger prints, iris scans, etc.) have been blamed for a declining U.S. share of the global travel market. In fact, according to the Las Vegas Convention and Visitors Authority, the U.S. share of international travelers has steadily declined over the past decade from 17% to 12%. Nevada will be bucking this trend as it tries to capture an increasing share of this growing global market.

[34] Applied Analysis, *The Economic and Fiscal Impact of Authorizing Internet Poker in the State of Nevada*, presented to Regional Entertainment Enterprises, Ltd., January 2011.
[35] Richard N. Velotta, "Sandoval to Revive Gaming Policy Committee," *Vegasinc.com*. 4 November 2011, http://www.vegasinc.com/news/2011/nov/04/sandoval-revive-gaming-policy-committee/.

- **Land transport congestion discouraging visitors from California.** A large share of Las Vegas's visitors comes from Southern California, often traveling by car. Congestion during peak travel times is exacerbated by the location of the California Agricultural Inspection Station just east of Barstow, which can turn a 3-4 hour driving trip to a frustrating 6-8 hours for travelers from California. To avoid this risk, many Californians arrive by short-haul flights that are taking up valuable capacity at Las Vegas's McCarran Airport; this capacity could potentially be diverted to serve national/international markets instead. To assure Las Vegas's dominant position in the important California market, this surface infrastructure bottleneck will need to be addressed by examining alternatives such as high-speed rail, a widening of I-15 in California, or relocating the agricultural inspection station to Nevada along the California border to reduce the bottleneck of the mountain pass in I-15.

- **Lack of tax credit for the film industry.** Competition among communities to host film production is fierce and is increasingly defined by a "race to the bottom" mentality. This is because a high-end feature film or television series can spend an estimated $260,000 per day while on location, generating significant economic impact for the community. In order to capture these expenditures, many states (including California and New York) are offering tax credits of 20-40% to lure television and film production to their communities. Nevada will continue to find itself at a disadvantaged position to attract large-scale film projects in the absence of such a credit.

B. HEALTH & MEDICAL SERVICES

INDUSTRY ADVANTAGES AND BUSINESS CASE

The strategic targeting of the *Health & Medical Services* industry in Nevada represents an opportunity not only to close the healthcare service gap for residents, but also to grow a large, relatively stable base of economic activity and high-quality jobs in the state. The *Health & Medical Services* industry cluster is less volatile than the consumption-based industries that dominate much of Nevada's economy, and instead is driven largely by long-term population growth and demographic trends, as well as by government programs and policies. Jobs in *Health & Medical Services* cover a wide range of positions, from moderate- to very high-skill, and employment has grown steadily over the past decade in the United States (+2.34% employment CAGR from 2001-2011), as well as in the State of Nevada (3.49% employment CAGR from 2001-2011) – remaining positive even during the recent economic recession.[36] According to EMSI projections, national employment in the *Health & Medical Services* industry is expected to grow 20% over the coming decade (2011-2021).

While a large and growing segment of the state economy, both data analysis and stakeholder testimony suggest that the *Health & Medical Services* sector in Nevada is not as large and robust as it ought to be. Statewide, the *Health & Medical Services* industry is significantly less concentrated in Nevada as compared to the national average (employment concentration ratio of 0.658). Many stakeholders interviewed believed that Nevada residents continue to experience a critical gap in health and medical services, and as a result health outcomes are suffering and many patients (if financially able) go out-of-state for specialty care and procedures. In the Southern Nevada market, studies have suggested that Las Vegas residents are less satisfied with their current healthcare than residents of other Western cities and are willing to pay for better services.[37]

With steady growth of the national healthcare sector, there are increasing shortages in healthcare workers throughout the country.[38] Stakeholders in the industry have reported difficulty in hiring qualified healthcare workers at all levels – from nursing aids to surgeons. Nevada has a below-average concentration of healthcare workers (as compared to national occupation averages), both for *Healthcare practitioners & technical occupations* (0.71 location quotient) and *Healthcare support occupations* (0.73 location quotient). In 2011, the concentrations of both *Physicians and surgeons* (0.76 location quotient) and *Registered Nurses* (0.73 location quotient) also fall well below the national averages. Nevada and the surrounding region are expected to experience a growing shortage in nurses over the coming decade.[39]

[36] SRI calculations based on EMSI data.
[37] Booz Allen Hamilton, *Building a New Hospital & Clinic in the City of Las Vegas*, commissioned by the Cleveland Clinic, 14 February 14 2004.
[38] IBISWorld, *IBISWorld Industry Report 62211: Hospitals in the U.S.*, March 2011.
[39] J. Packham, *Nursing Workforce Supply and Demand in Nevada: 2000 to 2020*, 2003.

Nevada's strong business case for growing the *Health & Medical Services* industry rests on several key factors:

Large industry cluster with rising demand aligned with demographic trends. The *Health & Medical Services* cluster is not only a stable, high-quality source of employment – it is also a large segment of economic activity in the state, as in the nation. The *Health & Medical Services* cluster employs 86,710 workers in Nevada, and over 15 million nationwide. Hospitals alone in Nevada were estimated to generate $8.5 billion dollars in economic activity in 2009, as a result of direct spending on employee compensation, benefits, and goods and services.[40] The demographic trend of aging baby boomers and their need for health and medical services will continue to drive demand for growth in this industry.

Capturing market leakage and reversing the import of health services. The low concentration of the *Health & Medical Services* industry in Nevada constitutes a missed economic opportunity for the state. Roughly 6% of total jobs (or 86,710 workers) in Nevada fall within the *Health & Medical Services* industry cluster, significantly lower than the national average of 9%. Some may argue that Americans are over-consuming healthcare services in general; the expenditures and growth of this sector are unsustainable; and the trend toward increased use of technology for service delivery will reduce the pace of job growth in the sector compared to the past two decades.[41] However, even if Nevada closes one-third of the workforce gap with the current national average, it could mean an additional 14,000 healthcare jobs in the state. While jobs in the industry vary from moderately to extremely high-skill, the average annual pay in this industry is $67,969 (well above the state average $48,077).

Current service gaps in Nevada's *Health & Medical Services* sector, according to stakeholders, range from a shortage of basic health education and preventative care (especially in rural Nevada) to a lack of specialists and surgeons in the state's hospitals. Nevada ranks 45th in the nation in terms of active physicians per 100,000 population,[42] with only 194.9 physicians compared to the national average of 254.5. In Nevada, ten (of 14) rural and frontier counties, as well as large portions of the state's urban areas, have been federally-designated as Primary Medical Care Health Professional Shortage Areas (HPSAs).[43] Nevada also ranks below the national average in several measures of preventative care, such rates of flu vaccination, dentist visits, pap smears, and sigmoidoscopies/colonoscopies.[44] There are estimates that Las Vegas may be leaking a quarter of its medical services to nearby locations such as Los Angeles and Phoenix. While the specific leakage and its impact is difficult to measure and verify, strong anecdotal evidence suggests that many upper-middle to high-income families routinely travel to out-of-state facilities and specialists for medical care and procedures.

[40] J. Packham, E. Fadali, T. Harris, and T. Griswold, *The Impact of Hospitals and the Health Sector on the Nevada Economy*, 2011, http://www.medicine.nevada.edu.
[41] McKinsey Global Institute, *An economy that works: Job creation and America's future,* June 2011.
[42] American Association of Medical Colleges, *State Physician Workforce Data Book*, 2009.
[43] NSORH, 2011
[44] NSORH, 2011

New institutions have brought increased patient care and research capabilities. In recent years Nevada has acquired the Cleveland Clinic Lou Ruvo Center for Brain Health and the Nevada Cancer Institute – these are centers for research as well as patient care. The addition of these nationally known centers has raised the prestige and recognition of high quality, specialty patient care in Nevada. They also enhance Nevada's medical research capabilities and research linkages to other world-class medical research centers and communities.

Increased investment in and attention on the health/medical workforce. The need for improving the supply of qualified healthcare professionals has received increased attention and investment from the State of Nevada and industry stakeholders. With gifts from private foundations, the University of Nevada School of Medicine has recently increased its capacity to eventually expand from the current class size of 62 to 100 students, for a total enrollment of 400 students at full capacity.[45] It also received a $960,000 grant from the Health Resources and Services Administration to expand its residency program, which will facilitate increased patient services in Las Vegas and the training of more family medicine physicians to serve the rural areas.[46] In recent years, leaders in government, education, and business have begun working together to address workforce issues and to undertake a wide variety of initiatives that have helped to expand and improve healthcare and health education in the state, through partnerships such as the Southern Nevada Medical Industry Coalition and the Nevada Health Care Forum.

Improving quality of life for Nevada residents. Providing access to quality healthcare for Nevada residents is critical to ensuring a high quality of life in the state, which in turn will play an important role in Nevada's economic future. Multiple stakeholders have emphasized the importance of strong healthcare and education systems to attract and keep highly skilled professionals in Nevada – the kind of talent necessary to successfully grow the state's target industries.

TARGET OPPORTUNITIES

SURGICAL SPECIALTIES

Anecdotal evidence and market research suggest that medium- and high-income Nevada residents routinely leave the state for specialty care and surgical procedures. Research has found that more than 50% of Nevada residents seeking care in California and Arizona are doing so for surgical procedures.[47] Recapturing this market by improving the capacity to perform surgical procedures represents a significant economic opportunity for Nevada. New technologies and procedures are also boosting industry growth. Throughout the market, the overall demand for surgical procedures is expected to rise with advancements in surgery techniques (e.g., minimally invasive, laparoscopy,

[45] University of Nevada School of Medicine, http://www.medicine.nevada.edu/news/unr-announces-10-million-dollar-gift-for-health-sciences-building.htm.
[46] University of Nevada School of Medicine. http://www.medicine.nevada.edu/news/school-of-medicine-awarded-grant-to-expand-family-medicine-residencies-in-las-vegas.htm.
[47] Booz Allen Hamilton, *Building a New Hospital & Clinic in the City of Las Vegas*, commissioned by the Cleveland Clinic, 14 February 2004.

endoscopy, robotics, etc.), allowing doctors at specialty hospitals to offer procedures that are more effective and that were previously unavailable.[48]

GERIATRICS AND RELATED SERVICES

The overall demographic trend of aging baby boomers and the attraction of retirees to Nevada create opportunities for the geriatrics specialty and related care and services in the state. Among the major metro areas across the United States, Las Vegas ranks third for the rate at which its age 65+ population has grown from 2000-2010.[49] The need for geriatrics care to serve this population segment will continue to grow. The geriatrics-related care opportunity tracks the national trend, where the largest job growth in the past decade has been in nursing and residential care, social assistance, and home healthcare services.[50] *Home health aides* (SOC Code 31-1011) and *personal and home care aides* (39-9021) are two occupational categories that have relatively low location quotients in Nevada (0.61 and 0.56, respectively), suggesting an opportunity to create more jobs in this segment to serve the aging population.[51]

DISAGGREGATION OF MEDICAL SERVICE DELIVERY, CREATING NEW OPPORTUNITIES FOR MIDDLE-SKILL JOBS

One emerging trend in the health/medical industry and elsewhere is the disaggregation of work, which is the breaking down of conventional jobs into discrete tasks that can be parceled out to other people. In the health/medical industry, this trend has manifested in the separation of the technical parts of the jobs that must be done by a physician, a nurse practitioner, or a nurse, and reassigning these tasks to other less skilled professionals (e.g., administering flu shots or routine tests, such as strep tests).[52] As the nation continues to suffer shortage of physicians, nurses, and other skilled healthcare professionals, and as the medical industry continues to operate under cost-reduction pressures, the trend toward disaggregation is likely to continue, creating opportunities in middle-skill, middle-income jobs that can help fill the current service gaps in the industry.

LEVERAGING A STRONG MEDICAL/HEALTH SECTOR TO BUILD OTHER EMERGING INDUSTRIES

Nationally, the *Health & Medical Services* industry is a stable, growing, and high-wage industry that provides people with critical services. By building a stronger *Health & Medical Services* industry in the state, complete with a robust educational pipeline and centers of excellence for care and research, Nevada will be well positioned to take advantage of opportunities in related segments such as executive care and medical tourism, biotechnology, clinical trials and testing,

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[48] IBISWorld, *Industry Report 62231: Specialty Hospitals in the U.S.*, February 2011
[49] Emily Brandon, "10 Fast-Growing Retirement Spots," *U.S. News & World Report*, 5 July 2011, http://money.usnews.com/money/retirement/articles/2011/07/05/10-fast-growing-retirement-spots_print.html.
[50] McKinsey Global Institute, *An economy that works: Job creation and America's future,"* June 2011.
[51] Larry Mosley, Dennis Perea, and Bill Anderson, *Health Care and Social Assistance Industry Report: Top Ten Occupations – Broad Economic Context (2002-2010)*, Nevada Department of Employment, Training & Rehabilitation, Research and Analysis Bureau.
[52] McKinsey Global Institute, *An economy that works: Job creation and America's future,"* June 2011.

imaging/devices, and medical equipment and supply industries. Stakeholders see long-term potential in these emerging industries – and there are some existing capabilities in the state – and they emphasize the importance of a strong medical service and education/research cluster to serve as the foundation for these emergent opportunities.

INDUSTRY CONSTRAINTS

Regional stakeholders interviewed emphasized the need to grow the state's *Health & Medical Services* industry, but also stressed that this is a complex problem that Nevada has been seeking to address for years. Key challenges and roadblocks to industry growth may include the following:

- **Inadequate medical education and research activities in the state's largest medical market.** The University of Nevada School of Medicine (UNSOM), while based in the University of Nevada, Reno, has a considerable footprint in Southern Nevada through its offerings of 3rd and 4th year rotations and clinical clerkships, as well as residencies and fellowship programs. UNSOM recently opened its primary Clinical Simulation Center in Las Vegas. However, compared to similarly sized or smaller cities in the Western U.S. region – such as Denver, Albuquerque, Salt Lake City, Tucson, and Phoenix – all of which have highly research-oriented medical schools, Southern Nevada is undeniably placed at a disadvantage. The current level of education and research activities have been insufficient in building a strong and vibrant medical and health cluster that would deeply engage the local communities, energize local philanthropic contributions, attract major research dollars, and spur adjacent biomedical research activities.
- **Vertically integrated market with a dominant, single payer.** Historically, the healthcare market in Southern Nevada has been more vertically integrated and less competitive than in other markets, with approximately 60% of the payer market accounted for by a major healthcare group. The dominance of a single payer and its business model of low price (reimbursement rates) and high volume is often cited as a reason for the slow entrance of new health and medical service providers, as well as some of the quality issues encountered in the region's healthcare market.
- **High percentage of Medicare patients and low reimbursement rates**. Nevada has a lower percentage of insured residents than the United States overall, with 19.5% of the population uninsured in Nevada (as compared to 14.5% nationally), and a large percentage of residents are on Medicare. This has been cited by some stakeholders as an obstacle to providing high-quality care while remaining economically viable in Nevada.
- **The uncertainty of the legality of PPACA going forward.** Nevada is one of 27 states that have joined in a federal lawsuit to challenge the legality of the Patient Protection and Affordable Care Act of 2010. PPACA is expected to have a considerable impact on the health services market, both nationally and in Nevada, with its provisions governing the private health insurance industry and mandated insurance coverage. The extensive legal challenge to this act and the

uncertainty of its legality going forward (especially in the light of the 2012 elections) will continue to create a lot of uncertainties in the health and medical services market.

- **Gaps between graduates and the workforce needs of the industry.** While health education programs at various levels are abundant in Nevada, the educational pipeline for health and medical careers is not functioning optimally in the state, largely (according to stakeholders) as a result of workforce supply/demand gaps and poor coordination. Stakeholders from leading healthcare institutions mentioned the difficulty of hiring professionals with the necessary qualifications in-state, while educational stakeholders are unable to place talented students locally and lose graduates to out-of-state. Stakeholders point to the gap in coordination between educators, government, and industry leaders as the likely cause of this disconnect.

C. BUSINESS IT ECOSYSTEMS

INDUSTRY ADVANTAGES AND BUSINESS CASE

Nevada's opportunities in *Business IT Ecosystems* span a wide range of technological and skill levels. Given that Nevada has not yet built up an image or reputation as a strong location for technology-based businesses, a logical development approach for this industry is to focus on attracting lower-to-moderate skill range (and higher job-creating) business services operations in the near term, while simultaneously establishing new marketing and entrepreneurship/innovation support mechanisms that will spur growth and attraction of higher-end IT-based businesses over the longer term.

Business IT Ecosystems[53] is currently a very small industry cluster in the State of Nevada, representing 51,597 employees (in 3,857 establishments) and only 3.5% of total state employment. Nevada's lack of critical mass is evident in the employment concentration ratio for this cluster, at 0.774 statewide, meaning that the cluster is much less concentrated in Nevada than the national average. However, the cluster does have a slightly higher concentration in the Reno/Carson City region, at 0.933, which is just below the national average. Overall cluster employment has been declining in Nevada over the last five years (-3.83% CAGR in Nevada from 2006-2011, or about 11,000 net jobs lost), but that decline is entirely driven by job losses in the *BPO & Employment Services* sub-cluster, which has been especially hard-hit by the recession – both in Nevada and nationwide. Activities related to temporary help and employment services are generating most of the job losses here (Nevada lost 13,500 jobs in *NAICS 5613-Employment Services* from 2006-2011), as these employees are the easiest and first to be cut when the economy turns downward. All other sub-sectors within this industry have actually seen solid employment gains in Nevada over the last several years (many at rates above the national average), and future growth projections for the overall cluster are positive (with a projected 2.04% CAGR and Nevada and 1.74% CAGR nationally from 2011-2016).[54]

Since it is a small industry, *Business IT Ecosystems* has until recently been "off the radar screen" of many in Nevada, overshadowed by the massive growth in Nevada's core consumption industries (such as tourism/gaming) and its better-known traditional industries (such as mining). The attention and support that have been provided to this industry have largely come through small scale regional economic development initiatives and through private sector leaders who are working in these sectors. However, in the wake of the recent recession – and in light of attention paid to this industry in other states and regions around the country, as well as the growing importance of this industry in

[53] Note here that the "Business Services" component of this industry is defined narrowly to include operations such as call centers, back office services, administrative services, employment services, and other activities related to business process outsourcing and shared services.
[54] SRI calculations based on EMSI data.

today's increasingly knowledge-based global economy – there is currently very broad interest in developing the *Business IT Ecosystems* industry in Nevada.

Nevada's advantages and assets for growing its *Business IT Ecosystems* cluster – and for expanding the cluster into higher-value, higher-skill activities – include the following:

Strong and growing base of moderate-skill business services and IT-related activities. Low- to medium-skill business services activities already have an established critical mass in Nevada, and these activities have been growing in both the Las Vegas and Reno metro areas (even in the wake of the recession). Well-established and growing segments in Nevada include call centers and customer service operations, as well as back-office services (i.e., business process outsourcing and shared services). Nevada has excellent workforce and infrastructure assets to support and attract these kinds of businesses, which could serve as an opportunity to pivot toward higher-skill segments in the broader IT and business services industries. The best testament to this opportunity is the fact that Zappos.com moved its headquarters from San Francisco to Las Vegas in 2004, due primarily to the city's advantages for running call center and customer service operations.

Strong (but under-marketed) IT industry anchors. While the state's IT industry remains quite small, Nevada does have some excellent but not widely-known assets for building its IT industry and expanding its high-tech workforce. These include the Switch SuperNAP (one of the most advanced and well-connected data centers in the world), UNLV's School of Informatics (a leading cyber security academic institution), the presence of the Zappos.com headquarters and many other lesser-known e-commerce companies, and a growing urban arts district in Las Vegas's Fremont East neighborhood (soon to be anchored by the new Zappos headquarters building in the former city hall). These assets, and the capabilities they represent, should be proactively marketed and tapped into as a foundation for expanding the IT-based companies and workers in the state.

World-class Internet infrastructure and other locational advantages. As elaborated in *Section II*, technology infrastructure and Internet connectivity is considered to be excellent in both the Reno and Las Vegas metro areas, but this strength has not been well-marketed and is not documented by the available quantitative indicators of technology infrastructure. A particular advantage for Nevada is that the state's technology infrastructure is relatively new (as compared to other states), so fiber optic cable is more prevalent, and there are often multiple service providers available. The Switch SuperNAP data center in Las Vegas represents a unique strength, in that it boasts Internet connectivity, speed, and reliability that, it claims, is second to no other data center in the world, with more than 20 Internet service providers on-site. This service also allows Switch to offer an aggregated telecom purchasing/pricing approach for its customers that is highly competitive against any other region in the country. The potential for the SuperNAP's capabilities to serve as an anchor for attracting higher-end IT-centric activities is only beginning to be explored by regional stakeholders.

An additional locational advantage for Nevada in the *Business IT Ecosystems* industry is that the state is considered to have a relatively low risk of natural disaster. For example, Las Vegas has been ranked 15th out of the 50 largest cities nationwide for having low natural disaster risk.[55] This locational factor is critical for businesses such as data centers/colocation centers, cloud computing, other IT-based activities, call centers, back office services, and other types of companies that require 100% uptime, high security, and low risk of business processes being interrupted for any reason.

TARGET OPPORTUNITIES

As mentioned above, the recommended approach for developing Nevada's *Business IT Ecosystems* industry is to focus in the near term on building the "lower-tech" and low-to-medium skilled segments of the industry that already have established growth trends in the state and that can serve as stronger job creation mechanisms for Nevada's unemployed service workers. Simultaneously, Nevada should work on establishing the right environment, image, and support mechanisms necessary for growing "higher-tech" segments of the industry – recognizing that building up a reputation and critical mass in IT and technology-based sectors will require a much longer time horizon to see sizeable growth.

Specific target opportunities within the *Business IT Ecosystems* industry are highlighted below. The opportunities are presented in order from lower-tech/nearer-term opportunities to higher-tech/longer-term opportunities. For the most part, the identified opportunities have the potential to develop and grow in both the Las Vegas and Reno/Carson City regions (although specific nuances and assets for particular niches may vary across the two regions, and these differences are mentioned wherever relevant).

CALL CENTERS/CUSTOMER SERVICE AND BACK OFFICE/BPO/SHARED SERVICES

Based on existing assets and recent growth trends, this sector is a high-potential, near-term prospect for development in Nevada. Outsourcing and consolidation of business and administrative functions is a national (and global) trend that is expected to continue growing at a rapid rate due to business cost-cutting and streamlining efforts. Nevada is already attracting an increasing number of these kinds of businesses and has the necessary infrastructure and workforce to continue to grow this segment.

Although this sector encompasses a wide range of niches and activities (elaborated further below), the factors that can attract these companies to Nevada are largely the same:

[55] "Natural Disaster Risk: 2008 Rankings," *SustainLane*, http://www.sustainlane.com/us-city-rankings/categories/natural-disaster-risk. The rating criteria looked at hurricanes, major flooding, catastrophic hail, tornado super-outbreaks, and earthquakes, taking into consideration potential frequency of disaster as well as the extent of damage.

- Low business and labor costs, along with a business-friendly environment. This is an especially important advantage, since outsourcing/consolidation of business processes is largely a cost-cutting endeavor.
- Available existing real estate for retrofits (especially around Las Vegas) as well as ample available land for new construction.
- Ample available workforce at low- to medium-skill levels. Stakeholder interviews suggested that workforce availability in Nevada has become less of a concern for this industry over time as the unemployment rate has risen. Additional advantages for Nevada's workforce include the large bilingual population (which supports the ability to develop call center and customer service operations in both Spanish and English), as well as the fact that workers are accustomed to working in a 24/7 work environment (due to the culture of the region's tourism and gaming industry).
- Solid and reliable Internet and telecommunications infrastructure.

Specific opportunities to focus on within this sector include the following:

- ***Call Centers/Customer Service Operations:*** The State of Nevada has seen strong growth and continued new investments by these kinds of businesses in recent years. Employment in call centers/customer service is difficult to document (because unless the call center is a standalone operation, its employment will be counted under its parent company's industry). However, the measurable employment count in standalone call center operations (*NAICS 56142-Telephone Call Centers*) has been growing steadily in Nevada at 3.6% annually from 2006-2011 (stronger than the national average of 1.8%) – and while employment numbers are low (5,466 workers in 2011) Nevada's employment concentration is 1.446, well above the national average (and this figure most likely should be higher, given that not all employment in this sector is counted in these figures). As an example of the undercounting, the data used here for NAICS 56142 counts about 1,350 workers in call centers the Reno/Carson city region, in 28 establishments. Data collected in the region by EDAWN, however, estimates that there are over 2,500 workers in call centers in the greater Reno region alone, working in at least 70 companies.

  Calls centers vary in terms of their skill-level requirements, with inbound call centers and customer service operations generally requiring higher skill sets (such as a high school or community college education, computer skills, etc.) than outbound call centers (which tend to be more standardized and scripted operations). While many call center operations are moving offshore, call centers that incorporate value-added and revenue generating services are likely to stay within the United States and also require higher skill sets (for example, multi-function operations that handle customer service or customer support as well as sales and marketing functions). These multi-function call centers could be particular targets for Nevada to push this sector toward higher skill and wage levels.

- ***Back Office/BPO/Shared Services:*** This segment involves the outsourcing or consolidation of business processes such as human resources, finance & accounting, IT operations & data storage, customer service (call centers), procurement, and other industry-specific functions. This is typically done through two mechanisms: *business process outsourcing (BPO)*, which involves outsourcing to a third party provider, and *shared services*, which involves centralizing/consolidating functions within a large company. Back Office/BPO/Shared Services is especially difficult to measure using standardized industry data, but the best possible estimate using 2011 industry data is that there are approximately 9,000 workers in this segment in the State of Nevada (but the actual employment count is likely to be much higher), with a concentration ratio of 0.742.[56] BPO/shared services operations currently operating in Nevada include shared services centers for Amazon.com, U.S. Environmental Protection Agency, Intuit, HCA, and Avery Dennison, among others. Nevada's employment declined over the last five years (-1.3% CAGR from 2006-2011) but is projected to resume growth at a rate slightly below the national average (1.9% CAGR in Nevada and 2.3% CAGR nationally from 2011-2016). Back Office/BPO/Shared Services represents a high-potential opportunity for Nevada to build upon its existing strengths in call centers and push these activities into higher-value services that require higher skill levels and pay higher wages.

E-COMMERCE OPERATIONS/HEADQUARTERS

E-commerce operations/headquarters typically combine a range of functions that may include standard company headquarters activities, along with call center/customer support, IT and website management, retailing, and marketing operations. This is currently a very small segment in Nevada right now (with an estimated 6,750 jobs in 290 establishments for *NAICS 45411-Electronic Shopping & Mail Order Houses*), but Nevada has a very strong concentration ratio of 2.131, indicating good competitive advantage for further growth. Nevada's growth trends mirror the national average (0.7% CAGR from 2006-2011, and a projected 1.6% CAGR from 2006-2011).

A strong endorsement for Nevada's potential in this industry is the movement of Zappos.com's headquarters from San Francisco to Las Vegas in 2004. Zappos' locational decision was based primarily on the need to expand its call center/customer service operations, and Las Vegas was selected because it is such a good location for those activities (and Zappos' headquarters functions moved to Las Vegas along with the call center because the company places such a high priority on customer service as the core of its business). Based on this example, real potential does seem to exist in using Nevada's strong foundations for call center/customer service operations as a platform for attracting the higher-value e-commerce company operations. These operations would bring high-skill jobs in management, IT, design, and so on, and could possibly be a bridge toward growing other IT-based businesses (as the critical mass of technology/knowledge workers in Nevada grows).

[56] *Note:* These estimates do not count workers in establishments that provide temporary employment services.

Note that another core function of e-commerce operations is distribution/fulfillment (i.e., dealing with the physical products that are being sold by these companies). Locational decisions for e-commerce distribution/fulfillment are typically an entirely separate decision process than for the headquarters/operations functions and are based on different factors; therefore, distribution/fulfillment by e-commerce companies is covered in *Section VIII*, which focuses on logistics/distribution, and is not specifically included here. As an example of this distinction, while Zappos.com has located its headquarters and call center in Las Vegas, its distribution operations are still located in Kentucky (because the company believes that is the most efficient and cost-effective location for the national distribution model it uses). Nevada has seen strong growth in e-commerce distribution/fulfillment operations moving into the state (especially in Northern Nevada), so this does also represent a strong, but separate, opportunity segment. At the same time, for some e-commerce firms, co-locating distribution/fulfillment functions nearby to headquarters or call center/customer service operations may be advantageous, so Nevada may be able to leverage its advantages across these various segments to attract an array of e-commerce-related companies and functions.

DATA CENTERS

While data centers are not typically a long-term job engine for most regions (a typical data center may create 50-75 permanent positions and a similar number of related support positions.), in the short-term they employ a substantially larger number of people in construction-related jobs. With its large skilled construction workforce and other locational advantages, data centers may represent an opportunity to utilize Nevada's currently under-employed construction workforce. The scale of the SuperNAP and Switch's aggressive expansion plans indicate Las Vegas's suitability as a home for large-scale data centers. Meanwhile, some stakeholders suggest that Reno may also be well-suited for data center operations. To offset the advantages of established data center hubs in other regions, the state may focus its data center development efforts on Nevada firms looking to consolidate their physical facilities. The state's existing BPO service providers, for example, may find advantage to locating some of their infrastructure in local data center facilities.

CLOUD COMPUTING/HIGH PERFORMANCE COMPUTING

Cloud computing is a "pay-per-use model for enabling, available, convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."[57]

The cloud computing market is experiencing explosive growth, with IDC estimating that the market for cloud computing will grow from $16 billion in 2009 to $55 billion by 2014. As a result of this and other technical factors, the scale of data centers is rapidly increasing to match demand, with a new

[57] National Institute of Standards and Technology, Information Technology Laboratory, USA, May 2009.

generation of super data centers coming online in places like Washington, North Carolina, and Nevada. Thanks to a fortuitous combination of factors, including the growth of cloud computing, the collapse of Enron (leading to a unique confluence of telecommunications services at a single point), and entrepreneurial vision, Las Vegas is home to one of the most advanced and well-connected data centers in the world – the Switch SuperNAP.

Looking at other regions around the country (such as western North Carolina and Quincy, Washington), data centers are not usually associated with large-scale economic growth, and they tend to attract other data centers (to leverage the same locational advantages), but not necessarily other IT companies. Companies such as Amazon, Google, or Apple who utilize a large volume of data center space usually have little reason to locate a substantial number of human resources in close proximity to their data centers. To date, there is no precedent for a region leveraging data center assets to build a broader IT-based industry cluster. However, new cloud-based services do show some potential as drivers for regional economic growth, especially as the need grows for extremely low latency and near-proximity connections between end-users and data center assets.

It is these opportunities that Nevada should tap into to pursue synergistic IT industry growth based on Switch and its unique data center capabilities. For example, some industries, such as video production, rely on extensive in-house computational capabilities. Companies like Weta Digital (*Avatar, Lord of the Rings*) and Lucasfilm (*Star Wars)* are home to some of the fastest computing systems in the world, representing a substantial investment in internal data center assets. The potential cost savings of cloud services are driving these types of firms to explore alternatives to their traditional in-house computing service approach. Because of the large quantities of data involved and the rapid iteration required among large teams of animators and other staff, high-bandwidth and low latency data connections between the cloud and the customer are critical for these applications, potentially driving growth in cloud-enabled jobs close to major cloud computing centers, such as the SuperNAP.

In order for Nevada to make a strong case for companies that use cloud computing/high performance computing capabilities to physically locate their activities in Nevada (to be close to the Switch data center), the state may consider focusing its efforts on early adopters of cloud and high performance computing services and identifying specific initiatives to attract firms in these specific niches. The experience of the SuperNAP indicates that broadcasting companies and video production/animation firms represent one possible target sector for further development.

CYBER SECURITY

According to the White House, the "cyber threat is one of the most serious economic and national security challenges we face as a nation."[58] Due to government and private industry's increased reliance on information technology, the growth of cloud services, and other factors, cyber security is

[58] http://www.whitehouse.gov/administration/eop/nsc/cybersecurity

a rapidly growing industry. U.S. Federal government spending alone on cyber security is expected to exceed $13 billion by 2015.[59] No city or region has established itself as the leader in cyber security, and Nevada is home to several assets that could be leveraged to build a robust cyber security industry:

- Solid and reliable Internet and telecommunications infrastructure, as well as data center infrastructure (the Switch SuperNAP) boasting some of the most robust physical security in the industry.
- A leading cyber security academic institution, as recognized by the designation of UNLV's School of Informatics as a Center of Academic Excellence (CAE) in Information Assurance Education by the National Security Agency.
- Las Vegas is home to two major cyber security conferences, DEF CON and Black Hat. These two conferences draw more than 10,000 cyber security experts to Las Vegas annually.
- Cyber security is absolutely critical for the success of online gaming operations. Nevada's data center infrastructure and robust gaming governance structure may lead to a growth in Nevada-based online gaming operations; these firms will require specialized cyber security technology to manage risk in an online environment.

INDUSTRY CONSTRAINTS

In spite of broad enthusiasm in Nevada for building up the state's IT and high-tech capabilities, the fact that Nevada significantly lags most other states around the nation in supporting and growing a solid *Business IT Ecosystems* industry means that a proactive and calculated approach needs to be taken in pursuing opportunities in this industry. As described above, there are a number of pockets of growth and existing assets in Nevada that can be built upon for growing this industry; however, there are also a number of broad challenges that need to be overcome:

- **Nevada has lagged other states in building this industry.** To date, Nevada has not taken a proactive approach to marketing itself as a location for IT, high-tech, and knowledge-based businesses, but it is competing against dozens of states that have been marketing and growing these capabilities for years. To be successful in attracting higher-end, higher-skill IT-based businesses, Nevada will need to develop a very solid business case for why these businesses should locate in Nevada and will need to actively market and cultivate this image.
- **Need to improve the state's image and assets for attracting a creative class and high-tech workforce.** Nevada's case for business attraction and growth has in the past focused almost exclusively on the state's low-cost, low-regulation, business-friendly environment. While these qualities are important, they will not be enough to attract the higher-end, higher-skill, high-tech businesses that the state is interested in growing. Businesses that employ a high level of

[59] INPUT, *Federal Information Security Market*, 2010-2015.

technology and IT/knowledge-based professionals typically look for thriving, creative, urban environments with strong quality of life features and "creative class" assets (culture, arts, recreation, universities, and so on). Since Nevada does not yet have this image, it can be difficult for Reno and Las Vegas to compete against cities like Seattle, Portland, or Austin in attracting IT-based and knowledge-based businesses and professionals.

According to stakeholders, this challenge is partly perception and partly reality. On the one hand, Nevada does have excellent quality of life features, recreation/outdoor/entertainment assets, and a family-friendly environment that is not widely recognized outside the state. Particularly in the Las Vegas region, stakeholders complain that the region's "sin city" reputation tends to overshadow other quality of life assets and creates a misperception of what it means to live and work in Nevada. Professionals who have relocated from California to Reno or Las Vegas claim that the quality of life amenities combined with the low costs and low congestion make these regions highly attractive to educated professionals relocating from California and other West Coast urban areas. The challenge, however, is to get potential workers and businesses to physically visit Nevada and see for themselves the regional assets that exist outside the Vegas Strip, in order to overcome this perception problem and truly "sell" Nevada as a location.

At the same time, stakeholders also recognize that Las Vegas and Reno do not, in fact, have the thriving urban environment of places like Seattle or Austin, and there is not yet the concentration of highly-educated and young professionals or the active "college town" environment that is typically needed to grow and sustain such an atmosphere. Recent and ongoing downtown redevelopment efforts in both Reno and Las Vegas are a good start toward building these environments – for example, Reno's efforts to build arts and recreation amenities along the downtown riverfront and to market itself as a "green city," as well as Las Vegas's efforts to build an urban core around the Fremont East District and the new Zappos headquarters (moving into the city hall building in this neighborhood in 2013).

- **Relatively small (but growing) high-tech workforce.** A closely related challenge are the workforce issues faced by companies that require highly-skilled IT and knowledge professionals. Workers employed in "computer and mathematical occupations" (*SOC 15*, which is a good approximation of IT workers) represent only 1.4% of total employment in the State Nevada, while they represent a much higher share of employment in states such as California (3.0%), North Carolina (2.5%), Texas (2.6%), and Washington (4.0%). Employment in "computer and mathematical occupations" has grown in Nevada over the last five years (by 4.2% annually, or double the national average), and also represents a growing share of Nevada's total employment (from 1.0% in 2005 to 1.4% in 2010).[60] Backing up this data, most stakeholders interviewed for this study stated that it can be challenging to hire for IT and highly technical positions within Nevada. Most companies hire outside the state for these kinds of positions, but they also face challenges in recruitment due to the image issues discussed above, as well as

[60] Bureau of Labor Statistics, *Occupational Employment Statistics*, May 2010 and May 2005 Employment and Wage Estimates, http://www.bls.gov/oes/.

concerns about Nevada's weak educational and healthcare systems. The small critical mass and lack of "depth" in the IT industry is another concern for technology professionals, who may fear that if they move to Nevada for a specific job and then lose that job, there may not be other job opportunities locally to move into. While Nevada firms do have easy access to the extensive and high-skill labor market in neighboring California (and high-level managerial and IT professionals can, and do, commute to jobs in Nevada from California), it would be preferable for Nevada to have its own in-state pool of such talent.

- **Additional support for entrepreneurship and startups is needed.** Expanding the IT and high-tech sectors in Nevada is largely a function of providing an environment that is conducive for local startups and entrepreneurs to grow and thrive, rather than simply attracting business relocations from outside the state. In the past, Nevada has not been particularly proactive in providing entrepreneurial support and business incubation services (especially as compared to other states), although small and fragmented initiatives in these areas do exist. In addition to creating urban environments where innovators and "creative class" leaders can thrive, Nevada also will need to take a more proactive approach to connecting local entrepreneurs and startups with the support and capital resources they need, if the state truly wishes to grow this industry segment over the longer term

D. CLEAN ENERGY

INDUSTRY ADVANTAGES AND BUSINESS CASE

The *Clean Energy* industry is a high-potential target for Nevada because of the state's renewable resource base, its established geothermal headquarters, its proximity to large energy markets, and the recent energy investments that have been made in the state. Nevada's renewable resources are fairly balanced between the north and south, with higher geothermal resources in Northern Nevada and higher solar and hydropower resources in Southern Nevada. Of all U.S. states, Nevada has the second highest (behind California) installed geothermal capacity. Given the number of projects in the design and permitting phase of the state's construction pipeline, though, Nevada is set to surpass California in installed geothermal capacity in the near future. To date, Nevada's demand for solar power has been driven by the state's renewable portfolio standards (RPS), which require that Nevada utilities get 20% of their power from renewable sources by the year 2015 (and then 25% by 2025), with at least 6% coming from solar energy through 2016-2025. The state is home to several solar projects, with a mix of concentrating solar (CSP) and photovoltaic (PV) technologies. Several new solar power plants are planned for construction over the next few years. Strictly speaking, energy efficiency improvements do not generate *new* electricity, but these improvements save money for both users and suppliers of electricity because they free up capacity and slow the increase in electricity demand that may otherwise necessitate new power plant construction. While the installation and operation of new renewable energy facilities will generate some jobs in Nevada, the sector's greatest potential for job creation is in the manufacture and design of renewable energy systems and components, and in energy efficiency audits and upgrades.

Employment in Nevada's *Clean Energy* sector (including geothermal) grew by an average of +16.82% annually over the past five years, compared to only +7.63% annual growth at the national level. Nevada's metro areas have high concentrations of employment in different types of renewable energy. The geothermal industry is extremely concentrated in Reno, with an employment location quotient of 74.806. Though Reno has only 30 people working in the waste-to-energy sector, that number represents the highest concentration (4.620 location quotient) of waste-to-energy activity in the United States. Las Vegas has high employment concentrations of people working in solar photovoltaics (3.807 location quotient) and in hydropower (1.696 location quotient). Las Vegas had 103 jobs in cleantech manufacturing in 2010, up from only 10 in 2003, representing a 40% average annual growth rate. The Reno-Sparks metro area had 35 jobs in cleantech manufacturing in 2010 (up from only 9 jobs in 2003, a +21% CAGR increase).[61] Though Nevada's *Power Generation & Technology* sector has shrunk in recent years, shedding 860 jobs from 2006-2011, this sector is expected to make a modest rebound, with projected +0.08% annual growth rate in Nevada through

[61] Data from Brookings Institution calculations as part of *Sizing the Clean Economy: A National and Regional Green Jobs Assessment*, Brookings Metropolitan Policy Program, 2011.

2016. The *Power Generation & Technology* sector does not show a significant concentration of employment in Nevada (0.697 location quotient).[62]

Nevada's research activities are helping to reinforce the state's renewable energy industry. The Desert Research Institute (DRI) has developed hyperspectral imaging that allows a more focused search for productive geothermal wells. Nevada's solar research will be furthered by the construction of a Solar Demonstration Zone in the Nevada Test Site. In 2009-2010, Nevada produced 35 publications on "Energy & Fuel" topics. Energy and fuel research is fairly concentrated in Nevada as compared to the national average, with a location quotient of 1.8. Recent publication topics in Nevada include lithium-based batteries, hydrogen generation, titanium dioxide nanomaterials, and fuel cells.

Nevada's business case for growing the *Clean Energy* industry rests on several key advantages:

Nevada is at the epicenter of geothermal energy development in the United States, and the state is poised to become an international headquarters for geothermal development around the world. Geothermal power plants are mostly based in the Reno area, and the state's 22 operating plants have a current operating capacity of 442 megawatts of power, making Nevada second in the nation, after California, in installed geothermal capacity. With 65 projects in the pipeline, Nevada has more geothermal projects under development than any other state, and its installed capacity is expected to increase significantly in the future.[63] Ormat, a leading geothermal company, has its global headquarters in Reno and is considered by many to be the anchor company that has spawned Nevada's geothermal industry.[64] Ormat has installed geothermal plants in hot spots around the world, including Central America, the Pacific Rim, and several European locations. Reno is home to six other large geothermal companies: Enel North America, Terra-Gen, Magma Energy, Homestretch, Nevada Geothermal, and U.S. Geothermal. Reno also houses the headquarters of Gradient Resources and Ram Power, which are the top two companies in the United States in terms of geothermal capacity under development. The Nevada Geothermal Council in Reno advocates for the exchanges of ideas between the industry and state agencies.

To prepare its workforce for the expanding geothermal industry, Nevada is focusing on training new talent and updating the skills of existing workers. With assistance from the U.S. Department of Energy, UNR has launched the nation's first consortium of top geothermal schools, the National Geothermal Academy, to train the next generation of scientists, engineers, and policymakers. The Great Basin Center for Geothermal Energy, a well recognized center of excellence, is also based at UNR.

[62] SRI calculations based on EMSI data.
[63] Geothermal Energy Association, *U.S. Geothermal Production and Development Update*, 2010, http://www.geo-energy.org/pdf/reports/April_2010_US_Geothermal_Industry_Update_Final.pdf.
[64] Jason Hidalgo, "Clean Energy: Indicators point to Geothermal Cluster Growth in Northern Nevada," *RGJ.com*, 6 August 2011, http://www.edawn.org/docs/top-business-headlines/08.05.11_Geothermal_Cluster.pdf

Nevada has a high level of incident solar energy. Southern Nevada is among the best places in the country to harness solar energy and the state ranks second in the nation – after California – in installed solar capacity. As of the end of 2010, Nevada had 100.4 MW of installed capacity in solar photovoltaic and 64 MW in concentrated solar thermal. Nevada is home to the world's largest concentrating solar plant (CSP): the 64 MW Nevada Solar One plant near Boulder City. It is also home to the largest operating solar photovoltaic plant in the nation: the 48 MW Sempra Copper Mountain project near Boulder City. In 2010, twenty-five square miles of the Nevada Test Site were committed to the creation of the Solar Demonstration Zone, which will be used to demonstrate new technologies and study how to reduce the costs and environmental impacts of utility-scale solar. According to data from the Solar Energy Industry Association (SEIA), Nevada has 4,567 MW of utility scale solar projects under development.[65]

Nevada has good potential for wind energy capture. Though the state has strong potential for wind energy development (especially in the northern and eastern regions), Nevada lags the region in wind energy development. However, efforts are underway to tap into the state's wind power. Nevada has five wind projects totaling 1,150 MW on the drawing board. Pattern Energy's 150 MW project, upon completion, will be the state's first wind farm.[66] In addition to these projects, Nevada has the wind potential to add about 6,000 MW of additional wind power on land that is not reserved for protected lands or other incompatible uses.[67] There are significant challenges to implementing such projects, including the complicated environmental and regulatory permitting landscape and the mountainous terrain in many parts of the state.

Nevada's renewable manufacturing has attracted foreign investment to the state. Nevada has recently received investments from outside of the United States to fund renewable energy generation facilities and renewable component manufacturing facilities. This activity was set in motion in 2009, when Lt. Governor Brian Krolicki signed a Memorandum of Understanding with the Chinese Investment Promotion Agency, to encourage Chinese investment in Nevada's renewable energy industry.[68] In 2010, a consortium of U.S. and Chinese companies (including China-based A-Power Energy Generation Systems) announced plans to build a wind turbine manufacturing center in the Las Vegas area that will employ about 1,000 people. According to project partner U.S. Renewable Energy Group, the 320,000 sq.ft. manufacturing plant would take an initial investment of $344 million, and its first products would supply the construction of a wind farm in Texas.[69] The Clark County Board of Commissioners began negotiations in 2011 with a branch of China's ENN

[65] Solar Energy Industry Association, *Utility Scale Solar Projects in the United States: Operating, Under Construction, or Under Development*, http://www.seia.org/galleries/pdf/Major%20Solar%20Projects.pdf.
[66] Leslie Berliant, "Wind Turbine Production Plant Comes to Nevada," *EnergyBoom.com*, 17 March 2010, http://www.energyboom.com/wind/wind-turbine-production-plant-comes-nevada.
[67] Nevada has a total 7,247MW of potential wind capacity at 80m of height on non-excluded lands. *Source:* U.S. Dept. of Energy, *Nevada Wind Map and Resource Potential*, http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=nv.
[68] Nevada Commission on Economic Development, *Foreign Direct Investment (FDI) in Nevada*, http://www.diversifynevada.com/divisions/global_business_development/foreign_direct_investment_in_nevada/.
[69] Leslie Berliant, "Wind Turbine Production Plant Comes to Nevada," *Energyboom.com*, 17 March 2010, http://www.energyboom.com/wind/wind-turbine-production-plant-comes-nevada.

Group to establish the Mojave Green Center, a proposed 720MW solar plant combined with a 100,000 sq.ft. facility with manufacturing lines to produce thin-film photovoltaic panels.[70] Renewables manufacturing projects such as these (whether they are foreign-funded or not) have the potential to establish Nevada as the U.S. leader in renewables production. In spite of competition from foreign manufacturers, the United States was a significant net exporter of solar energy products in 2010, with total net exports of $1.9 billion.[71]

Nevada is proximate to a large amount of energy demand. With its population of about 2.6 million residents, Nevada's energy market is not huge, and the state's internal appetite for renewable energy will be limited. However, Nevada's close proximity to California, with the latter's requirements for greater amounts of its electricity coming from renewable sources, has the potential to create a huge market driver for development of renewable energy projects in Nevada. For instance, Sempra Energy recently entered into a 25-year power purchase agreement to sell 150 MW of solar-generated electricity to northern California utility PG&E. The power will come from an expansion of Sempra Energy's Copper Mountain solar farm in Boulder City, NV. Depending on the availability of transmission infrastructure, similar projects could be developed to serve both the California and Nevada markets.

TARGET OPPORTUNITIES

Nevada's main opportunity in the *Clean Energy* industry is to aggressively pursue development that will enable the industry to export from the state. The development of new manufacturing operations, new transmission lines, and new markets will enable the export of expertise, products, and energy – each of which will create wealth for Nevada. The specific opportunities within this industry are delineated below:

RENEWABLE COMPONENT MANUFACTURING

Several manufacturers of renewable components are already operating in Nevada. Windspire Energy (maker of the innovative Windspire wind turbines) is based out of Reno, and Amonix's branch in North Las Vegas makes concentrated photovoltaic panels. However, Nevada's manufacturing of renewable energy components could be greatly expanded to create jobs and export products for the state. Nevada already has a high concentration of employees (3.12 location quotient) working in the solar photovoltaic sector; its thirteen existing solar PV companies employed

[70] Benjamin Romano, "China's ENN plans PV factory and 720MW project for Nevada," *ReCharge.com*, 6 July 2011, http://www.rechargenews.com/energy/solar/article265771.ece.
[71] Greentech Media, *U.S. Solar Energy Trade Assessment 2011*, http://www.seia.org/galleries/pdf/GTM-SEIA_U.S._Solar_Energy_Trade_Balance_2011.pdf.

630 people in 2010. Nevada's solar thermal sector and wind sector are less developed, though both have grown over the past seven years.[72]

The component manufacturing opportunity includes power *storage* components as well as power *generation* components. Lithium-based batteries in particular have potential in Nevada, due to the substantial deposits of lithium in the state. Until newer technology is developed, lithium-based batteries are the power source of choice for cell phones, computers, and electric cars, and several companies are already addressing this opportunity. Altairnano is a Reno-based manufacturer of lithium-ion based batteries used primarily in the electric vehicle industry. With several battery and solar PV-related patents, Altairnano is one of Nevada's leading non-gaming patent producers. The firm is currently receiving DOE, Navy, and NSF support through the federal SBIR program to further develop its battery and TiO2-based solar technology. K2 Energy Solutions is a Henderson-based manufacturer of lithium-ion phosphate batteries that has received multiple SBIR awards from the DOD to develop its battery technology. Over the period 2003-2010, the two battery technology establishments in Nevada added employees at an average annual rate of 42.4%.[73]

EXPANDING TRANSMISSION CAPACITY

As mentioned above, Nevada is very close to the power-hungry State of California. If the appropriate transmission infrastructure were put in place, Nevada might be able to generate electricity and send it across state borders. This could be lucrative given the higher price for electricity in California, but creating the infrastructure required for transmission will be a difficult task. Nevada has recently begun developing intrastate electrical transmission lines through the One Nevada Transmission Line (ON Line) project, which is expected to significantly increase the ability to connect the state's renewable energy generators to the power grid.[74] The ON Line project is the first phase of a larger transmission project called the Southwest Intertie Project (SWIP) connecting Wyoming, Idaho, and Nevada to California. Developers anticipate exporting wind and solar power via the SWIP to California. Other transmission projects that have proposed transmission lines passing through Nevada are TransWest Express, Zephyr, Chinook, and Gateway South. Only the SWIP has the possibility of allowing Nevada renewable resources some access to out-of-state markets.

In order to identify the costs of importing renewable energy into California, the California Energy Commission created a Renewable Energy Transmission Initiative (RETI). RETI has estimated that California could purchase renewable energy from Nevada and Arizona at competitive costs.[75]

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[72] Data from Brookings Institution calculations as part of *Sizing the Clean Economy: A National and Regional Green Jobs Assessment*. Brookings Metropolitan Policy Program, 2011, http://www.brookings.edu/~/media/Files/Programs/Metro/clean_economy/0713_clean_economy.pdf.

[73] *ibid.*

[74] Michael Yackira, "Transmission Infrastructure and Collaboration," *Renewable Energy World.com*, 28 February 2011, http://www.renewableenergyworld.com/rea/news/article/2011/02/final-word-transmission-infrastructure-and-collaboration.

[75] The cost assessments in RETI analysis represent the levelized cost of generation, and for cross-state transmission, the model includes the associated transmission costs for energy delivery to California. *Source:* Renewable Energy Transmission Initiative

However, California may try to increase its own renewable capacity rather than waiting to connect with out-of-state generation facilities. Also, the question of how new transmission capacity will be financed is a sensitive issue, and the Nevada State Office of Energy is taking a thorough approach to evaluating the state's financing options.

ADVANCING AND INTERNATIONALIZING GEOTHERMAL DEVELOPMENT

As discussed above, Nevada has huge geothermal resources, and Reno houses the headquarters of many of the world's major geothermal development companies. But, while these Nevadan companies may install and operate facilities at home and abroad, much of the equipment and expertise they use comes from outside Nevada. Aside from the construction and operation services that Nevada supplies, the geothermal value chain includes exploration equipment, drilling equipment, drill operation, pumps, pipes, heat exchangers, and other segments. Nevada has the opportunity to become the knowledge center for the global geothermal industry, and also to become a source for drilling equipment, expertise, design, and manufacture.

ENERGY EFFICIENCY UPGRADING

Many new commercial facilities were built during Nevada's recent construction boom from 2003-2007. However, many of these buildings were not constructed to high standards of energy efficiency. If Nevada's commercial and residential buildings were updated to comply with international energy codes, the energy savings would be huge. The nation's slump in construction has displaced workers across a spectrum of occupations, including carpenters, plumbers, electricians, HVAC technicians, contractors, architects, and others. The energy efficiency and conservation sectors share many occupations with the construction industry, such as architects and contractors to design and manage energy efficiency upgrades; energy auditors who have expertise in HVAC systems and data collection; and workers with hands-on construction skills to install and troubleshoot energy conserving products, such as thermostats, alternative lighting, and insulation. Now that Nevada's construction industry is largely dormant and its outlook for new commercial construction is poor, Nevada can take the time to evaluate the efficiency of its newer and older buildings, and to upgrade efficiency with improvements to lighting, insulation, water management, and other building systems. With the recent completion of Las Vegas Union Park and CityCenter projects, Nevada's construction industry has demonstrated its capacity to meet environmental standards such as LEED. Nevada was recently approved for a $765,000 competitive grant from the U.S. Department of Energy (DOE) to assist in energy retrofit projects for commercial buildings across the state.[76]

Coordinating Committee, *Phase 2B Final Report*, May 2010, http://www.energy.ca.gov/2010publications/RETI-1000-2010-002/RETI-1000-2010-002-F.PDF.

[76] Nevada News Bureau Staff, "Nevada Receives $765,000 Federal Grant For Commercial Energy Retrofit Projects," *Nevada News Bureau*, 19 September 2011, http://www.nevadanewsbureau.com/tag/energy-retrofit/.

INDUSTRY CONSTRAINTS

Regional stakeholders indicated that several significant barriers are limiting further growth of the *Clean Energy* sector in Nevada:

- **Renewable projects require a lengthy and onerous licensing process**. With the federal government owning or managing nearly 87% of Nevada's land, land use policies and permitting requirements by various federal agencies – Bureau of Land Management (BLM), U.S. Fish and Wildlife Service, U.S. Forest Service, and Department of Defense, among others – have the potential to significantly delay project development. These restrictions make it difficult to build solar plants (which are typically land-intensive) and difficult to route power transmission lines in the state. Furthermore, the uncertain cost associated with getting approvals, permits, and licenses can make renewable energy projects difficult to finance. The BLM in particular is now working on fast-tracking permitting for certain land areas in western regions called the Solar Energy Study Areas, as well as working with states to fast-track certain applications.
- **Incentives for renewable power generation have not been very predictable.** Uncertainty surrounds the important federal subsidies that make renewable energy sources economically viable in the current market. Many tax credits, loan guarantees, and grants are set to expire in the next 2-3 years, which will make it difficult for renewable energy projects to access funding. Federal incentives for geothermal are set to expire in 2013 and are fueling a rush to get projects up and running in California and Nevada, raising concern about a potential geothermal bubble in these states. On a more positive note, Nevada's state-level renewables incentives have remained stable, including the Renewable Energy Sales & Use Tax Abatement, which has been in place since 2009.
- **Limited transmission capacity has constrained renewable development**. Without adequate transmission infrastructure connecting Nevada both internally and to its neighbors, the development of renewable resources – for the state's internal consumption and for energy export – will be hindered. Financing interstate transmission lines has been difficult; interstate lines are a somewhat risky investment, since the value of such infrastructure depends on the cost of energy in different energy markets.
- **Financing of geothermal (and other renewable) projects has been an issue.** Geothermal exploration can be a risky expense; the front-end of a geothermal project is the most risky and costly, often requiring tens of millions of dollars in exploratory drilling. It is uncertain how many exploratory wells a company will drill before they find one suitable for geothermal development. Often this activity is not financed by banks or lenders due to high risks, making the developer dependent on high-risk venture capital. The potential for company failure could cause the formation (and subsequent burst) of an investment bubble in the geothermal sector.[77]

[77] Conversation with Karl Gawell, Geothermal Energy Association.

While geothermal financing is especially difficult, access to finance for all renewable projects has also been challenging, especially in the current economic environment.

E. MINING, MATERIALS, & MANUFACTURING

INDUSTRY ADVANTAGES AND BUSINESS CASE

Nevada's mineral resources, combined with the state's knowledge base in mining operations and its existing materials and manufacturing activities, make the *Mining, Materials, & Manufacturing* industries a clear-cut target for the state. These related industries have been grouped together for this analysis on the basis of the common technical expertise and resources that are exchanged between their component sectors. For instance, several chemical businesses (with products such as lime, cyanide, and cement) are in the Reno area because of their close relationship to mining. Though these are consumption-based industries that rely on (often cyclical) consumer demand, they are export-based industries that can improve Nevada's trade balance over the long term.

The mining industry is closely tied to Nevada's history, and it remains an important part of the state's economy today. Mining employment is ten times more concentrated in Nevada than the national average, and the state's mining activity predominantly takes place outside of the major metro areas. Mining employment grew by 2.04% annually over the 2006-2011 period[78], and the industry is projected to continue growing through investment in new projects (largely due to high gold prices) and subsequent development of the supply chain. Nevada is home to North America´s only commercial lithium mine, located 20 miles from Borate Hills, NV. American Lithium intends to develop Borate Hills and its other lithium brine exploration projects through cooperation with international partners.[79]

Much of Nevada's mining workforce is trained in the Mackay School of Mines at UNR and in Great Basin College in Elko (these schools also receive substantial industry funds). The mining industry has developed relationships with the College of Southern Nevada and UNLV. There are some research partnerships between the mining industry and the state's research institutes, though these partnerships could stand to be developed and deepened.

Largely due to the recession and the decline in new construction, Nevada's ***Mining & Materials*** industry cluster experienced a net decline in employment over the past five years (2006-2011), contracting at an average annual rate of -3.85%. The *Construction, Industrial, & Other Materials*; *Metals*; and *Plastics, Resin, & Rubber* sub-clusters were particularly hard hit by the economic downturn. Economic indicators project a modest rebound for these sectors, though, with job growth predicted in the chemicals, plastics, and resin sectors.[80]

Nevada's ***Manufacturing*** industries have also experienced a net decline in employment from 2006 to 2011, although Nevada's CAGR of -1.94% is better than the national average of -2.87% during this time period. The only *Manufacturing* sub-cluster that experienced job gains in Nevada during this

[78] SRI calculations based on EMSI data.
[79] http://www.americanlithium.com/
[80] SRI calculations based on EMSI data.

period was *Food Processing* (with a marginal positive CAGR of +0.61% from 2006-2011). Notably, EMSI forecasts positive growth trends for *Manufacturing* in Nevada over the next five years (+2.04% from 2011-2016), even in the face of ongoing decline nationally (-0.85% CAGR).[81] Historically, Nevada's manufacturing sector has benefited from the state's proximity to California. Many California manufacturers have relocated to Nevada to take advantage of the state's business-friendly environment while remaining close to major western markets. Unlike many regions of the United States, Nevada saw a net increase in manufacturing activity over the past decade, though the industry has experienced a dramatic downturn since the recession. Relocation to Nevada is still attractive, though, due to the tax environment and a favorable regulatory climate.

The *Mining, Materials, & Manufacturing* industries are a strategic opportunity for Nevada, for the following reasons:

The presence of significant mineral resources in the state is the greatest strength driving Nevada's mining industry. Nevada leads the nation in gold production and is the fourth largest gold producer in the world. Other minerals and ores produced in the state include: aggregates, barite, copper, diatomite, dolomite, gypsum, limestone, lithium carbonate, magnesium oxide, molybdenum, perlite, precious opals, salt, silica sand, silver, and specialty clays.[82] According to the Nevada Bureau of Mines and Geology, the state has tremendous potential for the discovery of additional mineral deposits. Areas where prospective rocks exist beneath a cover of young, valley-filling sediments and volcanic rocks have only been explored to a limited extent, and ore deposits continue to be discovered in and near Nevada's mining districts.[83]

Nevada has a strong geosciences knowledge base. Relative to nationwide research production, Nevada's research activity is heavily concentrated in fields related to geology, geosciences, and mining. While the total number of scientific publications produced by Nevada institutions is low, these fields account for a greater proportion of Nevada's research publications than in the country as a whole. Key scientific publication topics in Nevada, with location quotients (LQ) indicating high concentrations of activity, include: "Mining & Mineral Processing" (LQ=5.77), "Geological Engineering" (LQ=4.19), "Geology" (LQ=4.01), "Multidisciplinary Geosciences" (LQ=3.83), and "Geochemistry & Geophysics" (LQ=2.64). Nevada's prolific research in these fields could contribute to more efficient and streamlined mining operations.

The *Mining, Materials, & Manufacturing* industries have also seen new innovations introduced by small businesses in Nevada. For example, Digital Solid State Propulsion is a small Reno-based firm developing solid rocket engines. The technology behind the firm's advanced electrically controlled solid rocket propellant may also find application as a mining explosive. Also, Multi-Phase Technologies is a Sparks-based firm that designs and manufactures Electrical Resistivity Tomography

[81] SRI calculations based on EMSI data.
[82] http://www.nevadamining.org/faq/index.php
[83] Nevada Bureau of Mines and Geology, *The Nevada Mineral Industry 2008*, http://www.nbmg.unr.edu/Pubs/mi/mi2008/mi2008.pdf.

(ERT) instruments, which are used for imaging sub-surface structures from electrical measurements taken at the surface or in boreholes. The firm has recently received three SBIR awards from the Department of Energy to develop more precise ERT systems. Innovations in this area could reduce the cost of exploratory drilling for mining and geothermal companies.

Nevada has manufacturing strengths in several areas, such as gaming, food, metals, and plastics. Gaming-related manufacturing is well-anchored in Nevada, with its largest companies (Bally's, IGT, and Aristocrat Technologies) dominating the world market share. Most of the cards, chips, gaming machines, accounting and payout systems, and hardware used in casinos worldwide are made in Nevada. There is a fair amount of food manufacturing in Nevada, which includes food processing, dairies, energy bars, cereal, salad dressing, nutraceuticals, and vitamins. This sector benefits from Nevada's proximity to the food production activities in California. There are a number of "metal benders" and machine shops that provide materials to the state's industrial, building, automotive, and semiconductor manufacturers. Plastic manufacturing has a decent presence in the Reno area and is diverse in its downstream market base.

TARGET OPPORTUNITIES

After reviewing industry trends and developments, speaking with various stakeholders, and assessing Nevada's unique strengths, the SRI/Brookings team has identified several growth opportunities for the *Mining, Materials, & Manufacturing* industries. Descriptions of four opportunities follow the table below, which summarizes the value chain opportunities for low-, medium-, and high-value mining materials.

Supply chains for mining low- medium- and high-value materials in Nevada
O=Opportunity, X=Already developed or unlikely to develop

Value Chain Segment	Low-value materials (e.g. gypsum, barite)	Medium-value materials (e.g. lithium, vanadium)	High-value materials: (e.g. gold, silver)
Upstream: **Exploration services and mine-site services**	**O** – There is little design and manufacture of equipment in Nevada, though some expertise exists at UNR. Many services are brought in from out-of-state.		
Midstream: **Mineral development, production, and rehabilitation**	**X** – Mining groups already extract these materials	**O** – Nevada has significant resources of medium-value materials	**X** – Mining groups already extract these materials
Downstream: **Smelting & refining of materials; manufacture of products**	**X** – Already vertically integrated: refining and manufacturing are near mines and near customers	**O** – Demand is increasing for derivatives and products of medium-value materials	**X** – Refining conducted out-of-state at high-capacity refineries. Unlikely to change.

Expand Participation in Upstream Mining Activities

As the table above shows, the opportunities for new development are limited in the downstream of the value chains for low- and high-value materials. However, because Nevada holds mineral resources, the state has the opportunity to capture activity in the upstream of the mining value chains, by targeting exploration and mine-site services. This includes further development of the state's mine support services, including: construction of buildings and surface facilities, provision of mining services (both surface and underground), design and manufacture of mining equipment (both vehicles and components of extraction equipment), and provision of specialized services (i.e., drilling, blasting, engineering, analytical, metallurgical, environmental, and management).

There is significant overlap of expertise and activity between Nevada's mining industry and its geothermal industry. Both mining and geothermal development rely on drilling and extraction technologies, and both sectors depend on the ability to assess underground resources. According to industry representatives, the mining and geothermal industries could benefit dramatically from the development and deployment of better technologies for drilling and exploring.

Medium-Value Mineral Supply Chain Development

In the mining industry, Nevada's downstream opportunities (such as refining and manufacturing) vary depending on the minerals in question. There is significant opportunity for Nevada to expand its supply chain for medium-value materials, such as lithium, boron, and vanadium. These material resources are abundant in Nevada, and lithium in particular could prove to be valuable to the renewable energy industry. As discussed in the *Clean Energy* section, the demand for lithium is increasing, as lithium-based batteries are increasingly used in consumer electronics and hybrid-electric vehicles. Nevada has a wealth of medium-value material resources and has the opportunity to develop downstream refining and manufacturing activities to process them.

Manufacture of Advanced Composite Materials

As noted above, Nevada has established strengths in the manufacture of plastics, resins, and structural components. The metals and plastics manufacturers in Nevada could be a natural intermediate industry to support the development of an advanced composites industry in the state. Composite materials have applications in materials for wind turbines, lightweight automotive products, and aircraft. The national composites industry is projected to grow by 7.8% annually from 2011-2016.

Organizing and Marketing of Manufacturing Base

Industry observers noted that Nevada's manufacturing base is fragmented, with no common directory of the suppliers and service providers that operate in the state. Nevada has the opportunity to develop a cohesive cluster of manufacturing activity by improving the organization of

its existing manufacturing base and connecting its manufacturers and tool shops to component buyers and broader supply chains, both inside and outside of the state. Some efforts are already underway in this area; for example, Susan Clark of the Nevada Venture Accelerator is developing a "Virtual Manufacturing Environment" to organize smaller suppliers and connect them to larger manufacturers and military contractors (both inside and outside of Nevada).

INDUSTRY CONSTRAINTS

Stakeholders in the *Mining, Materials, & Manufacturing* industries indicated several barriers that are limiting further growth of these industries in Nevada:

- **Lack of a fully-developed mining supply chain.** In spite of the historical and ongoing significance of Nevada's mining industry, the industry has remained largely extraction-based. In particular, there are few developed upstream and downstream linkages for Nevada's highest value minerals, such as gold and silver, and this means that the state is not reaping full benefit from its precious natural resources that are extracted and exported out of state. For example, although Nevada is the nation's largest producer of gold, the state is not home to any major gold mining company headquarters (the state's two largest gold mining companies are headquartered in Denver and Toronto, and Barrick Gold – which extracts the majority of its North American in Nevada – has its North American headquarters in Salt Lake City). Due to the nature of the industry for high-value minerals such as gold and silver, it may be challenging to relocate downstream portions of that industry to Nevada, but supply chain linkages for other medium- and low-value minerals should certainly be explored.
- **State and Federal land-use policies.** Stakeholders noted that state and federal land-use policies (especially those from the Bureau of Land Management) hinder the growth of the mining industry. Similar to the *Clean Energy* industry, the uncertain cost and timeline associated with getting approvals, permits, and licenses can make mining projects difficult to finance.
- **Fragmented manufacturing industry.** Stakeholders observed that Nevada's manufacturing industry is fragmented and consists of mostly small companies. While the state has done well in attracting companies to relocate to Nevada, it has lacked the post-sales support to keep them in the state. The Nevada Manufacturers' Association serves as a common voice for the industry on some issues, but more could be done to organize and promote the state's existing manufacturing base.
- **Absence of a developed high-skilled workforce**. Companies have a limited supply of entry-level workers, since many students trained at UNR leave Nevada after graduation. Nevada's manufacturing industry is particularly sensitive to the state's shortage of high-skilled workers and the high workforce costs associated with retraining and relocating workers. Stakeholders noted that it is difficult to recruit senior management and workers to Nevada for mining industry, especially with the lack of worker housing near mining operations, as well as the low quality of K-12 education for children of employees.

- **Limited water resources.** Nevada is one of the most arid U.S. states, and its constrained water resources make it Nevada an unattractive location for many water-intensive manufacturing operations, such as food processing and mineral refining. Entities across the state face a myriad of technical, regulatory, and legal hurdles in the effort to secure water resources.

F. LOGISTICS & OPERATIONS

INDUSTRY ADVANTAGES AND BUSINESS CASE

Based on existing infrastructure, locational advantages, critical mass, and recent growth trends, *Logistics & Operations* is a natural target industry for Nevada and has strong potential for job creation over both the short- and long-terms. The identified opportunities in this industry exist across both Northern and Southern Nevada, although there are some significant differences across the two regions in terms of available infrastructure and industry critical mass and momentum (these differences are highlighted, wherever relevant, throughout this section).

As a result of the recession and lower consumer demand, the *Logistics, Distribution, & Transportation*[84] industry has declined in employment both in Nevada and nationally over the last five years (-1.56% CAGR in Nevada and -1.15% CAGR in the United States from 2006-2011). As the economy recovers, future growth trends are forecasted to turn positive, with a projected annual growth rate in Nevada (+1.61 CAGR) that is double the national average (+0.82 CAGR) from 2011-2016. Over 85,600 workers are employed in this industry in Nevada, with about 40% of these workers falling into the *Wholesale Trade* sub-cluster.[85] The strengths and composition of the *Logistics, Distribution, & Transportation* industry vary across Northern and Southern Nevada, as elaborated further below.

Northern Nevada: In the Reno/Carson City metro area, the *Logistics & Warehousing* and *Ground Freight Transportation* sub-clusters are both highly concentrated (with regional location quotients of 2.885 and 1.200, respectively), and these are the second and third largest sub-clusters in employment after *Wholesale Trade*.[86] Northern Nevada's critical mass and competitive advantage in these segments is evident in the wide range of national-name logistics/distribution companies that have already set up operations in the region. New investments have been made this year by companies such as Toys 'R Us and Urban Outfitters, while other major distribution operations in the region include Barnes & Noble, Patagonia, Amazon.com, PetSmart, JC Penney, Walmart, Kmart, General Motors, and others. A number of major national-name logistics companies are also operating in the region (as well many regional/local players), including OHL, UTi, ITS Logistics, Hopkins Distribution, Kuehne + Nagel, Griffin Global Logistics, and others.

Linked with these activities are a number of assembly-based and light manufacturing operations that have also set up facilities in Northern Nevada, primarily to serve as a West Coast hub and take advantage of the region's strong distribution and transportation network. Existing Northern Nevada manufacturing operations that are closely linked with the logistics/distribution industry include

[84] *Note:* As it is not possible to define and measure the "Related Manufacturing Operations" opportunity segment using standardized industry data, the industry-level data presented here only covers the warehousing, distribution, logistics, and transportation (ground/air/water/rail) components of this industry.
[85] SRI calculations based on EMSI data.
[86] SRI calculations based on EMSI data.

companies such as Schluter, Pittsburgh Paints, Sherwin Williams, Starbucks, Ralston Food Products, Hidden Valley Manufacturing, Haws Corporation, and others. Note that these manufacturing activities should be differentiated from other manufacturing-related activities/opportunities discussed elsewhere in this report (*Section IV.E*), because the operations discussed here are typically regional hubs within a larger national-caliber company or network (rather than smaller, regionally-based, standalone operations). The growth in this arena is coming primarily from national, Midwest, or East Coast-based firms investing in Nevada to reach the West Coast market, rather than from growth or relocation of existing Nevada firms.

Southern Nevada: In Southern Nevada, the *Logistics, Distribution, & Transportation* industry is much more dominated by activities related to the region's tourism industry. *Ground Passenger Transit* and *Airport & Aviation Services* are highly concentrated sub-clusters in the Las Vegas metro area (with regional location quotients of3.251 and 2.152, respectively) and are the second and third largest sub-clusters in terms of employment after *Wholesale Trade*.[87] According to stakeholders, a large share of Southern Nevada's growth and activities in warehousing, distribution, logistics, and freight transport are also very much linked to the tourism and gaming industry (bringing in the food and other goods that are demanded by tourism and hospitality businesses). There are also, however, a growing number of "export-oriented" distribution, warehousing, and logistics companies in Southern Nevada. Although Southern Nevada does not have quite as strong a critical mass and momentum in this industry as does Northern Nevada, there are some national name distribution centers that have set up operations in the region, including CDW; Bed, Bath, & Beyond; Levi Strauss; Amazon.com; Sysco; and others. In addition, since so many products are brought into Southern Nevada, and then trucks are returning to their origins empty, this excess capacity could be an attraction for firms to set up distribution operations in Nevada in order to take advantage of the outgoing freight availability.

The State of Nevada's strong business case for growing the *Logistics & Operations* industry rests on several key advantages:

Locational and geographic advantages. Nevada's central location on the West Coast means that it is ideally situated for reaching the entire West Coast market by ground or air. All of the major California consumer markets are within a few hours radius by truck, and most of the Western United States can be reached overnight by truck. Since both Northern and Southern Nevada are more centrally located to the entire West Coast than Los Angeles, both regions can compete strongly on a time and cost basis for goods that are brought in (from national or international sources) to be distributed regionally to neighboring states. Additionally, higher value air cargo coming into the United States can land at a Nevada airport and reach destinations in the Mountain West region more quickly and cost-efficiently (as compared to arriving at the Los Angeles airport) by avoiding traveling through the congested Alameda Corridor and the Cajon Pass. Because it is located further north and west than Los Angeles, Northern Nevada also has a time and cost advantage against Los

[87] SRI calculations based on EMSI data.

Angeles region for air cargo coming into the United States from China (and these advantages become more compelling as fuel prices rise).

Strong existing infrastructure. Both Northern Nevada and Southern Nevada have the necessary infrastructure in place to compete for firms conducting distribution, logistics, and related activities.

Northern Nevada: Because it is already seeing so much momentum and growth in this industry, Northern Nevada in particular has extensive infrastructure in place to support growth in logistics, distribution, transportation, and related manufacturing – as well as ample room to expand and grow in the future. All of the critical infrastructure and service providers in the supply chain for this industry are already in place, and very low capital investments are necessary for new companies moving into the region.

- Excellent road connections are available on north/south and east/west routes, and rail connections are also considered to be strong (via the Union Pacific and Burlington Northern Santa Fe networks).
- Northern Nevada's Reno-Tahoe International Airport is already a growing air cargo hub serving a five-state catchment area (northern and rural NV, northeast CA, southeast OR, southern ID, and northern UT) and has excellent facilities for these services, including a new air traffic control tower, multiple runways, snow removal and ground support, and 24/7 emergency response teams.[88] The airport is well-connected to major transportation routes (5 miles from the rail spur and 3 miles from I-80), there are 100 acres of land adjacent to the airport for cross-docking and final assembly, and there is ample land surrounding the airport for expansion. All of these factors – in addition to the low level of airport and air traffic congestion as compared to major hubs in California – make the Reno-Tahoe Airport an attractive location for air carriers and freight forwarders. In addition, Reno-Stead Airport (a general aviation facility located north of Reno) does not handle air cargo but has a variety of other aviation-related uses and is surrounded by industrial, manufacturing, and warehousing facilities.
- In terms of warehousing/industrial/manufacturing space and facilities, the most notable asset in Northern Nevada is the massive Tahoe-Reno Industrial Center (TRI Center) in Storey County, a 107,000 acre park with pre-built infrastructure (water, sewer, utilities) and pre-approved uses for industrial and warehousing operations. Many major national companies in the logistics, distribution, and related manufacturing industries have already established a presence at the park (including, for example, Hardie Building Products, Schluter, Pittsburgh Paint, Alcoa, Diapers.com, Toys 'R Us, and GSI). Anecdotal evidence from stakeholders indicates that existing/pre-built industrial space is somewhat less widely available in the Northern Nevada region (especially in and around urban areas), but the availability of low-cost land and the ease

[88] In 2010, Reno-Tahoe Airport handled 64.3 million pounds of outbound air freight and 42.0 million pounds of inbound air freight. See: Bureau of Transportation Statistics, "Air Carriers: T-100 Market (All Carriers) – Freight Origin/Destination Data," *TransStats*, http://www.transtats.bts.gov/.

of permitting in the region (especially at the TRI Center) makes it easy for businesses to construct their own facilities.

Southern Nevada: Although Southern Nevada does not have as much current critical mass in the logistics, distribution, warehousing, and related sectors, the region does have a strong base of infrastructure from which to support growth in these activities.

- Excellent north/south and east/west road connections are available in the Las Vegas region, and the area is served by a rail network as well (via Union Pacific).
- Las Vegas's McCarran International Airport is a large and rapidly-growing airport; with over 39 million passengers in 2010, McCarran ranked as the 8th busiest airport in the United States (in terms of passenger traffic).[89] In spite of the drop in passenger traffic since 2007's peak levels (47 million passengers), a major expansion is currently underway in anticipation of future ongoing growth of tourism-related traffic, and the $2.4 billion, 14-gate Terminal 3 is projected to open in 2012. The new terminal will significantly expand the airport's ability to handle international flights (with six dedicated international gates, up from four currently), and customs will be able to process more international travelers (handling 2,000 international visitors per hour, up from the current 800). More than 85% of the passenger traffic at McCarran is origin and destination (one of the highest percentages of any U.S. airport)[90], meaning that the large volume of people traveling through the airport is also translating into broader economic impacts for the region (as compared to airports that have high volumes of transfer traffic). The new terminal will significantly expand McCarran's capacity (to handle up to 53 million passengers annually), but once that capacity is reached there is limited room for significant further expansion (due to residential and commercial developments surrounding the airport).[91] McCarran Airport has also recently ramped-up its air cargo capabilities, with the opening of a new 200,000 sq.ft. air cargo center in 2010 (located on a 19-acre site next to the new Terminal 3), and the facility offers world-class build-to-suit suites for tenants that include FedEx, UPS, Southwest Airlines, and others.

  While McCarran has world-class infrastructure and capabilities, the airport is almost an entirely passenger-centric operation (carrying tourists in and out of Las Vegas). Any air cargo that goes through Las Vegas tends to be small packages carried in the belly of passenger planes, rather than on dedicated cargo planes. In addition, there is more air cargo coming into the airport than going out, indicating that these operations are largely serving the local market rather than

[89] Airports Council International – North America, "2010 North American (ACI-NA) final rankings," *Airport Traffic Reports*, http://www.aci-na.org/content/airport-traffic-reports.
[90] Madhu Unnikrishnan, "Las Vegas Airport Bets Big On Expansion," *Aviation Week*, 14 May 2010, http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/awst/2010/05/17/AW_05_17_2010_p46-224550.xml.
[91] A second reliever airport has been proposed to be built outside of Las Vegas, in the Ivanpah Valley (to handle long-haul flights), and environmental studies are underway at the site, but definite plans for this project will not be made for another couple of years and are likely to depend on the economy and on traffic patterns at McCarran.

acting as an industry in their own right.[92] As mentioned above, the excess outgoing capacity for air cargo at McCarran Airport could potentially be an opportunity to attract distributors who could take advantage of this available space on the many planes flying out of the airport.

- Land availability for logistics/warehousing/distribution operations is considered to be quite good in Southern Nevada (especially in the regions around Henderson and North Las Vegas), but space for especially large operations (300-400,000+ square feet) can be more difficult to locate in the region. Much of the vacant building inventory around Las Vegas is not built to the specs required by industrial-type operations (e.g., lacking docks), so existing industrial space is not easy to locate (although land for new construction is available). Rail-connected development sites are also considered to be much less widely available in Southern Nevada (as compared to Northern Nevada).

Cost and regulatory advantages. In addition to their locational and infrastructure requirements, logistics, distribution, and related manufacturing operations tend to be highly cost conscious and look for locations that offer ease of start-up and site availability. In this regard, Nevada offers a number of advantages that allow it to compete strongly as a location against California and other neighboring states.

- For new industrial/warehouse/distribution facilities, the permitting and construction process is generally streamlined, easy, and fast in Nevada (especially as compared to the extensive red tape faced by these operations in California), which is a significant attraction for businesses making new investments. At the Tahoe-Reno Industrial Center, for example, this process is so streamlined that a business can easily get a permit in 30-60 days and have a new facility up and running in 6 months; this same process could take a year or two in other West Coast states.
- For air cargo, the Reno-Tahoe Airport has streamlined, 24/7 customs support as well as a flexible Foreign Trade Zone (encompassing 2,000 acres of private and public land). Speed through customs is especially critical for perishable, expensive, and time-sensitive goods, so streamlined customs processes are yet another area in which the region can compete against places such as Los Angeles. The broader Foreign Trade Zone in the Reno-Sparks region encompasses a wide swath of Northern Nevada and has seven active locations, providing a wide range of benefits for companies conducting warehousing, distribution, assembly, and manufacturing operations. In Southern Nevada, the Terminal 3 expansion at McCarran Airport will significantly speed up the customs process there as well, and the airport is located within the Southern Nevada Foreign Trade Zone (which consists of six sites around the region).

[92] In 2010, McCarran handled 97.7 million pounds of outbound air freight and 103.0 million pounds of inbound air freight. See: Bureau of Transportation Statistics, "Air Carriers: T-100 Market (All Carriers) – Freight Origin/Destination Data," TransStats, http://www.transtats.bts.gov/.

TARGET OPPORTUNITIES

In sum, Nevada's main opportunity in this industry is to attract a wide range of warehousing, distribution, and manufacturing operations that are seeking a West Coast hub of operations. Nevada can especially compete against California and other neighboring states to attract these operations because of the available infrastructure, lower costs and regulatory hurdles, lower congestion, and overall ease of doing business. Specific opportunity segments within this industry are defined very broadly and include a wide range of sub-sectors that span the industry supply chain:

WAREHOUSING AND DISTRIBUTION

Operations serving a broad range of goods/industries could locate in Nevada, but particular opportunities may include warehousing/distribution operations for e-commerce/retail fulfillment, chemicals, electronics, pharmaceuticals/medical equipment, and food/agricultural products (especially linking in with Northern California's agriculture industry). Essentially, any company looking for a West Coast distribution hub to serve the broad Western U.S. market could be a potential target here.

ADVANCED LOGISTICS

These include a wide range of companies that focus on logistics and distribution services, such as freight forwarders, third-party logistics providers (3PL), supply chain management/consultants, etc. Northern Nevada has especially seen a lot of recent growth in this segment, and growth opportunities will continue as the broader air cargo, warehousing/distribution, and manufacturing industry expands in the region.

AIR CARGO

There is a strong opportunity in Northern Nevada to expand the amount of air cargo that is being carried in and out of the Reno-Tahoe International Airport, and especially to position the region as a strong alternative West Coast air cargo hub to Los Angeles, since Reno's airport is significantly less congested, costly, and bureaucratic. The Reno-Tahoe Airport also has potential to attract an increasing amount of international air cargo from China, especially as a gateway for goods moving from China through the United States to South America (because planes must stop for fuel along this route).

Excellent air cargo opportunities also exist in Southern Nevada, although until recently the emphasis on passenger traffic at McCarran Airport has been so strong that there has been little interest among airport officials in expanding or dedicating any extra space for air cargo flights (however, capacity to expand these operations certainly exists if regional stakeholders build momentum and interest in this sector). In the near term, the strongest opportunity at McCarran Airport is to expand the amount of small cargo packages being carried in passenger planes – with every new

international passenger connection at McCarran, capacity to carry international air cargo in the belly of planes also expands (without competing with the airport's passenger focus). Given the high volume of passenger flights in/out of McCarran, Southern Nevada could also be attractive for distribution companies that bring in freight over land and then ship out small packages by air (for example, e-commerce fulfillment companies).

INTEGRATED MANUFACTURING-DISTRIBUTION, ASSEMBLY MANUFACTURING, AND FOOD PROCESSING OPERATIONS

An additional opportunity emphasized by stakeholders in Northern Nevada is that a wide range of manufacturing and assembly operations could potentially be attracted to that region based on the same advantages that serve the logistics/distribution segment:

- Manufacturing companies that have integrated supply chains, with manufacturing and distribution functions conducted within a single facility, would be good targets because they largely depend on the same locational advantages and networks as standalone distribution operations.
- Assembly/kitting-type manufacturing are a possible target, as these firms depend on a streamlined transportation and distribution infrastructure to bring in components, assemble them, and then ship them out again.
- Another possible related target would be food processing operations, especially linked with the large northern California agricultural industry, as well as Nevada's agricultural industry (although the fact that many food processing operations are heavy water users could pose challenges for attracting large-scale operations of this nature).

FREIGHT TRANSPORTATION (GROUND AND RAIL)

The transportation segment is essentially a downstream opportunity from the other segments listed above. As distribution, air cargo, and manufacturing operations grow and expand in Nevada, the transportation businesses serving these operations will also grow.

INDUSTRY CONSTRAINTS

Regional stakeholders interviewed in the *Logistics & Operations* industry mentioned few barriers for further industry growth and development, but a few possible challenges merit mentioning here:

- **Workforce availability is weaker at higher skill levels.** Stakeholders said that workforce availability and skills for distribution, logistics, and related manufacturing operations are generally considered to be quite good in Nevada, and firms investing in the state are generally able to find the workers they need (unless they are looking for hundreds of new employees at one time, which could be a challenge). As Nevada moves into higher-end manufacturing, though, higher-skill labor will be needed, and these workers are generally less available locally.

In particular, stakeholders mentioned that UNR formerly housed a highly-regarded Center for Logistics Management, which was recently closed, and this is generally considered to be a loss to the region's industry. Even though many of the graduates of this program ended up in jobs out-of-state, the closure of program has eliminated the possibility of in-region training for higher-skill positions in this sector and has also made the possibility of building university-industry linkages more challenging.

- **Need to improve business retention and expansion support for companies investing in Nevada.** Some stakeholders indicated that Nevada does not always do a good job retaining distribution, warehousing, and related manufacturing facilities after investments are made – they cited instances in which a major firm set up an operation in Nevada and then closed or moved the facility out of state after several years (examples include Porsche, UTC, and Salomon Sports). Sometimes these closures are due to broader market pressures, cost cutting, and consolidation efforts, but in any case (especially given the current economic climate) it may be wise to step up follow-up efforts with firms to ensure that the companies that do invest in Nevada have the conditions and operating environment they need to stay and grow in the state. In cases where such firms are encountering cost pressures, perhaps proactive efforts could be made to address these concerns head on rather than losing these jobs and companies.
- **High energy costs and water availability issues.** While the infrastructure and cost environment for these firms is overall quite good in Nevada, two possible areas of concern are Nevada's relatively high energy costs (which can be important for manufacturing operations) and water availability issues (which are important for manufacturing activities that require high water usage, such as many types of food processing).

G. AEROSPACE & DEFENSE

INDUSTRY ADVANTAGES AND BUSINESS CASE

The *Aerospace & Defense* (A&D) industry holds high potential for Nevada because of the state's existing base of defense expertise, its established testing and training infrastructure, and its geographic characteristics that enable extensive testing operations. Nevada's A&D industry has traditionally focused more on testing and support operations than on weapons and systems manufacture. The state's support operations have served to attract branches of larger systems integrators, though, and companies such as Boeing have benefitted from the state's testing infrastructure. Nevada's test ranges host specialized testing and training activities for unmanned aerial vehicle (UAV) platforms.

Nevada has about 863 employees in *Aerospace-* and *Defense-Related Manufacturing*, and 75% of the state's A&D manufacturing activity is centered in the Reno metro area.[93] The *Federal Military* accounts for about 14,792 employees in Nevada, and employment has increased steadily, with a +1.12% average annual growth rate in Nevada (compared to U.S.-wide shrinkage of -0.06% annually) from 2006-2011. Nevada's concentration of *Federal Military* employment (location quotient=0.858) is slightly below the national average.[94] In spite of possible long-term spending cuts and increased insourcing in the defense sector, there are several areas, such as robotics and unmanned aerial vehicles (UAVs), which are expected to grow rapidly.

The *Aerospace & Defense* industry has the potential to play a significant role in Nevada's future, for the following reasons:

Existing base of defense expertise. Nevada has an existing base of aerospace and defense companies, which include: URS Corporation and Raytheon [as the Joint Test, Tactics, and Training (JT3) team], Northrup Grumman, and Sierra Nevada Corporation. Several companies in the state are developing advanced materials and sensors for A&D applications. Digital Solid State Propulsion develops rocket fuel for satellite and missile propulsion, and MC-21, Inc. in Carson City has developed a high-strength composite aluminum that has the potential for use as lightweight, multi-layer armor. Advanced Materials and Devices, Inc. is working on technology in Reno to improve the shock resistance of U.S. Navy submarines. An existing base of activity is important to the development of a fully functioning industry cluster.

Nevada has existing test ranges and infrastructure required to test aerospace systems. Nevada is well positioned to become a leader in aerospace systems development because of the expertise at

[93] Note that *Aerospace & Defense* (A&D) employment in Nevada is likely higher than the figures shown here. It is extremely difficult to quantify the A&D industry using NAICS-based data, because many A&D-related activities related to electronics, communications, engineering, drafting, testing, etc. are subsumed within broader industry categories and cannot be isolated from other non-A&D activities.

[94] SRI calculations based on EMSI data.

Creech AFB in Indian Springs, Nevada, as well as the testing ranges in the state that are available to test integrated flight operations. The first U.S. Air Force squadron of UAVs (the 42nd Attack Squadron) was formed in 2007 and is currently based out of Creech AFB. This Nevada-based squadron oversees the training and combat deployment of aerial vehicle and sensor operators assigned to the new MQ-9 Reaper platform.

Nevada's geography and low population density are well suited for A&D system testing. The State of Nevada has a low population density, and much of the state's land is owned by the federal government. The state's geography and dispersed population centers make Nevada an ideal place for testing hazardous aerospace and defense systems (such as rockets, helicopters, and jets) that require wide open, isolated ranges for testing. Rocket engineers in the state have indicated that Nevada has the ideal environment for their work, because away from the metropolitan areas it is easy to conduct explosive range testing.

TARGET OPPORTUNITIES

Nevada's main opportunity in the *Aerospace & Defense* industry is to focus on niche areas of technology and services to complement and expand the defense-related activities that already exist in the state. By localizing the expertise and support activities that are already demanded by Nevada's A&D industry, the state may attract businesses to round out its current cluster. The specific A&D opportunities identified are:

UNMANNED AERIAL VEHICLE (UAV) SUPPLY, ASSEMBLY, AND TESTING

Unmanned systems are next-generation technologies emerging in the aerospace field, with applications in the military, and also for police and border patrols and for search-and-rescue operations. The United States alone is planning to spend just under $4 billion each year through 2013 on the development, procurement, and operation of UAVs, and worldwide UAV expenditures are expected to more than double over the next 10 years.[95,96] Many of the U.S. systems will be tested on Nevada ranges, and industry stakeholders indicated that there is an opportunity for businesses in Nevada to partner in the development and assembly of UAVs, and to participate in supplying and maintaining the ranges and the sensors with which they are tested.

This opportunity dovetails well with the advanced composite materials opportunity described in *Section IV.E*. The use of advanced composite materials in UAVs helps to decrease vehicle weight and increase fuel efficiency. Unmanned Aerial Systems, Inc. (UAS) of Las Vegas builds the Nightwind 2 aircraft, a blended wing aircraft with 100% composite construction.[97]

[95] Chris Pocock, "Issues abound in expansion of UAV missions," *Aircraft Industry News Online*, June 2007.
[96] Teal Group Corporation, *World Unmanned Aerial Vehicle Systems: Market Profile and Forecast 2010*, 2010.
[97] "Heavy-Fuel Wolverine3 Engine Takes Flight At Nevada Test Site," *Aero-News Network*, 15 October 2010, http://www.aero-news.net/index.cfm?do=main.textpost&id=fdc9b45f-0b61-45b8-92c6-8599bd9b7d27.

MAINTENANCE, REPAIR & OVERHAUL (MRO) OF AIRCRAFT SYSTEMS

Though aircraft MRO is a mature industry, the back-shop maintenance of flight and navigation systems is a growth opportunity for Nevada, since the developmental aircraft tested on Nevada's ranges will require specialized (typically) on-site services. These activities include maintenance and repair, overhaul of aircraft and aircraft parts, inspection and testing, and sourcing of parts and supplies. Nevada already has some activity in this area: Chromalloy's Carson City facility builds, repairs, and provides parts and coatings for aircraft engines used in the defense industry.[98]

INDUSTRY CONSTRAINTS

- **Competing with larger defense contractors is difficult**. Industry stakeholders reported that several larger defense contractors have cut or withdrawn their Nevada operations, and that many of Nevada's homegrown defense companies are small businesses that have trouble competing with major defense contractors.
- **There is not much collaboration amongst A&D companies, or with Nevada universities.** Industry stakeholders indicated that the secretive nature of aerospace and defense development frequently prevents companies in Nevada from teaming together or from sharing knowledge or resources on projects. Stakeholders also cited a low level of interaction between A&D developers and universities. In particular, universities could stand to increase their limited aerospace offerings, and the A&D industry could provide more assistance in the form of internships and curriculum development.
- **Tax-related barriers for aircraft and components.** Although Nevada's tax structure is generally considered to be quite business friendly, some aircraft/aerospace-related manufacturing operations (e.g., aircraft manufacturing, maintenance/repair/overhaul) have found that sales and use tax-related costs for new operations that require a high level of capital investment can actually be quite high. Once an operation is up-and-running, the tax climate is favorable, but the initial start-up costs related to the sales and use tax can be a barrier for these firms. Nevada does have a Sales & Use Tax Abatement program, but it does not apply to aircraft and aircraft components, so further development of this segment could be inhibited by this barrier.

[98] Rob Sabo, "Defense contracts bring in millions to Northern Nevada", *Northern Nevada Business Weekly,* http://www.nevadaappeal.com/article/20101114/NEWS/101119817.

H. ADDITIONAL INDUSTRY OPPORTUNITIES

It bears noting that the Nevada economy is complex and varied, and not all of its growth potential resides within the discrete target industries and segments focused on within this analysis. Other industries and segments may also emerge as high-potential centers of activity. Therefore, Nevada should – while focusing its efforts on the target industries – remain open to new industry developments and fact-based opportunities within them. Most notably, at least three areas of economic activity outside of the seven priority industries merit additional mention, as elaborated below.

AGRICULTURE AND FOOD PROCESSING

Agriculture & Food Processing remains a very small industry in the State of Nevada (representing less than 1% of the state's jobs, or 13,593 workers). However, the industry retains considerable strategic importance to the rural areas of the state. Around 4,100 people in Rural Nevada work in *Agriculture & Food Processing* (4.4% of all rural employment). The majority of these jobs reside in *primary agriculture* (crop and animal production and related supporting functions), and this segment is very highly concentrated in Rural Nevada (rural LQ=2.167). On the other hand, the majority of the state's jobs and companies in *food processing* are located in Northern and Southern Nevada, but this segment represents only about 4,800 jobs statewide and has a very low concentration in Nevada relative to the national average (state LQ=0.304).[99] Nevada exported just under $19 million in agricultural and livestock products in 2010, and these exports have doubled over the last five years, but Nevada still ranks 49th in the nation for its level of agricultural/livestock exports. Nevada's manufactured food exports were just under $60 million in 2010 (more than triple their 2005 levels), and Nevada also ranks in the bottom ten of all states for these exports.[100]

Employment in Nevada's *primary agriculture* segment has been declining over the last five years during the recession, but a small positive growth rate is projected in Rural Nevada over the next five years (+0.31% CAGR from 2011-2016).[101] Range livestock production (cattle and sheep ranches, as well as dairies) has historically been the largest component of Nevada's agriculture industry, but this segment has been in decline over the last several decades (primarily due to federal regulations on grazing and water easements), and headcounts for cattle and sheep are now at a fraction of their peak levels historically. Revival of this traditional industry in Nevada could create jobs and income in rural areas, and according to local stakeholders, could also have positive impacts on wildlife populations, water yields from watersheds that supply irrigation and recharge aquifers, and other benefits. This industry may also benefit from the growing market interest in sustainably-, organically-, and locally-produced meat. On the other hand, local stakeholders also see potential to

[99] SRI calculations based on EMSI data.
[100] International Trade Administration, "State-by-State Exports to a Selected Market," *TradeStats Express*, http://www.tse.export.gov/TSE/TSEReports.aspx?DATA=SED.
[101] SRI calculations based on EMSI data.

attract additional large feedlot, poultry, and slaughtering operations to Nevada, especially by attracting relocations from California (due to land constraints and regulatory pressures there).

In terms of crop production, leading cash crops in Nevada currently include hay (mainly alfalfa hay), potatoes, and wheat, along with oats and fruits and vegetables on a smaller scale.[102] According to local stakeholders, future growth opportunities exist in a wide range of crops, including alfalfa, potatoes, lettuce, biofuel crops, and niche crops (such as teff). A small but growing number of individuals are engaging in specialty crop operations in Nevada, with an estimated 150 or more specialty producers statewide in 2008 – primarily selling their products through farmers markets, roadside stands, and community sponsored agriculture projects. A key future consideration for Nevada's crop industry will be focusing on lower-water-use crops, to account for the state's arid environment.

In contrast to *primary agriculture*, *food processing* has maintained positive job growth trends in Nevada (+0.61% CAGR statewide from 2006-2011) even during the recession when the industry was shrinking nationally, and this segment has solid growth projections in the coming years in both Northern and Southern Nevada (+2.07% CAGR in the North and +1.37% CAGR in the South from 2011-2016). Nevada's current *food processing* employment is primarily in segments related to bakeries, dairy-related manufacturing (ice cream and frozen desserts, fluid milk manufacturing), perishable prepared foods and frozen specialty foods, coffee and tea manufacturing, and confectionary manufacturing from chocolate.[103] The *food processing* segment is closely linked with serving the state's large tourism/hospitality/gaming industry, as well as with processing the crops and animal products that are actually grown in Nevada. Nevada's assets and advantages for *food processing* are very much linked to its broader distribution, logistics, and assembly-based manufacturing industry – including excellent access to regional West Coast markets, strong transportation and distribution infrastructure, and cost and regulatory advantages. For this reason, *food processing* has already been highlighted as an opportunity in this report, within the context of the *Logistics & Operations* target industry (see *Section IV.F*). Particular opportunities may exist to tap into the large agricultural market in neighboring California. As with other segments of Nevada's agriculture industry, attention would need to be paid to seek out *food processing* operations that do not require heavy water usage.

WATER AND "WATER TECH"

Nevada is well-positioned to develop its water industry, given its local expertise and the constraints on water resources that exist in some areas of the state. Water-related industries involve the products and technologies used to test, treat, transport, and supply water. According to the Pacific Institute, water-related industries are growing at a rate of 3% to 4% per year.

[102] National Agricultural Statistics Service, USDA, *2010 State Agriculture Overview: Nevada*, http://www.nass.usda.gov/Statistics_by_State/Ag_Overview/AgOverview_NV.pdf and Nevada Department of Agriculture, "Agriculture in Nevada," http://www.agri.nv.gov/AgInNevada.htm.
[103] SRI calculations based on EMSI data.

With a hydrologic sciences division and its own data-gathering research vessel, the Desert Research Institute (DRI) has the capacity to study and advance water technologies. DRI has the second-highest institutional concentration of hydrologists and related geo-hydrological experts in the United States (second to the U.S. Geological Service). UNLV has a Master's program of study in Water Resources Management that trains students to enter the water industry, and the Southern Nevada Water Authority has deep expertise in water testing, treatment, and delivery. Nevada researchers produced 95 scientific publications on the topic of "water resources" in 2009-2010, and Nevada has a very high concentration of publishing activity in this field (LQ of 5.03) as compared to the national average. The majority of these publications were in the Las Vegas metro area, and this region alone produces 1.44% of all U.S. water publications, far higher than would be expected given its size. A number of companies with water-related activities have offices in Nevada, and it would be advantageous for the state to leverage its local expertise to inventory its water and "water tech" holdings and explore whether to actively build an industry cluster around water technology.

FINANCIAL AND "INTANGIBLE" ENTERPRISES

A recent stakeholder-driven effort in Nevada has identified a relatively large category of businesses in Nevada that are being defined as "intangible" enterprises – essentially, enterprises that can conduct business from virtually any physical location and can relocate at will. These businesses would typically be very small operations (sole proprietorships, partnerships) but would generally represent knowledge-based, highly-skilled, and high-paying activities – in particular, finance-related operations (e.g., investment management, investment pools and hedge funds, mutual funds, securities/insurance brokerage, financial advising); intellectual property management; professional and consulting services; professional arts/sports agents, managers, and promoters; trade brokers; and other similar activities. Other larger operations might include industrial banks, captive banks, financing companies, and holding companies. Nevada currently has very high concentrations of employment in a number of these kinds of activities, including: trusts, estates, and agency accounts (LQ=6.917); insurance funds (LQ=4.935); health and welfare funds (LQ=4.118); miscellaneous intermediation (e.g., investment clubs, royalty dealing, etc., LQ=3.818); and promoters of performing arts, sports, and similar events (LQ=2.342).[104]

These kinds of enterprises generally require no infrastructure other than office space and basic utilities, and they may be a good fit for Nevada because of its large inventory of vacant office space (at favorable rates); the state's overall low taxes and business-friendly regulatory climate would also be an attraction. Financial and Intangible Assets Enterprises of Nevada (FIAE) has recently been set up as a non-profit corporation to advocate for this industry and recruit additional businesses to the state. Care should be taken in promoting this sector to ensure that the businesses being supported are enterprises that are actually physically located and conducting real business in Nevada, rather than shell companies or businesses that are just registered in Nevada for the tax benefits.

[104] SRI calculations based on EMSI data.

Appendices:

Industry Profiles and Market Trends for Nevada's Industry Opportunities

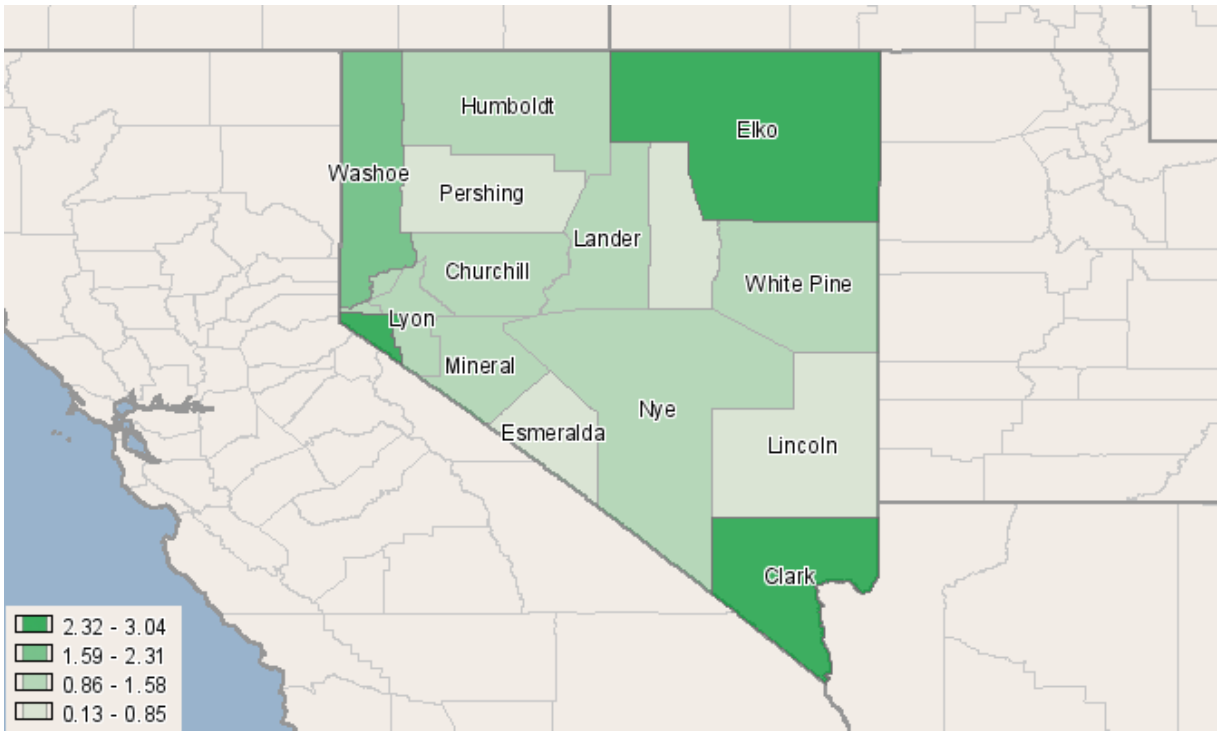
APPENDIX A: TOURISM, GAMING, & ENTERTAINMENT

A. INDUSTRY PROFILE IN NEVADA

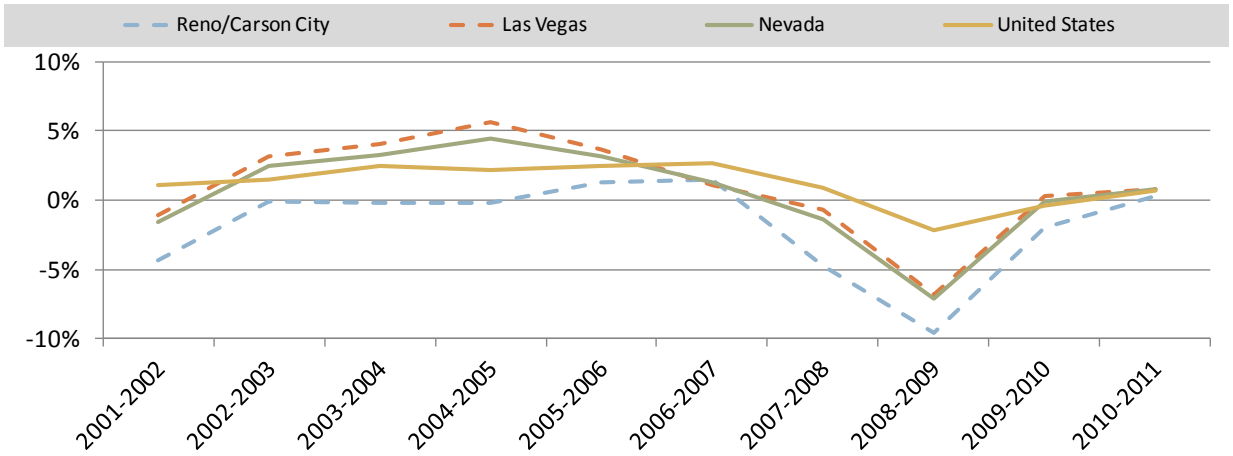
The *Tourism, Gaming, & Entertainment* cluster in Nevada accounts for 24.51% of total state employment, with 357,638 workers across 8,675 establishments. *Tourism, Gaming, & Entertainment* is highly concentrated in Nevada compared to the United States on average (location quotient of 2.443), with an extremely high concentration in the Las Vegas metro area (2.814). As illustrated in the map below, the *Tourism, Gaming, & Entertainment* cluster has a significant presence throughout the state, including high concentrations in and around the two major metro areas. Wages in the *Tourism, Gaming, & Entertainment* cluster are generally low, with average annual pay of $34,704 (compared to the state average of $48,077).

Employment growth in Nevada's *Tourism, Gaming, & Entertainment* industry mirrors national trends, but with higher volatility; Nevada displayed high rates of growth during the 2002-2007 expansion and dramatic contraction during the recession from 2007-2009 (see chart on the following page). According to EMSI projections, employment in *Tourism, Gaming, & Entertainment* is expected to grow in Nevada over the next five years, but more slowly than in the nation overall (projected 2011-2016 CAGR is 0.69% for Nevada, 1.53% for the United States).

Concentration of Jobs in the Nevada *Tourism, Gaming, & Entertainment Cluster*, 2011
Map of location quotients by county



State of Nevada *Tourism, Gaming, & Entertainment*
Annual Employment Growth Rates, 2001-2011



TOURISM, GAMING, & ENTERTAINMENT SUB-CLUSTERS

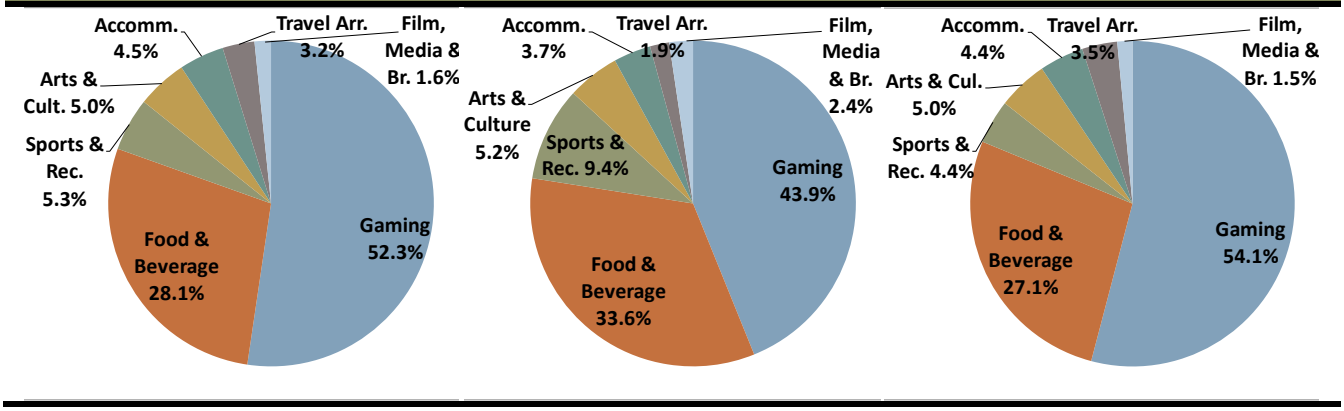
Gaming is Nevada's largest sub-cluster in the *Tourism, Gaming, & Entertainment* industry, employing 187,167 workers in 595 establishments. The sub-cluster accounts for 52.3% of all *Tourism, Gaming, & Entertainment* employment in Nevada, and the *Gaming* sub-cluster alone comprises 12.83% of total employment in the state. *Gaming* is extremely concentrated in the State of Nevada, compared to the national average, with a location quotient of 45.468. Within the Las Vegas metro area *Gaming* is even more highly concentrated (location quotient=54.149), and over 15% of all regional employment falls within this sub-cluster. Average annual pay in the *Gaming* sub-cluster is $40,967, moderately lower than the state average pay of $48,077. Within the *Gaming* sub-cluster, employment is dominated by *Casino Hotels* (NAICS code 721120), which employ 175,097 workers (over 93% of the sub-cluster's employment).[105] The *Gaming* sub-cluster also includes activities such as *Casinos, except Casino Hotels (NAICS 713210)*, employing 7,923 workers, and *Other Gambling Industries (NAICS 713290)*, with 3,930 workers.

Food & Beverage is the second-largest sub-cluster in *Tourism, Gaming, & Entertainment*, with 28.1% of cluster employment (100,553 workers) in Nevada. The *Food & Beverage* sub-cluster is slightly more concentrated in Nevada compared to the United States on average, with a location quotient of 1.172. As the chart below illustrates, the *Food & Beverage* sub-cluster accounts for a higher percentage of the total *Tourism, Gaming, & Entertainment* cluster in Reno/Carson City, as compared to Las Vegas and the state – but the sub-cluster is actually more concentrated in Las Vegas (location quotient=1.303) than in Reno/Carson City (location quotient=0.902). With annual average pay of

[105] Note that because *Casino Hotels (NAICS code 721120)* are classified under one NAICS code, it is not possible to separate casino versus accommodation-related activities for these establishments. As a result, some accommodation activity is also captured in the *Gaming* sub-cluster.

$22,690, wages in this sub-cluster are less than half the average wage in Nevada ($48,077). Over 80% of employment in the *Food & Beverage* sub-cluster is in restaurants, with 48,898 workers in *Full-Service Restaurants (NAICS 722110)* and 32,087 jobs in *Limited-Service Restaurants (NAICS 722211)*.

State of Nevada *Tourism, Gaming, & Entertainment* Sub-cluster Employment, 2011



Recreation & Sports (except gaming) employs 18,875 workers in Nevada and comprises 5.3% of statewide *Tourism, Gaming, & Entertainment* employment, 9.4% in Reno/Carson City, and 4.4% in Las Vegas. The concentration of *Recreation & Sports* employment in Nevada is roughly on-par with the nation (location quotient=1.012). In Las Vegas this sub-cluster is slightly more concentrated than the national average (location quotient=1.154), and in Reno/Carson City it is slightly less than average (location quotient=0.965). Wages in the sub-cluster are very low, with average annual pay of $27,171. The *Recreation & Sports* sub-cluster spans a wide-variety of recreational and athletic activities in 19 different NAICS codes. The two NAICS codes with the highest levels of employment in Nevada are *Fitness and Recreational Sports Centers (NAICS 713940)*, employing 4,905 workers, and *Golf Courses and Country Clubs (NAICS 713910)*, with 4,468 jobs.

Arts & Culture in Nevada employs 17,893 workers, or 5.0% of *Tourism, Gaming, & Entertainment* employment in the state. The *Arts & Culture* sub-cluster is more concentrated in Nevada than the national average (location quotient=1.383), especially in the Las Vegas metro area (location quotient=1.587). Wages in the *Arts & Culture* sub-cluster are low, with average annual pay of $30,264 – well below state average pay. Over two-thirds of *Arts & Culture* employment in Nevada is in the *Independent Artists, Writers, and Performers* NAICS code (711510), with 12,906 workers. The second largest NAICS code in this sub-cluster, *Other Performing Arts Companies (NAICS 711190),*[106] employs 1,484 workers and has a very high location quotient of 15.394.

[106] The U.S. Census 2007 NAICS definition for *Other Performing Arts Companies (NAICS 711190)* is: "This industry comprises companies or groups (except theater companies, dance companies, musical groups, and artists) primarily engaged in producing live theatrical presentations." Available at: http://www.census.gov/cgi-bin/sssd/naics/naicsrch.

State of Nevada *Tourism, Gaming, & Entertainment* Sub-Cluster Industry Data, Q2 2011

	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Travel Arrangements	11,357	998	10,215	2.539	0.981	3.227	660	90	554	$45,466
Accommodation	15,963	1,940	12,895	1.186	0.634	1.354	472	134	235	$39,879
Food & Bev.	100,553	17,597	79,078	1.172	0.902	1.303	5,303	1,204	3,813	$22,690
Arts & Culture	17,893	2,720	14,533	1.383	0.924	1.587	602	90	501	$30,264
Rec. & Sports (except gaming)	18,875	4,901	12,740	1.012	1.154	0.965	698	193	445	$27,171
Gaming	187,167	22,971	157,772	45.468	24.524	54.149	595	146	370	$40,967
Film, Media, & Broadcasting	5,830	1,232	4,393	0.833	0.774	0.887	345	53	261	$43,718
Total Cluster	**357,638**	**52,359**	**291,626**	**2.443**	**1.572**	**2.814**	**8,675**	**1,910**	**6,179**	**$34,704**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

Accommodations employs 15,963 workers in Nevada, comprising about 4.5% of the state's *Tourism, Gaming, & Entertainment* employment.[107] The *Accommodations* sub-cluster is slightly more concentrated in Nevada compared to the United States overall (location quotient=1.186). The sub-cluster is less concentrated in Reno/Carson City (location quotient=0.634), and more concentrated in Las Vegas (location quotient=1.354). Average annual wages in *Accommodations* are below the state average, with average annual pay at $39,879. Nearly all employment, 15,466 jobs, in the *Accommodations* sub-cluster is in the *Hotels (except Casino Hotels) and Motels* NAICS code (721110).

Travel Arrangements comprises only 3.2% of employment in Nevada's *Tourism, Gaming, & Entertainment* cluster, accounting for 11,357 jobs in the state. The bulk of this employment (10,215 jobs) is in the Las Vegas metro area, where employment in *Travel Arrangements* is highly concentrated (location quotient=3.227). This high concentration in Las Vegas accounts for the high location quotient, 2.539, for the State of Nevada; *Travel Arrangements* employment in Reno/Carson City is slightly less concentrated than the national average (location quotient=0.981). Average wages in *Travel Arrangements* are moderate ($45,466), falling slightly below the state average wage. Employment in the *Travel Arrangements* sub-cluster is led by the *Convention and Trade Show Organizers* NAICS code (561920), which employs 5,154 workers and has a location quotient of 7.959. Other sub-cluster NAICS codes with high employment in Nevada include: *Travel Agencies (NAICS*

[107] Note that because *Casino Hotels (NAICS code 721120)* are classified under the *Gaming* sub-cluster, the *Accommodations* sub-cluster does not fully capture all hotel activity.

561510), with 1,629 jobs, and *All Other Travel Arrangement and Reservation Services (NAICS 561599)*, employing 1,699 workers.

Film, Media, & Broadcasting employs 5,830 workers in Nevada, comprising 1.6% of jobs in the *Tourism, Gaming, & Entertainment* cluster. The concentration of *Film, Media, & Broadcasting* employment is slightly lower in Nevada than in the United States overall (location quotient=0.833). The location quotients for Nevada's two major metro areas are also less than one, although Las Vegas's *Film, Media, & Broadcasting* sub-cluster is slightly more concentrated than in Reno/Carson City. Wages in the sub-cluster are moderate, with $43,718 in average annual pay. Most employment in *Film, Media, & Broadcasting* is within the following four NAICS codes: *Motion Picture Theaters, except Drive-Ins (NAICS 512131)* with 1,415 workers; *Motion Picture and Video Production (NAICS 512110)* with 1,160 jobs; *Radio Stations (NAICS 515112)* with 1,128 jobs; and *Television Broadcasting (NAICS 515120)* with 1,077 workers.

TOURISM, GAMING, & ENTERTAINMENT SUB-CLUSTER TRENDS

Employment in the *Tourism, Gaming, & Entertainment* cluster has (on average) declined over the past five years in Nevada, as well as in the Reno/Carson City and Las Vegas metro areas. This decline was driven largely by a strong contraction of *Tourism, Gaming, & Entertainment's* largest sub-cluster, *Gaming*, which posted a net loss of 43,465 jobs from 2006-2011. The *Accommodations, Arts & Culture, Food & Beverage*, and *Sports & Recreation* sub-clusters have all experienced net gains in employment from 2006-2011 in Nevada (though *Accommodations* and *Food & Beverage* declined slightly in Reno/Carson City over this period). *Accommodations* experienced strong growth in Nevada (+3.73% CAGR) during this period, as well as in the Las Vegas metro area (+4.74% CAGR), while the industry declined slightly nationally. According to EMSI projections, the *Accommodations, Arts & Culture, Food & Beverage*, *Recreation & Sports,* and *Film, Media, & Broadcasting* sub-clusters will grow moderately in Nevada over the next five years (2011-2016), while *Gaming* and *Travel Arrangements* will experience a slight decline in employment.

While the growth in *Tourism, Gaming, & Entertainment* is distributed across many industries, the following NAICS codes stand out for their net and/or rate of growth (2006-2011): *Full- and Limited-Service Restaurants (NAICS 722110 & 722211)* together added 6,150 net jobs (CAGR=1.59%); *Hotels (except Casino Hotels) and Motels (NAICS 721110)* added 2,538 jobs (CAGR=3.65%); *Independent Artists, Writers, and Performers (NAICS 711510)* added 986 jobs (CAGR=1.60%); and *Other Performing Arts Companies (NAICS 711190)* grew at an average annual rate of 9.96%, adding 561 jobs.

State of Nevada *Tourism, Gaming, & Entertainment* Sub-Cluster Industry Growth Rates								
	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Travel Arrangements	-3.39%	-1.38%	-3.64%	-2.41%	-0.64%	1.04%	-0.90%	0.85%
Accommodations	3.73%	-0.70%	4.74%	-0.63%	2.75%	4.86%	2.46%	0.86%
Food & Beverage	0.97%	-0.13%	1.21%	0.39%	1.54%	1.66%	1.50%	1.42%
Arts & Culture	1.37%	0.80%	1.30%	0.79%	2.37%	1.65%	2.50%	1.89%
Recreation & Sports (except gaming)	0.40%	0.07%	0.13%	1.77%	1.87%	1.74%	1.78%	2.41%
Gaming	-3.05%	-6.02%	-2.59%	-0.94%	-0.18%	-1.30%	-0.01%	1.65%
Film, Media & Broadcasting	-1.71%	-0.59%	-2.04%	-0.83%	0.75%	0.88%	0.74%	0.77%
Total Cluster	**-1.35%**	**-2.98%**	**-1.09%**	**0.31%**	**0.69%**	**0.51%**	**0.71%**	**1.50%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

B. MARKET TRENDS

MARKET OVERVIEW

Tourism is broadly defined as any travel and stay by individuals to places outside their usual environment for recreational, leisure, and business purposes. The tourism economy is typically measured by activities and products from related industry sectors that benefit from tourist activity. Major industries that benefit from tourist expenditures include domestic air transportation (11.5% of tourism industry revenues in 2011), international air transportation (5.4%), traveler accommodations (16.5%), food and beverage establishments (18%), automotive rentals (3.8%), and travel arrangement services (6.1%). Other beneficiaries of tourist activities include casino hotels, amusement and theme parks, historical sites, museums, national parks, souvenir shops, and performing arts studios.

According to the Travel Industry Association of America, leisure travel constitutes 81% of total person-trips,[108] followed by 12% for business and convention travel and 7% for combined business and pleasure related travel. *Tourism* is one of the largest industries in the United States with over 337,000 establishments generating $1.4 trillion in revenues, $112.8 billion in profits, and $1.7 trillion

[108] The Travel Industry Association of America defines a person-trip as involving one person who travels 50 miles (one way) or more from home on a day or overnight trip.

in exports in 2011. Tourism businesses are very labor-intensive due to the premium on customer service, employing 24 people on average who earn an average annual income of $27,188.[109]

Gaming is a popular leisure activity and refers to playing games of chance for stakes, which are legally allowed in licensed casino hotels, Native American casinos, lotteries, riverboat casinos, racetrack casinos, and other non-hotel casinos. This industry generated $34.6 billion in revenues in the United States in 2010, most of which came from Las Vegas and Atlantic City; globally, the industry generated $100.5 billion in revenues in 2009.[110] According to the American Gaming Association, approximately 370,000 people are employed in commercial casinos and gaming equipment manufacturers. By far, casino hotels generate the highest portion of the U.S. industry's revenues, with $46.9 billion in revenues in 2011 despite having only 170 businesses.[111] Native American reservation casinos and lotteries, on the other hand, consist of 1,720 establishments producing $10.7 billion in revenues in 2011,[112] while 462 non-hotel casinos generated $15.5 billion in revenues in 2011.[113] Furthermore, *Gaming* encompasses not only the casinos, but also gaming equipment manufacturers that supply electronic gaming devices, systems, table games, and other key components and support products.

MARKET DYNAMICS AND TRENDS

Driven largely by consumer spending and travel-related trends, ***Tourism*** revenues reflect the state of the global economy. Reflecting the economic downturn, the industry experienced only a 0.5% annual growth rate in U.S. revenues from 2006-2011, after having grown by over 2% in every year from 2003-2006. In 2009 alone, tourism revenue declined by 4.1% as the U.S. unemployment rate topped 10% and personal consumption expenditures dropped by 0.6%. Domestic travel spending fell sharply by 4.0% in 2008 and 5.1% in 2009 as consumers cut nonessential travel and businesses reduced the number of business trips and relied more on telecommunications. However, there are already some signs of economic recovery, leading to positive industry forecasts. From 2011-2016, U.S. industry revenue is projected to grow annually by 2.9% as consumer spending increases by 2.3%, domestic travel spending rises by 3.0%, and international travel spending rises by 3.5%.[114]

For the same reasons as the broader *Tourism* industry, ***Gaming*** revenues in the United States also declined by 8.4% in 2009 due to the economic recession. However, as consumer spending and travel spending are expected to recover, U.S. industry revenue is expected to grow by an average annual rate of 2.7% over the five years through 2016. There were some differences in industry performance across states, with traditional gaming markets in Nevada and New Jersey suffering major losses,

[109] IBISWorld, *IBISWorld Industry Report NN002: Tourism in the U.S.*, April 2011.
[110] The American Gaming Association measures gaming industry revenues using gross gaming revenue – the amount wagered minus the winnings returned to players.
[111] IBISWorld, *IBISWorld Industry Report 72112: Casino Hotels in the U.S.*, April 2011.
[112] IBISWorld, *IBISWorld Industry Report 71329: Lotteries & Native American Reservation Casinos in the U.S.*, April 2011.
[113] IBISWorld, *IBISWorld Industry Report 71321: Non-Hotel Casinos in the U.S.*, January 2011.
[114] Ibid.

while new gaming properties in Pennsylvania, Missouri, and Indiana sustained positive growth during the recession.

In addition to the expected global economic recovery, most of the projected growth in *Tourism* will come from emerging markets in Asia and South America. International tourism has increased as air transportation technologies have lowered international travel costs and as the trend toward online booking and promotions has made it easier to arrange travel abroad and has created more awareness of global tourist destinations. While most of U.S. tourism exports[115] have historically come from visitors from Mexico, Canada, and Western Europe, a growing middle class in Brazil, China, India, and East Asia have shifted the industry's focus to this new crop of potential travelers. Already, Las Vegas is well-positioned to move into this international consumer market with 7.7% of the U.S. share of overseas visitors, which is the seventh highest share in the nation. On the other hand, the globalization of tourism has also created more competition, as these emerging markets are positioning their countries as global tourist destinations. Furthermore, the current value of U.S. tourism exports ($1.68 trillion) is outweighed by the value of tourism imports ($2.57 trillion), due to the strength of the U.S. dollar historically and the greater per-capita expenditures by U.S. travelers.[116]

MARKET TRENDS IN SELECTED SUB-SECTORS

NICHE TOURISM

One of the avenues for growth and stability in the *Tourism* industry has been an expansion into niche tourism, which focuses on motivating travelers to consume a well-defined product within a specific market segment. Though niche tourism has not demonstrated empirical evidence of increasing the average level of per-tourist expenditures, niche tourism does provide diversification of a location's tourism product offerings, thereby minimizing the seasonality of focusing on one or two tourism products. Culinary tourism is an emerging niche tourism market in which local food, beverages and culinary experiences are the main motivating factors for travel to a particular location. Culinary experiences participated in by these niche travelers include participating in cooking classes, attending food festivals, visiting farmers markets and wineries, gourmet food shopping, and dining out for a "unique and memorable experience." This sub-sector has grown worldwide as a result of globalization, consumer well-being concerns, and the influence of celebrity chefs and culinary travel shows on television, and it has been especially appealing to younger, more affluent, and better educated travelers. According to the Travel Industry Association of America (TIA), about one in six U.S. residents who travel for leisure enroll in a cooking class, take a food tour,

[115] Tourism exports are defined as expenditures by international visitors in the United States on prepaid accommodations, tour packages, and other tourist and travel related activities. Tourism imports are defined by expenditures by U.S. visitors in international markets.
[116] IBISWorld, *IBISWorld Industry Report NN002: Tourism in the U.S.*, April 2011.

or participate in some other culinary activity as part of the trip.[117] U.S. leisure travelers also rate Nevada as one of the top 15 destinations for food-related travel.[118]

GLOBAL GAMING

Globalization has also had a pronounced effect on the *Gaming* industry. Worldwide casino gaming spending declined by -2.8% in 2009, with a large part of this decline coming from the United States (-3.4%) and Europe, Middle East, and Africa (-12.2%). By contrast, growth in industry revenue slowed but remained positive in Asia-Pacific (+7.4%) and Latin America (+4.4%), representing a shift in spending toward these emerging markets.[119] PwC forecasts Asia-Pacific's share of the global casino gaming market to increase from 22% in 2009 to 41% in 2014, stemming from the emerging middle class in Asia-Pacific and the establishment of new gaming centers that intensify competition in the industry. Globalization of the casino gaming marketplace represents both an opportunity and challenge due to the saturation of the domestic market. MGM, Las Vegas Sands, and Wynn Resorts have all established major casino resorts in Macau. Las Vegas Sands, which launched Marina Bay Sands in Singapore in April 2010, reported that more than 82% of its revenues in the second quarter of 2011 came from its properties in Macau and Singapore. Macau already overtook Las Vegas in 2007 as the largest casino gambling center in the world. Now Singapore is set to oust Las Vegas from the Number 2 spot, as rising earnings in its two newly established casinos are expected to generate up to $6.2 billion in revenues in 2011.[120]

The intensifying competition from international and domestic (e.g., American Indian and non-hotel casinos) casinos has driven industry consolidation to increase revenue and profits. Recently, there were two major mergers – a $9.4 billion merger between Harrah's and Caesars and an $8.0 billion merger between MGM and Mandalay – which constitute 30% of the industry's revenues. In addition, industry revenues will be driven by adoption of the latest and most efficient gaming technologies and attraction of high-stakes gamblers. Slot machines are now one of the most important revenue drivers in the industry, generating more than three times the revenue from table gaming in certain jurisdictions. Furthermore, most casino hotels generate 20% of their revenues from domestic and international high-stakes players, which also makes their revenue streams very volatile.

Other main driving factors of the global *Tourism* and *Gaming* industries are fuel prices and technological changes related to web-based travel services. While airlines have worked to increase their passenger capacities to lower travel costs, the volatility of gas prices has historically challenged this price-sensitive industry. Meanwhile, tourism is expected to grow from the trend toward web-based reservations, promotions, and payments, which offer lower costs and higher profits than

[117] U.S. Travel Association, *Profile of Culinary Travelers 2006*, 1 January 2007.
[118] Ibid.
[119] PricewaterhouseCoopers, *Playing to Win*, 2010.
[120] Associated Press, "Singapore set to overtake Las Vegas as second-biggest gambling market, groups says," *VegasInc.com*, 7 June 2011, http://www.vegasinc.com/news/2011/jun/07/singapore-set-overtake-las-vegas-second-biggest-ga/

those provided by traditional travel agencies. Being a mature industry that ebbs and flows with the health of the economy, most of the real growth in tourism will come from targeting emerging markets and in implementing web-based travel services to facilitate and promote tourist activities.

ONLINE GAMING

Enabled by the growing capabilities of cloud computing, every industry is moving toward more web-based services and products. Online gaming is an emerging sub-sector that represents a new frontier for the traditional *Gaming* industry, as demonstrated by the large number of land-based casinos positioning to tap this new consumer base. While offering many of the same games as brick and mortar casinos, worldwide online gaming operators generated nearly $21.2 billion in revenues in 2008, which is expected to grow by 43% to $30 billion by 2012.[121] Over that same timeframe, H2 Gaming Capital forecasts the entire gambling industry to grow by just 15%. Globally, there are more than 2,600 online gambling sites owned by more than 600 companies that offer online poker, sports betting, bingo, lotteries, and other casino games.[122] Growth in this industry has been driven by greater broadband penetration, increased promotional activity, and preference for in-home entertainment, especially considering the effects of the economic downturn.

The key to unlocking this sub-sector in the United States will be effective regulation, which varies across different countries and types of games. Online gaming is legal in 85 nations, most of which are in Western Europe. While horserace betting and state lotteries are legal online, the Unlawful Internet Gambling Enforcement Act of 2006 (UIGEA) prohibits any financial transaction in the United States that supports illegal online gambling. With strapped state and local budgets, there has been some movement by certain governments, such as that in the District of Columbia, to push for the legalization of online gambling.[123] At the same time, federal prosecutors have sent the opposite signal with their recent crackdown on online poker operators (PokerStars, Full Tilt Poker, and Absolute Poker).[124]

To convince governments and consumers, online operators are working to ensure fair play, secure transactions, and customer identification in their systems, while restricting money laundering, access to underage and troubled gamblers, collusive play, and use of artificial intelligence to gain an unfair advantage. Already, auditing software, IP tracking, and systems testing have been implemented in existing legalized markets to regulate this industry. Until online gaming is legalized in the United States, however, the industry will operate with a great deal of uncertainty. In addition, a regulatory approach called the "walled garden," emerging in the United States and Europe, will also need to be confronted as the need for cross-border liquidity grows. According to Goldman Sachs, the U.S. market for online casino and poker could be worth as much as $12 billion if

[121] H2 Gaming Capital, *eGaming Report*, July 2009.
[122] Stewart, David O. "Online Gambling Five Years After UIGEA." American Gaming Association, May 2011.
[123] Matt Richtel, "Starved Budgets Inspire New Look at Web Gambling," *New York Times*, 13 August 2011.
[124] Matt Richtel, "U.S. Crack Down on Online Gambling," *New York Times*, 15 April 2011.

legalized.[125] Furthermore, any nation with good technology infrastructure, easy access to mobile applications, and a sound banking system represents new market expansion opportunities if legalized in those locations. India, Australia, South Korea, Japan, France, Spain, Canada, and Latin America all represent potential new opportunities for expansion.[126]

If online gaming is legalized, there are a host of growth opportunities in addition to the opportunities arising from a new U.S. consumer base. As Facebook has demonstrated, social gaming has grown in popularity as more users are leveraging their online social networks for everything from entertainment, to shopping, to information sharing. Many online casino games, like Bingo, already have a social element, but other games could also add a social feature to increase their popularity.[127] In addition, improved mobile banking capabilities, wireless Internet (via 3G networks) and picture and video messaging have created an opportunity for mobile gaming and gambling. Sports betting, especially, is well-positioned to leverage the mobile platform, considering mobile sports-related subscriptions services already exist that send news and score updates to user phones. With online sports betting, participants will be able to place bets on their phones from anywhere while watching games in real-time.[128]

GAMING MANUFACTURING

As a supplier of gaming devices and systems to the *Gaming* industry, the gaming manufacturing sub-sector is important for product innovations within the industry, especially as the industry pivots toward more online gaming. Firms in this sub-sector design, develop, and manufacture slot machines, card counters, chips, automatic card shufflers, transaction systems, and gaming displays, with 69.5% of sales going to Nevada casinos, Native American casinos, and other casinos in the United States. According to Applied Analysis, a Nevada-based economic and gaming consulting firm, the U.S. gaming equipment manufacturing sector produced $11.5 billion in revenues and employed 29,400 workers who earned an average annual salary of $70,500 in 2010.[129] Until the recent economic recession, the gaming equipment manufacturing industry grew by 17.4% in revenues, 5.0% in employment, and 8.4% in wages in 2006; it grew by 27.3% in revenues, 3.8% in employment, and 7.6% in wages in 2007.[130]

Unlike other manufacturing industries, gaming equipment manufacturers are heavily regulated due to their downstream market of casinos. Gaming suppliers and manufacturers not only share in the gaming revenues generated by the casino gaming industry, but they also share the costs of annual taxes and quarterly licensing fees paid for the operation of slot machines and table games. In

[125] Jon Parker, "U.S. to legalise online gambling; worth $12 bn, Goldman Sachs predicts," *eGaming Review*, 29 June 2009.
[126] PricewaterhouseCoopers, *Playing to Win*, 2010, http://www.pwc.com/gx/en/entertainment-media/pdf/pwc-playing-to-win.pdf.
[127] KPMG, *Online Gaming: A Gamble or a Sure Bet*, 2010.
[128] Ibid.
[129] American Gaming Association, *State of the States: The AGA Survey of Casino Entertainment*, 2010, http://www.americangaming.org/industry-resources/research/state-states.
[130] Association of Gaming Equipment Manufacturers, *Global Gaming Supplier: Industry Impact Analysis*, 2008.

addition, as the share of international casino buyers has increased, many gaming manufacturers have positioned themselves internationally, setting up operations in South Africa, Australia, South America, and Asia.

FILM PRODUCTION

Film tourism is a growing global phenomenon that leverages a destination's scenery, backdrops, icons, and brand image to feature in movies, commercials, photo shoots, and other film projects. When a destination is featured in a film product, the destination benefits from indirect marketing of its attractions and brand, and from inspired film viewers who travel to the destination to experience it firsthand. Consequently, the local economy benefits from boosted visitor numbers and higher tourism revenues.[131] The potential drawbacks of film tourism, on the other hand, occur when films negatively portray a location or when filming negatively impacts the local environment. In addition, hosting a major film festival is also another way to spur film-related tourism activity.

It is estimated that a major feature film production can generate more than $200,000 per day in spending on location, making it a sales promotion target for many regions. Because film production is hyper-competitive and global, the cost advantages and physical attributes of a location are often not enough to secure a production. Many jurisdictions and their film commissions have mounted active promotional campaigns and aggressive tax incentives to lure big budget productions.[132] Others have directly sponsored films, maintained icons and sites featured in past films, ensured media coverage of the filming location, and negotiated the end credits and "making of the film" features with studios.

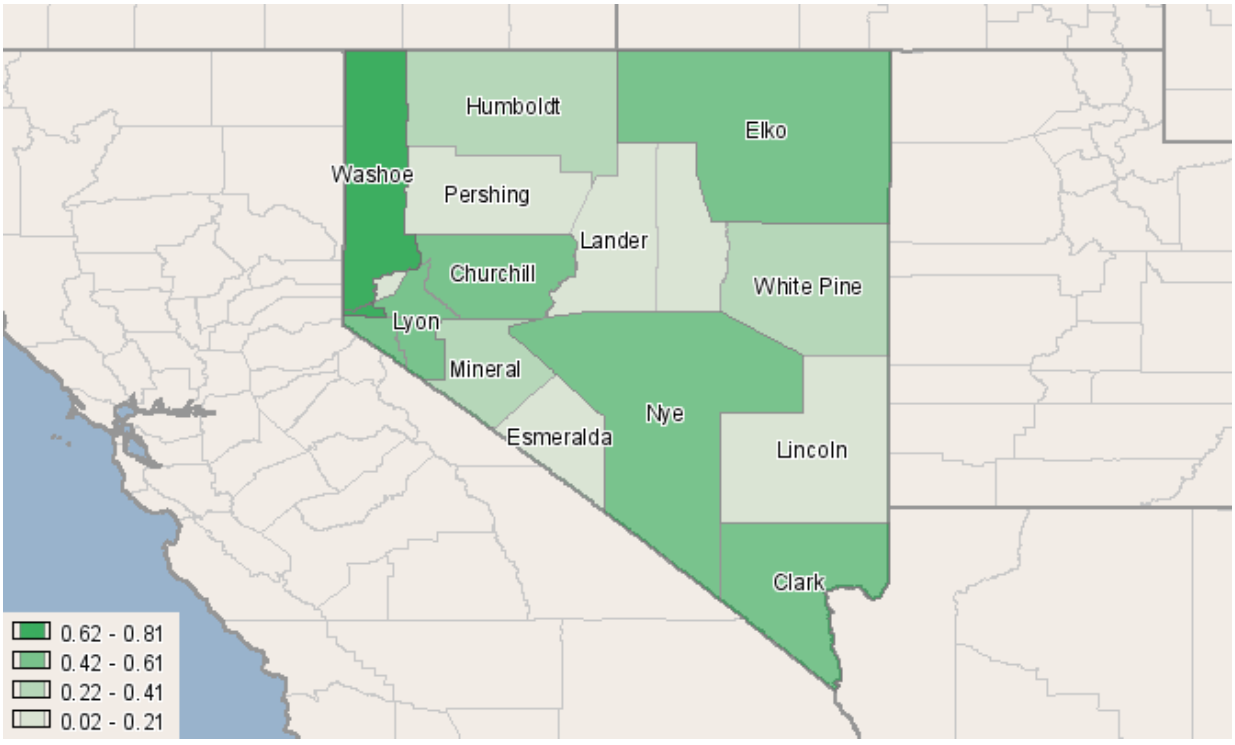
[131] Simon Hudson and J.R. Brent Ritchie, "Promoting Destinations via Film Tourism: An Empirical Identification of Supporting Market Initiatives," *Journal of Travel Research*, 2006.
[132] A compilation of state-level film incentives is provided by the Screen Actors Guild at http://www.sag.org/state-film-incentives.

Appendix B: Health & Medical Services

A. Industry Profile in Nevada

The *Health & Medical Services* cluster employs 86,710 workers in the State of Nevada, across 5,645 establishments. While employment in *Health & Medical Services* includes jobs with a wide range of skill and compensation levels, on average workers in this cluster are high-skill and high-wage. Although it is a significant source of employment in Nevada, the *Health & Medical Services* cluster has a location quotient of just 0.658 in the state, indicating that the cluster is significantly less concentrated in Nevada than on average in the United States. The cluster also has below average employment concentration in both major metro areas, with location quotients of 0.641 in Las Vegas and 0.769 in Reno/Carson City. In parts of rural Nevada, the *Health & Medical Services* cluster is even less concentrated (see figure below); in seven Nevada counties the location quotient falls below 0.250, one-fourth the average concentration nationally.

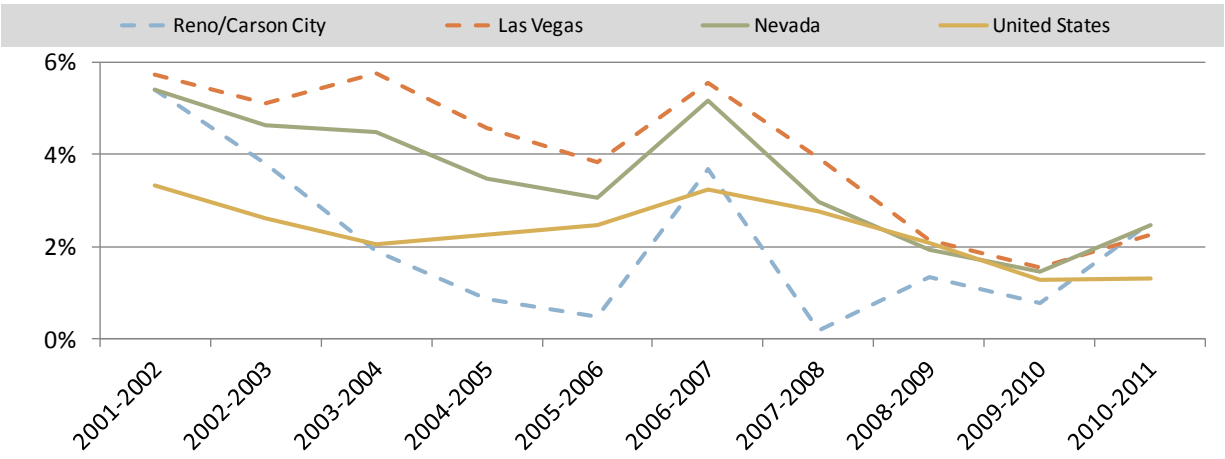
Concentration of Jobs in the Nevada *Health & Medical Services* Cluster, 2011
Map of location quotients by county



Despite the recent economic recession, the *Health & Medical Services* cluster has posted positive annual growth over each of the past 10 years (2001-2011) in Nevada, as well as in Reno/Carson City, Las Vegas, and nationally. Growth in this cluster has generally been higher, but also more volatile, in

Nevada compared to the United States overall (see chart below). Average annual pay for workers in *Health & Medical Services* is $67,969 in Nevada, well above the state average wage of $48,077.

State of Nevada *Health & Medical Services*
Annual Employment Growth Rates, 2001-2011



This cluster alone represents nearly 6% of all jobs in Nevada, yet it is significantly less concentrated (location quotient=0.658) than the national average (nationally, the *Health & Medical Services* cluster comprises about 9% of U.S. jobs). Nevada's employment in this cluster is predominantly in the following NAICS codes: *General Medical and Surgical Hospitals (NAICS 622110)*, with 20,381 jobs; *Offices of Physicians, except Mental Health Specialists (NAICS 621111)*, with 18,353 jobs; *Offices of Dentists (NAICS 621210)*, accounting for 8,048 jobs; and *Home Health Care Services (NAICS 621610)*, employing 6,269 workers.

State of Nevada *Health & Medical Services* Cluster Industry Data, Q2 2011

	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Health & Medical Services	86,710	23,045	59,794	0.658	0.769	0.641	5,645	1,336	4,066	$67,969
Total Cluster	**86,710**	**23,045**	**59,794**	**0.658**	**0.769**	**0.641**	**5,645**	**1,336**	**4,066**	**$67,969**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

HEALTH & MEDICAL SERVICES CLUSTER TRENDS

Over the past five years (2006-2011), the *Health & Medical Services* cluster has experienced an average annual growth of 2.79% in Nevada – slightly higher than the national growth rate of 2.13%. Employment in *Health & Medical Services* also experienced growth in both of Nevada's major metro areas, at an average annual rate of 1.70% in Reno/Carson City and 3.07% in Las Vegas. Over the next five years (2011-2016), the cluster is expected to grow in Nevada, its major metro areas, and nationally.

State of Nevada *Health & Medical Services* Cluster Industry Growth Rates

	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Health & Medical Services	2.79%	1.70%	3.07%	2.13%	2.36%	2.00%	2.49%	2.28%
Total Cluster	**2.79%**	**1.70%**	**3.07%**	**2.13%**	**2.36%**	**2.00%**	**2.49%**	**2.28%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

While the growth in *Health & Medical Services* is distributed across many types of businesses in Nevada, the following NAICS codes stand out for their net and/or rate of growth (2006-2011): *General Medical & Surgical Hospitals (NAICS 622110)* added 2,168 jobs (CAGR=2.27%); *Home Health Care Services (NAICS 621610)* added 1,684 jobs (CAGR=6.46%); *Offices of Mental Health Practitioners (NAICS 621330)* grew at 10.20% (CAGR), adding 416 jobs; and *Residential Mental Health & Substance Abuse Facilities (NAICS 623220)* grew at 9.33% (CAGR), adding 375 jobs.

B. MARKET TRENDS

MARKET OVERVIEW

The U.S. *Health & Medical Services* industry is made up of 595,800 establishments that use medical technology and skilled practitioners to diagnose, treat, and prevent disease, illness, injury, and other physical and mental impairments.[133] Healthcare in the United States is offered through a number of different venues that vary in size, staffing patterns, organizational structures, and types of services. At the large end, hospitals provide complete medical care and employ 35% of the industry's workforce, despite constituting only 1% of industry establishments in 2008. The other end consists of smaller healthcare establishments, such as outpatient care centers, medical and diagnostic laboratories, and offices of health practitioners, which combined constitute a large majority of the

[133] Bureau of Labor Statistics, *Career Guide to Industries: Healthcare*, 2011.

healthcare industry's employment (43%) and establishments (87%). In addition, the industry also consists of nursing and residential care facilities, which offer more long-term care and rehabilitation.

MARKET DYNAMICS AND TRENDS

There are a number of factors that affect the *Health & Medical Services* industry: demographics, consumer incomes, reimbursement trends, workforce, and technology. Taken all into account, the healthcare industry is projected to generate 3.2 million new jobs in the United States from 2008-2018, or an increase of 22% more jobs. The greatest employment opportunities will be in home healthcare services, medical and diagnostic laboratories, and physician offices, which are projected to increase in employment from 2008-2018 by 46.1%, 39.8%, and 34.1% respectively.[134] Hospital and specialty hospitals are expected to increase their U.S. revenues by 4.1% and 5.8% (CAGR) respectively from 2011-2016,[135][136] along with primary care doctors and specialist doctors (average annual growth of 4.2% and 5.5%, respectively, from 2011-2016).[137][138] Meanwhile, revenues of nursing care facilities are only expected to grow by 0.9% annually over the five years through 2016, part of which is attributed to the emergence of home healthcare services and devices.[139]

The changing demographics of the American population are one of the fundamental reasons driving the growth in employment and revenues in the healthcare industry. As the national population ages and becomes more obese, the demand for medical procedures will also increase. By 2030, all of the baby boomers will be over 65 years of age (representing one in five U.S. residents), and by 2050, the number of U.S. residents over age 65 will double to 88.5 million, and those over age 85 will triple to 19 million.[140]

The unique way the healthcare industry is reimbursed by private insurance companies and government insurance programs (i.e., Medicare and Medicaid) for its services and procedures is also a major factor in its growth projections. During the economic recession, in addition to having less disposable income for elective procedures, only 45% of Americans had employer-based insurance coverage in 2011, a drop from 49.2% coverage in 2008.[141] As a result, healthcare establishments treated more uninsured and Medicaid patients, resulting in higher amounts of uncollectible payments. Furthermore, with government health insurance covering nearly a quarter of Americans in 2011,[142] health industry profit margins fell from 6.0% in 2006 to 2.4% in 2011 as government reimbursements for Medicare and Medicaid were capped in response to budget pressures,[143]

[134] Ibid.
[135] IBISWorld, *IBISWorld Industry Report 62211: Hospitals in the U.S.*, March 2011.
[136] IBISWorld, *IBISWorld Industry Report 62231: Specialty Hospitals in the U.S.*, February 2011.
[137] IBISWorld, *IBISWorld Industry Report 62111a: Primary Care Doctors in the U.S.*, June 2011.
[138] IBISWorld, *IBISWorld Industry Report 62111b: Specialist Doctors in the U.S.*, March 2011.
[139] IBISWorld, *IBISWorld Industry Report 62311: Nursing Care Facilities in the U.S.*, March 2011.
[140] U.S. Census Bureau, *2008 National Population Projections*, August 2008.
[141] Elizabeth Mendes, "In U.S., Employer-Based Health Insurance Declines Further," *Gallup*, 17 June 2011, http://www.gallup.com/poll/148079/employer-based-health-insurance-declines-further.aspx.
[142] Ibid.
[143] IBISWorld, *IBISWorld Industry Report 62211: Hospitals in the U.S.*, March 2011.

preventing healthcare providers from raising prices in the face of mounting administrative and capital costs.

The Patient Protection and Affordable Care Act of 2010 (PPACA) may increase the number of individuals with health insurance coverage and reduce the number of uninsured patients who are unable to pay for the health service costs. The PPACA contains an individual mandate, effective in 2014, requiring non-exempt persons to obtain health insurance coverage, which is projected to add more than 32 million Americans to the customer base.[144] Unless these government insurance programs increase their reimbursement rates, however, there are concerns that health providers will benefit marginally from the larger consumer base. Given that Nevada has joined 26 other states in a federal lawsuit to challenge PPACA, the legality of PPACA going forward is uncertain.

Future growth in the healthcare industry is also limited by the critical shortage of physicians, nurses, physical therapists, and other medical support staff, stemming largely from the dearth of and high costs of health education programs. Teaching hospitals, which provide critical training experience for upcoming physicians and healthcare professionals in a clinical setting, rely heavily on Medicare's indirect medical education (IME) payments to help cover the higher costs associated with their patient care, education, and research capabilities. In spite of teaching hospitals receiving about $6.4 billion in Medicare IME payments in FY2011,[145] the Association of American Medical Colleges projects a shortage of 130,600 patient care physicians by 2025.[146] Due to an insufficient number of faculty, clinical sites, and classroom space, nursing schools in the United States turned away over 67,000 qualified applicants from baccalaureate and graduate nursing programs in 2010.[147] Even with the shortage of graduate and resident positions, the National Commission on Fiscal Responsibility and Reform proposed a 60% reduction (equivalent to $3.9 billion) in Medicare IME payments to teaching hospitals.[148] The personnel shortage is also exacerbated by the imminent retirement of a number of aging physicians and nurses. In response to this shortage, industry wages have risen in order to recruit and maintain qualified personnel.

The healthcare industry continues to be transformed by advances in technology. The latest medical technologies have improved the quality of lives of Americans and include innovations such as infection control, minimally invasive surgical techniques, gene therapy for cancer treatment, mobile devices used for diagnostic purposes, and portable medical devices that allow for more long-term care in patient homes (which are growing in demand in response to the aging population). The Health Information Technology Economic and Clinical Health Act, meanwhile, sets aside up to $27

[144] Ibid.
[145] Association of American Medical Colleges, *Proposed Reductions in Medicare IME Payments to AAMC Teaching Hospitals: National and State Economic Impacts*, February 2011.
[146] Association of American Medical Colleges, *The Impact of Health Care Reform on the Future Supply and Demand for Physicians: Projections Through 2025*, June 2010.
[147] American Association of Colleges of Nursing, *2010-11 Enrollment and Graduations in Baccalaureate and Graduate Programs in Nursing*, 2011.
[148] Association of American Medical Colleges, *Deficit Commission's Medicare Cuts Threaten Access to Patient Care*, 3 December 2010.

billion in incentive payments for providers and hospitals that adopt electronic health records (EHRs), which reduce recordkeeping errors, increase patient mobility, and promote more evidence-based medical procedures. Failure by healthcare providers to create an EHR for every American by 2015 would result in reductions in Medicare reimbursement rates.

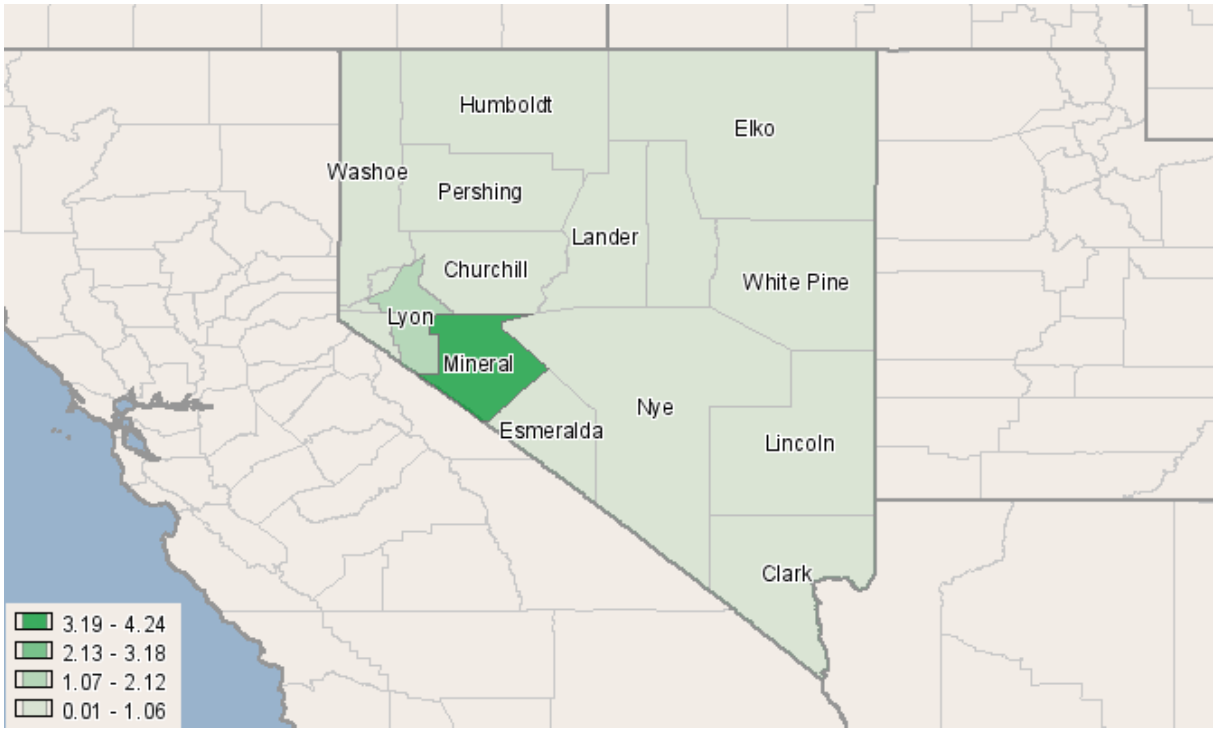
APPENDIX C: BUSINESS IT ECOSYSTEMS

A. INDUSTRY PROFILE IN NEVADA

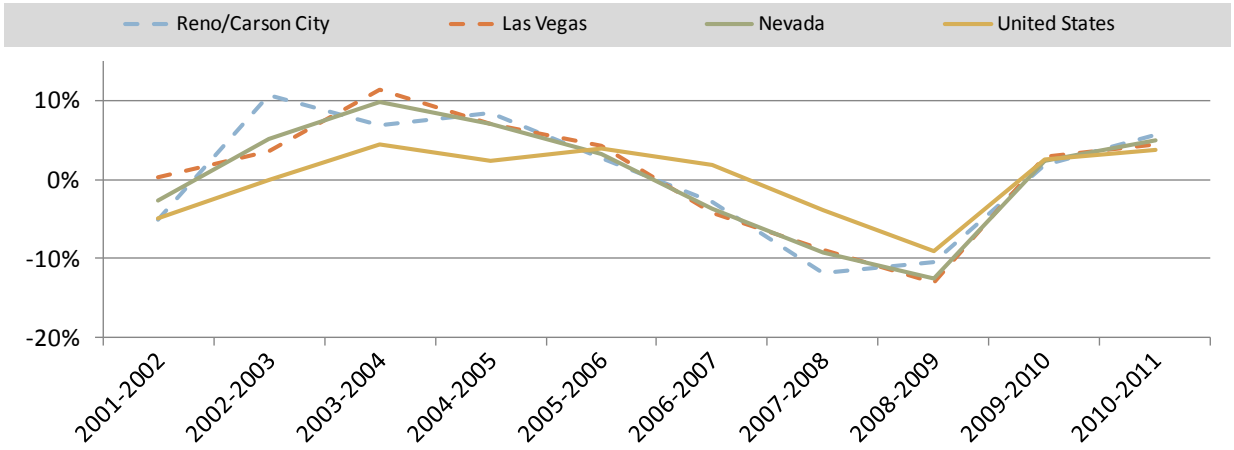
The *Business IT Ecosystems* cluster in Nevada employs 51,597 workers in 3,857 establishments across the state. Employment in *Business IT Ecosystems* is less concentrated than the national average in the State of Nevada (location quotient=0.774) and in its two major metro areas. The cluster is slightly more concentrated in Reno/Carson City (location quotient=0.933) than in Las Vegas (location quotient=0.740). As depicted in the chart below, the cluster is most concentrated in Northern and Western Nevada, where Mineral, Lyon, and Washoe counties all have location quotients greater than one. Wages in Nevada's *Business IT Ecosystems* cluster are moderate, at $40,437 in average annual pay (falling below the state average income of $48,077), but vary widely across industry sub-clusters.

As illustrated in the chart on the following page, the growth rates of Nevada's *Business IT Ecosystems* industry have fluctuated over the past decade – following national patterns but with higher volatility. Following a period of expansion, the *Business IT Ecosystems* industry in Nevada contracted significantly from 2006-2009, and now once again appears to be growing. The Reno/Carson City and Las Vegas metro areas have both followed similar industry growth patterns.

Concentration of Jobs in the Nevada *Business IT Ecosystems* Cluster, 2011
Map of location quotients by county



State of Nevada *Business IT Ecosystems*
Annual Employment Growth Rates, 2001-2011

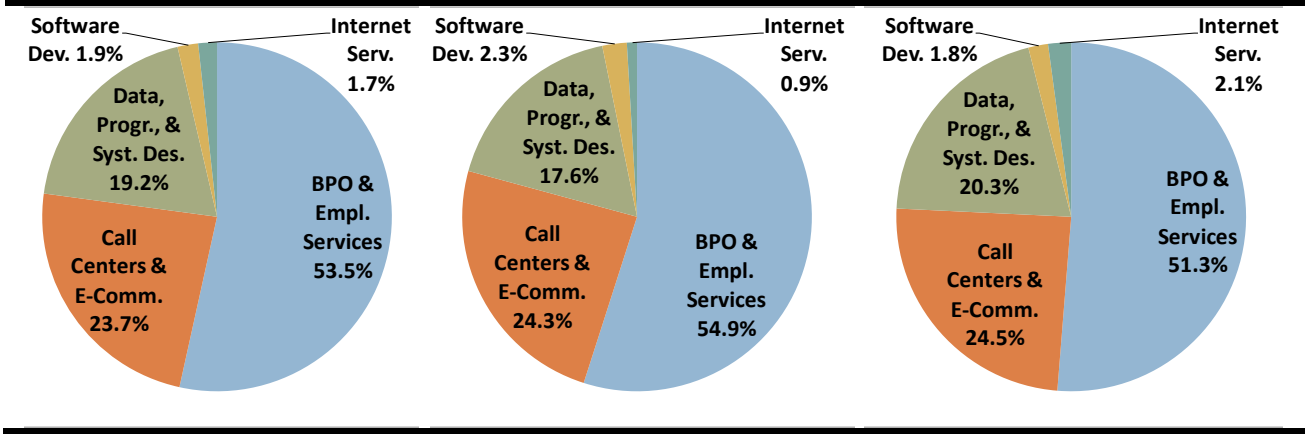


BUSINESS IT ECOSYSTEMS SUB-CLUSTERS

Business Process Outsourcing (BPO) & Employment Services comprises more than half of employment in the *Business IT Ecosystems* cluster, with 27,581 employees across 1,389 establishments in the state. While a significant segment of employment, the sub-cluster is not highly concentrated in the state (location quotient=0.749), or in either of the major metro areas. Employment in *BPO & Employment Services* is slightly more concentrated in Reno/Carson City (location quotient=0.928) than the state overall, and slightly lower in Las Vegas (location quotient=0.687). Average wages in the sub-cluster are very low, with average annual pay of $29,295 per year (compared to state average pay of $48,077). The *BPO & Employment Services* sub-cluster includes ten different NAICS codes, but the majority of employment is in *Temporary Help Services (NAICS 561320)*, with 17,392 employees.

Call Centers & E-Commerce engages 12,218 workers in Nevada, or 23.7% of all *Business IT Ecosystems* cluster employment in the state. The *Call Centers & E-Commerce* sub-cluster is more concentrated in Nevada than in the United States overall (location quotient=1.758), and even more-so in the Reno/Carson City metro area (location quotient=2.176). Average wages in the sub-cluster are relatively low compared to the state overall, with an average annual pay of $37,086. Most employment in *Call Centers & E-Commerce* falls within three NAICS codes: *Telemarketing Bureaus and Other Contact Centers (NAICS 561422)* with 5,171 workers; *Electronic Shopping (NAICS 454111)* with 4,004 workers; and *Mail-Order Houses (NAICS 454113)* with 2,665 employees.

State of Nevada *Business IT Ecosystems* Sub-cluster Employment, 2011



Data Services, Programming, & Systems Design employs 9,923 workers in Nevada – approximately 19.2% of the *Business IT Ecosystems* workforce. Employment in the *Data Services, Programming, & Systems Design* sub-cluster is roughly half as concentrated in Nevada as in the United States overall (location quotient=0.521), and is similarly un-concentrated in Reno/Carson City (location quotient=0.574) and Las Vegas (location quotient=0.526). Wages in *Data Services, Programming, & Systems Design* are high, with average annual pay of $67,138. The largest NAICS codes (in terms of employment) in the sub-cluster are: *Custom Computer Programming Services (NAICS 541511)* with 4,336 workers; *Computer Systems Design Services (NAICS 541512)* with 3,025 workers; and *Data Processing, Hosting, and Related Services (NAICS 518210)*, employing 1,292 people.

Software Development accounts for 1.9% of Nevada's *Business IT Ecosystems* employment, with 984 jobs in the state. Nevada's location quotient in *Software Development* is 0.383, indicating that employment in the sub-cluster is much less concentrated in the state than nationally. Reno/Carson City has a slightly higher *Software Development* location quotient (0.547), but still falls well below the U.S. average. At $91,318, average annual wages in *Software Development* are nearly double state average annual pay ($48,077).

Internet Services employs 891 workers in Nevada, the smallest sub-cluster in *Business IT Ecosystems*, with 1.7% of total cluster employment. *Internet Services* employment is less concentrated in Nevada than in the United States overall, with a location quotient of 0.690. While neither metro area has a location quotient greater than one, *Internet Services* employment is more concentrated in Las Vegas (location quotient=0.811) than in Reno/Carson City (location quotient=0.449). Worker pay is high in *Internet Services*, with an average annual income of $77,736. *Internet Services* is made up of only two NAICS codes: *Internet Publishing and Broadcasting and Web Search Portals (NAICS 519130)*, with 775 workers, and *Business to Business Electronic Markets (NAICS 425110)*, employing 116.

State of Nevada *Business IT Ecosystems* Sub-Cluster Industry Data, Q2 2011										
	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Data, Progr., & Systems Design	9,923	2,489	7,093	0.521	0.574	0.526	1,832	490	1,301	$67,138
Internet Services	891	132	741	0.690	0.449	0.811	138	26	111	$77,736
Software Dev.	984	320	637	0.383	0.547	0.350	67	28	38	$91,318
BPO & Empl. Services	27,581	7,779	17,914	0.749	0.928	0.687	1,389	356	968	$29,295
Call Centers & E-Commerce	12,218	3,440	8,558	1.758	2.176	1.740	431	119	296	$37,086
Total Cluster	**51,597**	**14,160**	**34,943**	**0.774**	**0.933**	**0.740**	**3,857**	**1,019**	**2,714**	**$40,437**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

BUSINESS IT ECOSYSTEMS SUB-CLUSTER TRENDS

Nevada's *Business IT Ecosystems* industry cluster has contracted significantly over the past five years (2006-2011), driven entirely by a major decline in employment in the *BPO & Employment Services* sub-cluster. The remaining sub-clusters, including *Call Centers & E-Commerce*; *Data Services, Programming, & Systems Design*; *Software Development*; and *Internet Services*, have all posted positive growth from 2006-2011 in Nevada. The *Data Services, Programming, & Systems Design* sub-cluster added the most employment over this period (1,719 jobs), and also grew at the highest rate (+3.88% CAGR). Over 80% of the net job growth in Nevada's *Data Services, Programming, & Systems Design* sub-cluster was in the Las Vegas metro area, which grew at an average annual rate of 4.57%. According to EMSI projections, the *Business IT Ecosystems* industry cluster is expected to grow at an average annual rate of 2.04% over the next five years (2011-2016) in Nevada. Positive growth is predicted in each of the *Business IT Ecosystems* sub-clusters in Nevada and its two major metro areas, as well as nationally.

While changes in employment in *Business IT Ecosystems* were spread across a number of segments and activities, a few NAICS codes stand out for dramatic job losses/gains in Nevada. The contraction of the *BPO & Employment Services* sub-cluster was driven by major losses in *Temporary Help Services (NAICS 561320)*, which lost 10,666 jobs (-9.12% CAGR), and *Professional Employer Organizations (NAICS 561330)*, which declined by 2,743 jobs (-25.63% CAGR). Growth within the *Business IT Ecosystems* cluster was more distributed, but the following three NAICS codes stand out for high net job growth in Nevada: *Computer Systems Design Services (NAICS 541512)* added 982 jobs (+8.17% CAGR); *Telemarketing Bureaus and Other Contact Centers (NAICS 561422)* added 892 workers (+3.86% CAGR); and *Electronic Shopping (NAICS 454111)* saw net growth of 843 workers (+4.84% CAGR).

State of Nevada *Business IT Ecosystems* Sub-Cluster Industry Growth Rates								
	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Data Serv., Progr., & Systems Design	3.88%	2.34%	4.57%	2.05%	3.49%	2.93%	3.64%	2.61%
Internet Services	2.46%	9.46%	1.20%	2.91%	5.16%	3.00%	5.51%	0.59%
Software Development	1.51%	5.06%	-0.09%	1.45%	2.79%	2.50%	2.85%	2.46%
BPO & Employment Services	-7.94%	-7.52%	-8.62%	-3.16%	1.29%	1.30%	1.22%	1.33%
Call Centers & E-Commerce	1.93%	1.73%	1.98%	1.32%	2.20%	1.49%	2.44%	1.39%
Total Cluster	**-3.83%**	**-3.82%**	**-4.01%**	**-1.10%**	**2.04%**	**1.68%**	**2.15%**	**1.74%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

B. MARKET TRENDS

MARKET OVERVIEW

Information Technology (IT) is defined by the Information Technology Association of America as the "study, design, development, implementation, support or management of computer-based information systems." Through these computer systems, people are able to process, store, analyze, transmit, and disseminate data; provide services and products to customers; optimize and automate business decisions and processes; and connect people regardless of their geographical location. Due to the capabilities of information technologies, IT services have penetrated a number of downstream markets: financial services, manufacturing, distribution and logistics, retail, medical and life sciences, and many other types of businesses. The broader IT industry also manufactures and sells personal computers, mobile phones, tablets, servers, modems, and a number of other devices. Globally, IT services revenues were estimated at $793 billion in 2010.[149]

Business Services includes a wide variety of support services, primarily in non-core functions, such as legal and accounting services, management, human resources, security, printing, call centers and electronic sales, facilities maintenance, and other general and industry-specific support. These business operations are increasingly outsourced through business process outsourcing (BPO), which involves a company outsourcing or engaging a third party provider for administrative, back office,

[149] Gartner, *Gartner Says Worldwide IT Services Revenue Returned to Growth in 2010*, 4 May 2011.

and other business functions/services. A study by First Research estimates that annual U.S. sales in *Business Services* total about $570 billion, across 390,000 establishments.[150]

Information Technology & Business Services combines two industries that are increasingly interrelated such that most firms are better classified as hybrid companies with services and products that are characteristic of both industries. As more downstream firms have adopted information technology to improve the efficiency and quality of its products and services, it is becoming increasingly difficult to differentiate one from the other.

MARKET DYNAMICS AND TRENDS

Over the past two decades, the utilization of business process outsourcing (BPO) has become an increasingly prevalent strategy for companies seeking to cut costs and focus on core business functions. As the growth of *Business Services* is closely linked to the overall health of the economy, businesses providing BPO have been negatively impacted by the recession. Yet the restructuring, layoffs, and recruitment freezes, as well as the focus on cost-cutting and risk-reduction that have resulted from the recession are expected to increase the demand for outsourcing post-recession.[151] The market for business process outsourcing is expected to grow significantly in the coming years. An IDC study estimates that the global BPO market will grow at a 5.8% annual growth rate from 2010-2014, reaching $201.5 billion in 2014.[152]

The United States comprises nearly half of the global BPO market and is expected to experience healthy growth in the coming years (five-year CAGR of 4.7%) reaching a value of $94.7 billion in 2014.[153] International competition for the outsourcing of business services is expected to increase over time, as technological advances and international capacity make near-shore and overseas outsourcing increasingly attractive. Global Industry Analysts, Inc. predicts that recovery will be strongest in the BRIC (Brazil, Russia, India, and China) countries, and regionally the highest growth rates over the next five years are expected in Asia (CAGR of 16%).[154]

Similarly, the global *IT Services* industry is expected to reach $846 billion in spending in 2011, a 6.6% increase from 2010.[155] For similar reasons as the BPO trend, businesses are increasingly outsourcing their IT functions to third-party vendors instead of maintaining those functions in-house, a pattern that has accelerated with the emergence of cloud computing. Furthermore, the importance of IT products for everyday functions ranging from business operations to entertainment gives the IT industry a very positive outlook for growth. Emerging markets offer the industry a chance to further enlarge its customer base. For instance, consumers from developing countries accounted for more

[150] First Research, *Business Services Sector Industry Profile*, April 2011.
[151] Global Industry Analysts, Inc., *Business Process Outsourcing (BPO): A Global Strategic Business Report*, February 2011.
[152] International Data Corporation, *Worldwide and U.S. Business Process Outsourcing Services 2010-2014 Forecast*, May 2010.
[153] Ibid.
[154] Global Industry Analysts, Inc., *Business Process Outsourcing (BPO): A Global Strategic Business Report*, February 2011.
[155] Gartner, *Gartner Says Worldwide IT Spending Is on Pace to Grow 7.1Percent in 2011*, 30 June 2011.

than 50% of PC sales and about 70% of cell phone sales.[156] The challenge for the U.S. IT industry, however, will be in keeping IT manufacturing and services onshore. The IT industry is a globalized industry with R&D, manufacturing, and service operations all across the world, which is a potential downside for the trend toward IT outsourcing.

The nature of business services being outsourced (both domestically and internationally) is expected to diversify in the coming years, with growth in higher value processes, including non-voice industry-specific services. This transition to higher-skill, technology intensive services aligns with the U.S. competitive advantage – increasingly popular non-voice services include web-enabled chat/email technical support, back office functions, and industry-tailored, high-skill services (e.g., engineering, business intelligence, design, and other core business functions). Areas of forecasted business outsourcing growth include financial and accounting services, customer relations and services, and business intelligence. While public sector and financial services markets are expected to continue outsourcing, outsourcing growth rates are anticipated to be higher in newer, less mature segments of the market, such as utilities and healthcare providers.[157]

MARKET TRENDS IN SELECTED SUB-SECTORS

CALL CENTERS & CUSTOMER SERVICE

In 2011, the U.S. call center and telemarketing sector is expected to generate $18.4 billion in revenues, including $972.3 million in profits. Like many other business services, the sector has experienced a recent decline as a result of the recession, with a contraction of -0.4% annually (in U.S. revenues) from 2006-2011.[158] While recovery is expected, it may be slow and growth rates are expected to be moderate – clients are likely to wait for clear signs of enduring recovery before extending or expanding contracts with call centers and telemarketers. Competition from international service providers will limit future U.S. industry growth, although increasing demand for high-value call center operations will benefit U.S. competitive advantage. IBIS World predicts an annual U.S. revenue growth rate of 1.4% from 2011-2016 for this sector.[159]

The call center and telemarketing sector includes activities such as customer service and technical support, telemarketing, telephone answering services, debt collection, and fundraising. In addition, there is increasing demand for higher-value services, such as up-selling and cross-selling,[160] from inbound call centers. These are value-added services, which enable call centers to generate revenue for their clients, where they have been traditionally engaged primarily as a means to cut costs.

[156] Plunkett Research, *Introduction to InfoTech Industry*, 2010.
[157] Global Industry Analysts, Inc., *Business Process Outsourcing (BPO): A Global Strategic Business Report*, February 2011.
[158] IBISWorld, *Industry Report 56142: Telemarketing & Call Centers in the U.S.*, January 2011.
[159] Ibid.
[160] Up-selling is selling the customer a more expensive product/service than they originally intended to buy. Cross-selling is selling the caller an additional or related product or service, or selling a product to callers who were not intending to make a purchase

These multi-function operations, which may handle customer service or technical support as well as a sales/marketing function, are expected to remain in the domestic market.

E-COMMERCE

E-commerce is a sub-sector with 50,973 establishments in the United States, valued at $186.4 billion in revenues (in 2011). The sector consists of all retail businesses that sell their products exclusively online, but excludes retailers that run an online sales operation in conjunction with a brick and mortar product business. The industry has grown rapidly by 8.4% annually in U.S. industry revenue from 2006-2011, as it has outcompeted traditional retail businesses with lower prices and broader product ranges.[161] Because online retailers only incur distribution and warehousing costs and do not incur costs from rent, utilities, cash registers, and staff in brick and mortar stores, they able to offer better prices and enjoy higher profit margins. Online retailers also offer more diverse product ranges because they are not constrained by shelf space and allow shoppers to more easily compare prices for similar products. Hard-to-find niche and electronics products have especially done well in the e-commerce industry. The keys to the success of e-commerce businesses have been branding, secure payment systems, reliability of delivery, informative product descriptions, and after-sales service. As competition has intensified due to the low barriers of entry, firms have had to differentiate their businesses with seasonal promotions, discount initiatives, advertisement, and free shipping and handling.

Like traditional retail businesses, however, online retailers were set back during the recent recession by high levels of unemployment and lower consumer incomes. In 2008, as a result of consumer disposable incomes dropping by 0.8% and the consumer sentiment index falling by 25%, industry revenues grew by only 0.8%. Starting in 2010, however, the e-commerce industry has rallied back as consumers slowly regained employment and confidence, causing revenues to grow by 14.1% in 2010 and 10.0% in 2011. As per-capita consumer income is expected to increase by 1.9% annually from 2011-2016, e-commerce revenues are also expected to grow in the United States by 9.4% annually over the next five years, to $291.9 billion. The number of U.S. e-commerce businesses, employment levels, and wages are also expected to improve annually from 2011-2016 by 2.4%, 1.0%, and 2.7%, respectively.[162]

Growth in this sub-sector will be driven by a number of factors. First, as broadband Internet is adopted more widely, online retailers will have greater accessibility to their customer base. More widespread broadband adoption has been driven by falling costs of owning a computer and obtaining high-speed Internet connections.[163] Furthermore, according to comScore, broadband users are more likely to make online purchases than dial-up users due to the greater speed and stability of broadband connections. The National Telecommunications and Information

[161] IBISWorld, *IBISWorld Industry Report 45411a: E-Commerce & Online Auctions in the U.S.*, June 2011.
[162] Ibid.
[163] Plunkett Research, *Introduction to the E-Commerce & Internet Business*, 2010.

Administration reports that 64% of U.S. households have broadband access, a percentage that is estimated to increase to 85% by 2016 according to IBISWorld estimates.

Second, the next frontier in e-commerce is social online shopping, which relies on group participation, user contributions, and word-of-mouth promotion to get discounts. Groupon and Living Social have already pioneered social e-commerce, which guarantee high volume of sales without the need for additional advertisement costs. Lastly, growth will come from expansion into emerging international markets, which are growing in consumer wealth and Internet connectivity.

DATA CENTERS, DATA PROCESSING & HOSTING

Data hosting and processing includes activities such as basic and specialized data storage, web and application hosting, data entry and processing, and the provision of data reports and analysis. After experiencing rapid growth during the late-1990s and early-2000s, the U.S. market share and competitiveness in this industry has fallen significantly in recent years due to increased international competition. IBISWorld estimates 2011 revenues for data processing and hosting services in the United States at $64.7 billion, with a negative growth rate (CAGR of -1.4%) over the last five years.[164] While the economic recovery is expected to stem this decline, the industry is still forecasted to experience slightly negative growth from 2011-2016 (U.S. revenue CAGR of -0.3%). The decline in industry revenue has been accompanied by a 0.4% annual decline in industry employment (2006-2011), with an estimated 413,610 U.S. jobs remaining in 2011.[165]

Globally, demand for data hosting and processing is strong and growing, as firms across nearly every industry require an increasing volume and level of data services to remain competitive. There has been significant growth in application service providers, which provide the explosively growing "software as a service" (deploying software over the Internet to run on companies' local networks). But the sector was hit heavily by the recent economic recession – the reduction in corporate profits prompted many companies to cut costs by sending data outsourcing services overseas. Internationally-owned firms (e.g., India-based Infosys) are able to provide comparable data services at a lower cost, and this trend of growing global competition is expected to represent a continued threat to U.S.-based data businesses.

One strategy that U.S. firms have employed to remain competitive is to move their own data processing and hosting operations offshore, while maintaining client services and sales staff domestically to sell those services within the United States. There are opportunities for growth, however, especially within high-security or specialized services, such as those that require government or industry certifications and compliance. Electronic medical records, expected to grow in coming years as a result of government requirements and funding, will require commensurate growth in highly regulated data hosting and services.

[164] IBISWorld, *Industry Report 51421: Data Processing & Hosting Services in the U.S.*, March 2011.
[165] Ibid.

CLOUD & HIGH PERFORMANCE COMPUTING

The advances in Internet connectivity and emergence of web-based powerhouse companies have directed attention to "cloud computing" as the future of the IT industry. Deloitte studied the wide-ranging definitions of cloud computing and defined it as "a collection of Internet-based services providing users with scalable, abstracted IT capabilities, including software, development platforms, and hardware."[166] Increasingly, the IT industry is moving away from computing as a product and from the traditional approach of acquiring and maintaining in-house software and hardware. Rather, cloud computing offers computing (i.e., software, platform, or infrastructure) as a service that is delivered through an Internet network and allows data to be processed and stored in remote, secure data centers. As a result, firms can focus on their core competencies and save business costs by not having to plan, configure, and deploy fixed quantities of computing equipment, which come with IT human resource costs, licensing costs, deployment and scalability lead-times, and financial risks. In addition, firms are able to save costs by sharing IT infrastructure (i.e., data centers) with other firms. Consumers and firms also have access to their applications in any location, allowing for swift changes to be made as business needs change.

Given these advantages, a number of IT firms are "moving into the cloud" and are changing their current outsourcing business models. The global market for cloud computing was valued at $58.6 billion in 2009 and $68.3 billion in 2010, a gain of 16.6% in industry revenue. Market revenue for worldwide cloud services is expected to reach $148.8 billion by 2014[167] and to grow by 24% annually from 2008-2013.[168] In addition to early adoption of cloud computing by the financial services, manufacturing, and high-tech industries, these robust growth figures are also driven by President Obama's Cloud First policy, which pushes for increased adoption of cloud services by government agencies as a means to increase public IT efficiency and save costs during a time when public budgets are constrained.[169] Furthermore, while most industries contracted during the slumping economy, cloud computing revenues exhibited modest growth as businesses looked to cloud computing solutions to save business costs with minimum investment or little added IT management.

The United States dominated the world market share of cloud computing in 2010, constituting 58% of 2010 world revenues, followed by Western Europe at 24% and Japan at 10%. Although the global industry's hierarchy is expected to remain the same in 2014, the United States is expected to lose some market share (falling to 50% of worldwide industry revenues) while Western Europe (29%) and Japan (12%) gain larger shares. Significantly, as other nations also aim to adopt more cloud computing, there will be a need for a global cloud policy that determines the limits of cloud data flow between nations.

[166] Deloitte, *Cloud Computing: Forecasting Change*, October 2009.
[167] Gartner, *Forecast: Public Cloud Services, Worldwide and Regions, Industry Sectors, 2009-2014*, 2010.
[168] Deloitte, *Cloud Computing: Forecasting Change*, October 2009.
[169] Vivek Kundra *Federal Cloud Computing Strategy*, 8 February 2011.

The nascent market for cloud computing has evolved to the point where there are now three widely accepted families of service: Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS). SaaS supports specific business processes or applications (e.g., social networking, micro-blogging) and represents the most mature service in the industry, claiming 89% of industry revenues ($8.1 billion) in 2008. While SaaS is an established segment within this industry, its growth is expected to outpace on-premise enterprise applications, with 17.2% annual growth in SaaS from 2008-2013 (compared to a 4.1% CAGR for on-premise enterprise applications), reaching $17.8 billion in 2013. High potential niches within SaaS include cloud products in communication and collaboration (18.7% CAGR, 2008-2013), customer relationship management (17% CAGR), enterprise resource planning (9.3% CAGR), and supply chain management (17.1% CAGR). From 2008-2013, digital content creation is expected to be the fastest growing segment within SaaS, with a 39.1% annual growth rate.[170] Meanwhile, PaaS provides the tools for development, testing, deployment, hosting and application maintenance (i.e., programming on the Internet) and IaaS provides subscriptions to servers, storage, database services, and networking equipment. Both PaaS and IaaS have high growth potential according to industry analysts, yet projections are difficult to make because people are just beginning to understand the technology and its applications.

On the other hand, there are a number of challenges that may inhibit some of the growth prospects in cloud computing. First, there is resistance from IT organizations in switching from on-premise IT services to vendor-provided cloud services, which is expected to dissipate as more organizations adopt cloud computing and become more aware of its capabilities. Second, as was the case when online payment services first came onto the scene, data security remains a concern for many consumers and businesses. To reassure clients of the security of cloud services, cloud computing firms are already moving toward adopting more contractual protections, conducting more security audits, and requiring standards compliance and security certification by trusted third party evaluators. Lastly, performance is another key concern for many customers of cloud computing. Though network latency still needs improvement, many cloud services are already reaching 99.9% uptimes.[171]

CYBER SECURITY

Proliferation of information technology and Internet connectivity have enabled globalization and spurred the information economy; however, the same information technology also has increased the magnitude and latitude of cyber crime, costing the worldwide economy more than $1.0 trillion in damages. Using the Internet as a channel for cyber attacks, online hackers and criminals (often anonymously) engage in financial fraud, phishing, pharming, malware, and database breaches on identities and other sensitive information. Furthermore, the growing usage social networking, cloud computing, and smartphones has raised the consumer, business, and government risk exposure to

[170] Deloitte, *Cloud Computing: Forecasting Change*, October 2009.
[171] Ibid.

cyber attacks. Consequently, more attention and investments have been directed toward cyber security. Valued at $55 billion, the U.S. cyber security industry is expected to grow by 6.2% annually from 2010-2015.[172] According to Global Industry Analysts, the global cyber security market is forecasted to reach $80.0 billion by 2017, with the United States and Europe dominating the global market share.[173] Network security is the largest revenue generating segment of the industry, followed by end point security, which is expected to generate $5.0 billion in global revenues by 2017.

[172] Market Research Media, *U.S. Federal Cybersecurity Market Forecast 2010-2015*, March 2011.
[173] Global Industry Analysts, Inc., *Cyber Security: A Global Strategic Business Report*, April 2011.

APPENDIX D: CLEAN ENERGY

A. INDUSTRY PROFILE IN NEVADA

The opportunities put forward in this report focus on *Clean Energy*, but in this section we present industry data for Nevada's traditional energy industry and clean/renewable energy industry, as trends within the broader industry are relevant to the state's future in renewables. In order to accurately capture the energy industry as a whole, but also highlight the high-potential renewable sector, we present findings in this section from two complementary datasets. We present data on traditional *Fuel Production, Distribution, & Other Supply Chain Activities* and *Power Generation & Technology* from the EMSI dataset utilized throughout this report. However, because EMSI does not classify specific clean/renewable energy activities, we also present findings from the Brookings Institution's *Sizing the Green Economy* dataset, including a detailed breakdown of the *Renewable Energy* and *Energy & Resource Efficiency* sectors in Nevada and its major metro areas. Because we are utilizing two separate data sources, which may contain some overlap, we do not present total figures and trends for the energy cluster, but instead highlight key sub-cluster and segment statistics and trends.

CLEAN ENERGY IN NEVADA[174]

Data for Nevada's *Clean Energy* industry is broken down here into two sectors: *Renewable Energy* and *Energy & Resource Efficiency*.

RENEWABLE ENERGY

Nevada's *Renewable Energy* sector employs 1,701 workers across 33 establishments in the state, largely within the metro areas of Reno/Carson City and Las Vegas. Employment in *Renewable Energy* is more concentrated in the State of Nevada (location quotient=1.432) and its two major metro areas than the national average. With 409 jobs, Nevada has an unusually high employment concentration in the *Geothermal* segment, driven by extremely concentrated employment in the Reno/Carson City metro area, where the location quotient is over 74. The state's high concentration in *Solar Photovoltaic* employment (location quotient=3.038) is centered in Southern Nevada, with 560 solar jobs (location quotient=3.807) in the Las Vegas metro area. Wages in Nevada's *Renewable Energy* sub-cluster are roughly on par with state average wages, at $45,671 in average annual pay.

State of Nevada *Renewable Energy* Industry Data, 2010

	2010 Total Employment*			2010 *National* Location Quotient			2010 # of Establishments			2010 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Biofuels/Biomass	12	12	0	0.068	0.297	0.000	1	1	0	$41,112
Geothermal	409	398	0	17.515	74.806	0.000	9	8	0	$46,241
Hydropower	579	3	573	1.216	0.028	1.696	6	3	1	$45,599
Renewable Energy Services	0	0	0	0.000	0.000	0.000	0	0	0	NA
Solar Photovoltaic	630	70	560	3.038	1.482	3.807	13	5	8	$46,338
Solar Thermal	15	0	15	0.325	0.000	0.458	2	0	2	$36,083
Waste-to-Energy	30	30	0	1.053	4.620	0.000	1	1	0	$38,034
Wave/Ocean Power	0	0	0	0.000	0.000	0.000	0	0	0	NA
Wind	26	26	0	0.125	0.547	0.000	1	1	0	$38,629
TOTAL *Renewable Energy*	**1,701**	**539**	**1,148**	**1.432**	**1.992**	**1.362**	**33**	**19**	**11**	**$45,671**

** Figures do not include establishments with <5 employees, so actual employment and establishment numbers may be slightly higher than the figures shown.*
Source: Brookings Institution's *Sizing the Clean Economy* dataset, location quotients calculated by SRI based on Brookings and EMSI data.

[174] This section draws heavily from the Brookings Institution's *Sizing The Clean Economy: A National And Regional Green Jobs Assessment* dataset and report, by Mark Muro, Jonathan Rothwell, and Devashree Saha, with Battelle Technology Partnership Practice.

Nevada's *Renewable Energy* establishments have shown rapid job-growth over the past three years (2007-2010), growing at a rate more than twice the national average (Nevada CAGR +16.82%). Reno/Carson City establishments have exhibited exceptionally high growth (+58.25% CAGR) from 2007-2010, and also showed strong growth in the preceding years of 2003-2007 (+14.91% CAGR), over which period the growth trend was slightly negative in Nevada and nationally. Nevada has shown exceptionally strong growth in the *Geothermal* segment; Reno/Carson City establishments have expanded employment from 65 to 398 jobs from 2003-2010. *Solar Photovoltaic* has also exhibited strong job growth in Nevada, especially from 2007-2010 when it grew at an average annual rate of 23.07%. *Waste-to-Energy* and *Wind* together employ only 56 workers and are not highly concentrated in Nevada, but have grown at an average rate of over 100% from 2007-2010.

State of Nevada *Renewable Energy* Establishment Growth Rates

	2003-2007 Average Annual % Employment Growth				2007-2010 Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Biofuels/Biomass	NA	NA	NA	11.10%	0.00%	0.00%	NA	6.05%
Geothermal	11.63%	13.27%	NA	5.07%	51.34%	54.94%	NA	9.02%
Hydropower	-6.07%	-6.94%	-6.06%	-6.18%	-0.06%	0.00%	-0.06%	-0.02%
Renewable Energy Services	NA	NA	NA	2.78%	NA	NA	NA	11.11%
Solar Photovoltaic	2.19%	-2.90%	2.33%	4.61%	23.07%	106.06%	19.28%	19.35%
Solar Thermal	6.78%	NA	6.78%	8.40%	4.89%	NA	4.89%	33.24%
Waste-to-Energy	NA	NA	NA	3.65%	115.44%	115.44%	NA	3.88%
Wave/Ocean Power	NA	NA	NA	20.99%	NA	NA	NA	20.89%
Wind	NA	NA	NA	12.93%	105.41%	105.41%	NA	17.60%
***Renewable Energy* Total**	**-1.66%**	**14.91%**	**-3.28%**	**-0.09%**	**16.82%**	**58.25%**	**7.78%**	**7.63%**

** Figures presented in this table and the accompanying text represent the employment growth of the clean establishments that existed in 2010, the year in which firms were identified as engaged in the clean economy. These numbers do not fully capture industry-level growth.*
Source: Brookings "Sizing the Clean Economy" dataset, SRI Calculations.

ENERGY & RESOURCE EFFICIENCY

Nevada's *Energy & Resource Efficiency* sector employs 2,209 workers across 65 establishments in the state, with employment concentrated in the metro areas of Reno/Carson City and Las Vegas. Overall, employment in *Energy & Resource Efficiency* is less concentrated in the State of Nevada (location quotient=0.676) and its two major metro areas than the national average. Employment in the *Professional Energy Services* segment is moderately concentrated in the state overall (location quotient=1.395), and is even more concentrated in the Las Vegas metro area (location quotient=1.551) than the national average. In the Reno/Carson City metro area, employment is highly concentrated in *Battery Technologies* (location quotient=3.772) and moderately concentrated in *Energy-Saving Building Materials* and *Professional Energy Services* segments. Average annual wages in Nevada's *Energy & Resource Efficiency* sector are similar to the state average pay, at $48,401 per worker per year (compared to the state average of $48,077).

State of Nevada *Energy & Resource Efficiency* Industry Data, 2010

	2010 Total Employment*			2010 *National* Location Quotient			2010 # of Establishments			2010 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Battery Tech.	119	119	0	0.859	3.772	0.000	2	2	0	$41,436
Electric Vehicle Technologies	66	0	18	0.489	0.000	0.188	2	0	1	$39,049
Energy-Saving Building Materials	1,094	402	686	0.787	1.269	0.696	36	13	22	$43,680
Fuel Cells	6	6	0	0.099	0.436	0.000	1	1	0	$56,439
Green Architecture & Construction Serv.	312	5	307	0.647	0.045	0.897	8	1	7	$58,266
HVAC & Building Control Systems	15	0	0	0.024	0.000	0.000	2	0	0	$33,439
Professional Energy Services	597	126	471	1.395	1.292	1.551	14	7	7	$54,614
TOTAL *Energy & Resource Efficiency*	**2209**	**658**	**1482**	**0.676**	**0.884**	**0.640**	**65**	**24**	**37**	**$48,401**

** Figures do not include establishments with <5 employees, so actual employment and establishment numbers may be slightly higher than the figures shown.*
Source: Brookings Institution's *Sizing the Clean Economy* dataset, location quotients calculated by SRI based on Brookings and EMSI data.

Nevada's *Energy & Resource Efficiency* establishments have posted strong, positive employment growth over the past seven years (2003-2010) and grew at an average annual rate (Nevada CAGR +10.58%) of more than three times the national average over the 2007-2010 period. Growth in *Energy & Resource Efficiency* employment has been especially robust in Reno/Carson City, where jobs have grown at a rate of +15.52% (CAGR) from 2007-2010, and also showed strong growth in the preceding years (+10.48% CAGR, 2003-2007). Nevada has shown exceptionally strong growth in the *Battery Technologies* segment (+71.74% CAGR, 2007-2010), concentrated in the Reno/Carson City metro area. Growth in Nevada employment has also outstripped national rates (2007-2010) in *Energy-Saving Building Technologies* and *Green Architecture & Construction Services*, both of which posted exceptionally high growth in the Las Vegas metro area.

State of Nevada *Energy and Resource Efficiency* Establishment Growth Rates

	2003-2007 Average Annual % Employment Growth				2007-2010 Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Battery Technologies	71.74%	71.74%	NA	2.09%	11.01%	11.01%	NA	0.55%
Electric Vehicle Technologies	-9.95%	NA	NA	-2.88%	11.20%	NA	NA	19.83%
Energy-saving Building Materials	17.21%	9.95%	23.11%	3.54%	5.34%	5.54%	5.27%	1.20%
Fuel Cells	0.00%	0.00%	NA	16.68%	44.22%	44.22%	NA	2.37%
Green Architecture & Construction Services	9.56%	5.74%	9.66%	2.75%	10.38%	0.00%	10.59%	11.35%
HVAC & Building Control Systems	0.00%	NA	NA	1.51%	0.00%	NA	NA	5.72%
Professional Energy Services	1.89%	21.32%	0.41%	6.02%	7.10%	34.31%	2.76%	8.19%
***Energy and Resource Efficiency* Total**	**10.58%**	**15.52%**	**10.43%**	**3.23%**	**6.94%**	**10.48%**	**5.87%**	**4.84%**

** Figures presented in this table and the accompanying text represent the employment growth of the clean establishments that existed in 2010, the year in which firms were identified as engaged in the clean economy. These numbers do not fully capture industry-level growth.*
Source: Brookings "Sizing the Clean Economy" dataset, SRI Calculations.

While it does not fall exclusively within the energy industry, it is also worth noting that Nevada's concentration and growth within "Cleantech" industries (a sub-set of the Brookings' *Sizing the Clean Economy* segments) are notable for posting exceptionally high growth in recent years.[175] Nevada's concentration of cleantech employment is higher than the national average, with 1,880 jobs and a

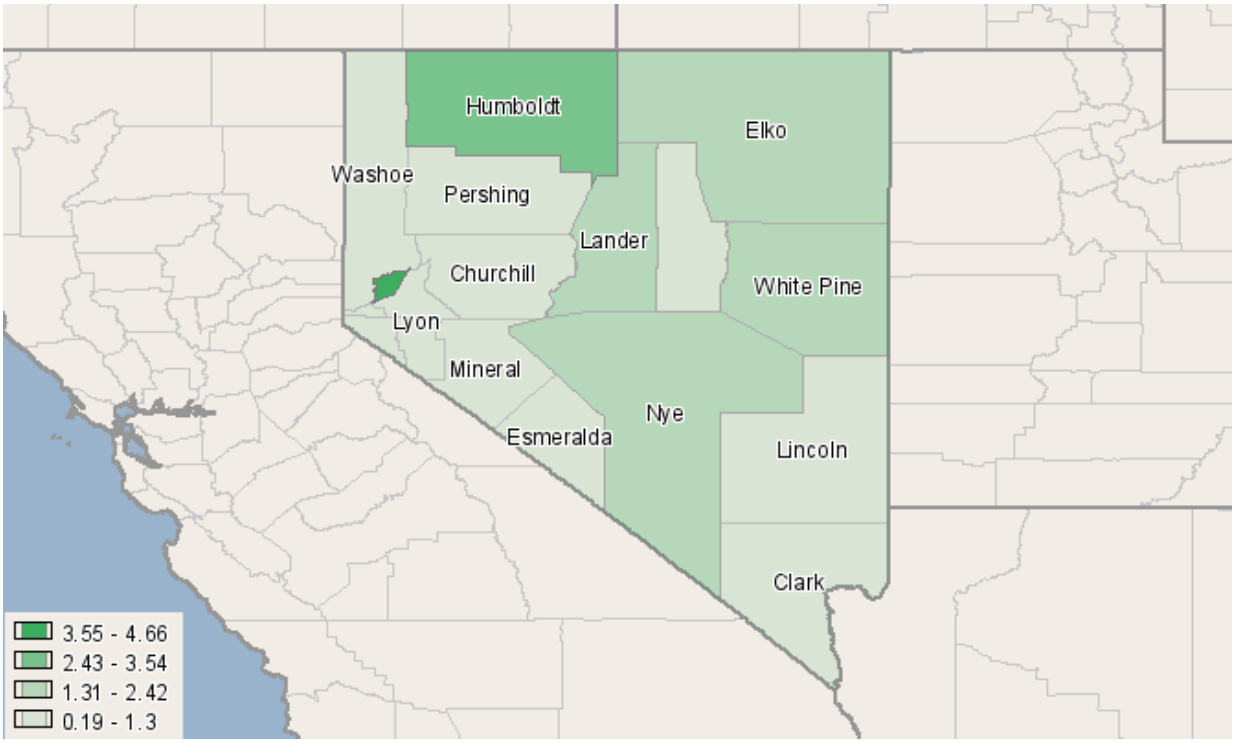
[175] The "Cleantech" segments include: battery technologies; biofuels/biomass; carbon storage and management; electric vehicle technologies; fuel cells; geothermal; professional energy services; renewable energy services; smart grid; solar photovoltaic; solar thermal; wave/ocean power; and wind.

location quotient of 1.195 in the state. Establishments in the state's cleantech segment have grown at an average annual rate of +10.54% (2003-2010), outpacing national growth over the same period (+8.27% CAGR). Cleantech growth was exceptionally high (+31.73% CAGR) and is highly concentrated (location quotient=2.111) in Reno/Carson City. Both Reno and Las Vegas showed strong growth in *cleantech manufacturing* from 2003-2010. Las Vegas's *cleantech manufacturing* establishments employed 103 workers in 2010, up from 10 in 2003 (39.54% CAGR), and Reno-Sparks grew at an average annual rate of 21.41% (2003-2010) to 35 jobs in 2010.

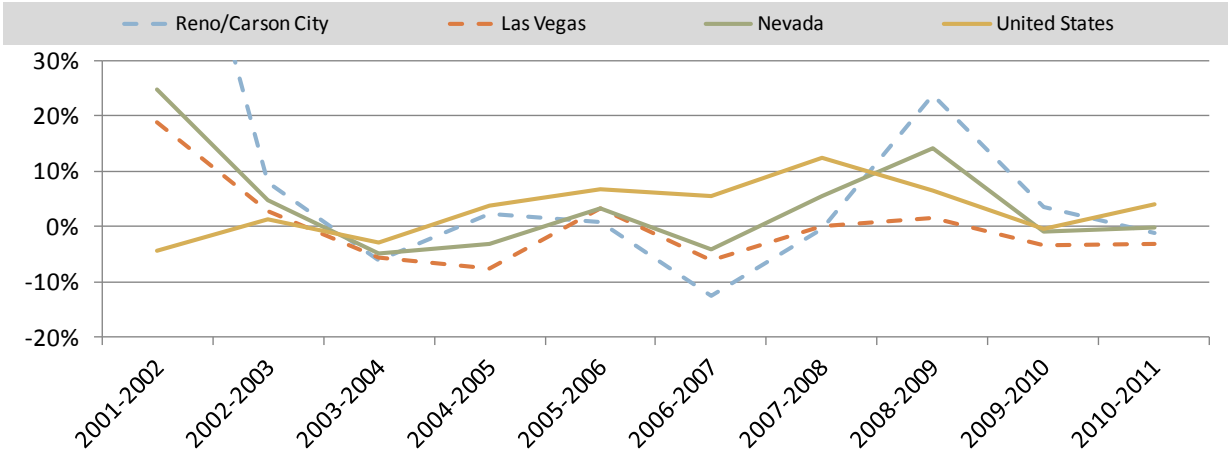
TRADITIONAL ENERGY SUB-CLUSTERS AND SUB-CLUSTER TRENDS

Employment in Nevada's traditional energy sub-clusters – *Fuel Production, Distribution, & Other Supply Chain Activities* and *Power Generation & Technology* – has shown overall growth in the past ten years (2001-2011), but with significant volatility, especially within the Reno/Carson City and Las Vegas metro areas (see chart on the following page). As depicted in the map below, there are areas of traditional energy employment concentration in both rural and urban Nevada, led by Storey County (4.63 location quotient) and Humboldt County (2.62 location quotient).

Concentration of Jobs in the Nevada *Traditional Energy* Sub-Clusters, 2011
Map of location quotients by county



State of Nevada Annual Employment Growth Rates, 2001-2011
Fuel Production & Distribution* and *Power Generation & Technology



TRADITIONAL *ENERGY* SUB-CLUSTERS

Fuel Production, Distribution, & Other Supply Chain Activities is the largest energy sub-cluster in Nevada, with 6,453 jobs in the state. *Fuel Production, Distribution, & Other Supply Chain Activities* are less concentrated in Nevada (location quotient=0.408) and its two major metro areas than the national average. The sub-cluster has a slightly higher concentration in the Reno/Carson City metro area (location quotient=0.624), and a very low concentration in the Las Vegas metro area (location quotient=0.165). Wages in the *Fuel Production, Distribution, & Other Supply Chain Activities* sub-cluster are moderate, with average annual pay of $50,013 (slightly higher than Nevada's average pay of $48,077). The *Fuel Production, Distribution, & Other Supply Chain Activities* sub-cluster has shown positive growth over the past five years (7.70% CAGR, 2006-2011), and according to EMSI projections will continue to grow from 2011-2016 (projected CAGR, 4.22%). The *Fuel Production, Distribution, & Other Supply Chain Activities* sub-cluster is comprised of twenty different NAICS codes, but more than half of employment is in *Crude Petroleum and Natural Gas Extraction (NAICS 211111)*, with 3,385 workers. *Natural Gas Distribution (NAICS 221210)* is the second-largest employer with 1,310 workers, and is the only NAICS code with a location quotient higher than one (1.356) in this sub-cluster.

Power Generation & Technology is Nevada's second-largest sub-cluster in energy with 2,834 jobs and 61 establishments in the state. With a location quotient of 0.697, *Power Generation & Technology* is not highly concentrated in Nevada, or in either of the major metro areas. Average pay in the *Power Generation & Technology* sub-cluster is very high – with average annual earnings per worker of $128,940, wages are two-and-a-half times the state average ($48,077). *Power Generation & Technology* has declined over the 2006-2011 period in Nevada, with contraction especially strong in the Reno/Carson City metro area (-13.38% CAGR), and is expected to post marginal (and in Reno/Carson City slightly negative) growth over the coming five years. The majority of employment

in the *Power Generation & Technology* sub-cluster is in *Electric Power Distribution (NAICS 221122)*, which employs 2,149 workers, followed by *Fossil Fuel Electric Power Generation (NAICS 221112)*, with 558 jobs.

State of Nevada *Traditional Energy* Sub-Cluster Industry Data, Q2 2011

	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Fuel Prod., Distr., & Other Supply Chain Activities	6,453	2,246	1,849	0.408	0.624	0.165	168	57	49	$50,013
Power Gen. & Technology	2,834	517	1,874	0.697	0.559	0.651	61	5	26	$128,940

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

State of Nevada Traditional Energy Sub-Cluster Industry Growth Rates

	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Fuel Production, Distribution, & Other Supply Chain Activities	7.70%	9.21%	-0.66%	6.84%	4.22%	4.71%	1.29%	2.95%
Power Generation & Technology	-5.19%	-13.38%	-3.63%	1.09%	0.08%	-0.43%	0.09%	-0.09%

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

B. MARKET TRENDS

MARKET OVERVIEW

Energy production and trade is important to the United States' economic security and prosperity given that the country is a net importer of energy and consumed 21% of the world's share of energy in 2007, while having only 4.6% of the world's population and producing only 15% of the world's energy. As a share of GDP, national energy expenditures constituted 8.8% in 2007, down

significantly from a 30-year high of 13.7% in 1981 but moderately higher than a 30-year low of 6.0% in 1998. Significantly, *renewable energy* comprised 11% of U.S. energy production and 8% of U.S. energy consumption in 2009. Most of U.S. energy production (78%) and consumption (83%) continue to come from fossil fuels (i.e., coal, oil, and gas), though in recent years nuclear energy has risen to surpass renewables as an alternative to fossil fuels (11% of production and 9% of consumption).[176] Consequently, the United States trailed only China in contributing 20% of the world's share of carbon dioxide emissions. The downstream consumers of energy in the United States are divided roughly evenly between residential and commercial users (41%), transportation (29%), and industrial users (30%).[177]

Nevada rates below the national average in per-capita energy consumption (36th) and just at the national average in per-capita energy expenditures (27th), though the state has the 11th highest per-unit energy prices in the nation. Because Nevada has few fossil energy resources and no nuclear energy plants, the state imports most of its natural gas and coal for electricity generation from California, Utah, and Wyoming, which are used for 68.6% and 20.0% of the state's electricity generation, respectively.[178] Nevada is also rich in potential for renewable energy, particularly in solar, geothermal, and wind power. Though Nevada is only ranked 23rd in the nation for renewable generation, it is one of the few states to produce electricity using geothermal resources, second only to California. In 2009, Nevada generated 6.5% of its electricity from hydroelectric energy, 4.3% from geothermal sources, and 0.5% from solar sources.[179]

MARKET DYNAMICS AND TRENDS

The global energy sector is forecasted to grow as the economy recovers, world population increases, and renewable energy sources become a larger part of the energy portfolio. Globally, energy use is expected to increase by nearly 50% from 2009-2035, led by the non-OECD Asian countries (118%), Middle East (82%), Africa (63%), and Central and South America (63%). By comparison, the OECD nations are expected to increase their energy use by 14% from 2009-2035. The United States' energy expenditures slipped to $1.1 trillion in 2009 due to the economic recession (from $1.7 trillion in 2007), but are expected to grow to $1.7 trillion in 2035 as the economy recovers and energy demand returns. From 2009-2035, energy consumption in the United States is expected to grow at an average annual rate of 0.7% (CAGR),[180] though per-capita energy use is expected to decline with efficiency improvements and as the U.S. economy becomes more centered on service industries over energy-intensive manufacturing industries.

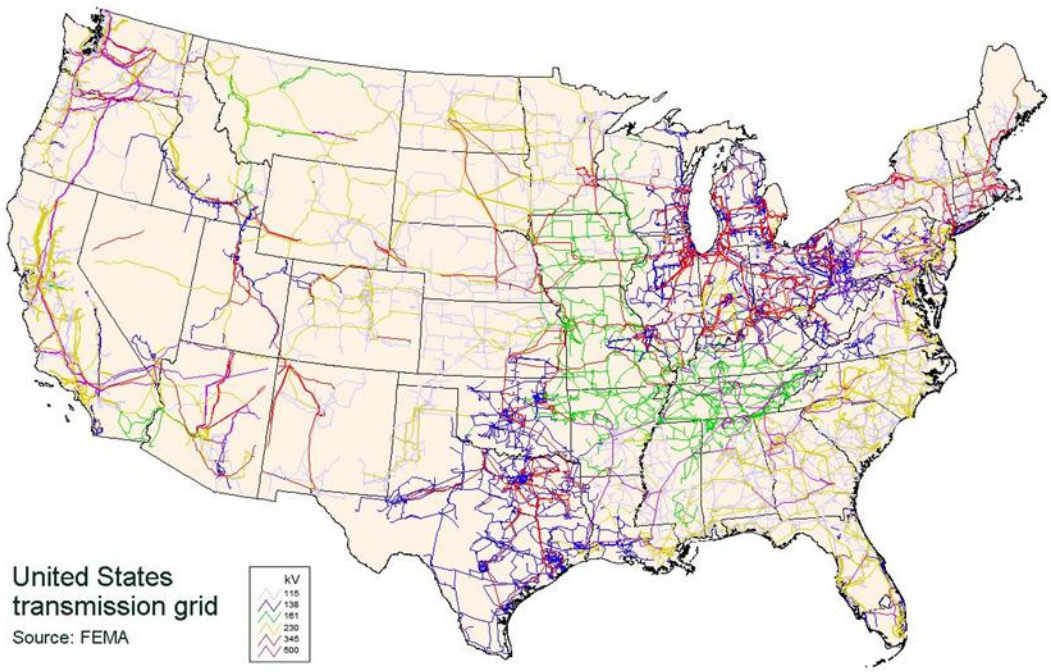
Of all the energy sources, petroleum is expected to be the slowest growing because of the limited supply of fossil fuels and growing concerns of global warming related to carbon-intensive fossil fuels.

[176] Ibid.
[177] U.S. Energy Information Administration, *Annual Energy Review*, 19 August 2010.
[178] U.S. Energy Information Administration, *Nevada Electricity Profile*, 2009.
[179] U.S. Energy Information Administration, *Nevada Renewable Electricity Profile*, 2009.
[180] U.S. Energy Information Administration, *Annual Energy Outlook 2011 with Projections to 2035*, April 2011.

The aggregate fossil fuel share of total U.S. energy use is projected to fall from 83% in 2009 to 78% in 2035,[181] while the improving prospects for domestic shale gas represent the only moderately competitive opportunity in fossil fuels. Nuclear energy sources are also expected to decrease in their share of total U.S. energy use, falling from 8.8% in 2009 to 8.0% in 2035. By comparison, the renewable share of total U.S. energy use is expected to increase rapidly from 8% in 2009 to 13% in 2035.

The success of renewables as a source of electricity generation hinges heavily on government assistance to make them cost competitive with conventional sources of electricity. At the federal level, investment tax credits (ITCs), which are set to expire in 2016, allow firms to write off 30% of capital costs associated with constructing a new renewable energy facility. With the ITCs, solar photovoltaic capacity, wind capacity, and ground-source heat pumps are all expected to grow by average annual rates of 39%, 48%, and 19% respectively; without the ITCs, the average annual growth rates drop to 1%, 0%, and 3%, respectively.[182] Recently, the American Recovery and Reinvestment Act of 2009 allocated $8.5 billion to subsidize loans for renewable energy projects and $13 billion in tax credits for renewable energy production.[183] Other renewable incentives include the production tax credits (PTCs); the rebate program outlined in the Energy Policy Act of 2005; and the Advanced Energy Manufacturing Tax Credit (MTC), which equaled 30% and expired in 2010.

At the state level, 29 states have established renewable portfolio standards (RPSs) that require a certain percentage of electricity in the state to be generated from renewable sources. Failure to meet the mandated energy requirements results in compliance penalties. Nevada's RPS dictates that the state reach 25% renewable electricity generation by 2025, while California aims to reach 33% by 2020. Furthermore, the Western Governors' Association allied with the Department of Energy and partners in Canada and Mexico to identify cost-effective and environmentally sustainable areas in the western states to develop renewable energy resources and facilitate their delivery to major load centers, under the Western Renewable Energy Zone (WREZ) initiative.



[181] Ibid.
[182] Ibid.
[183] U.S. Int .0.

In the face of rising demand for electricity, the nation's aging and stressed electricity infrastructure presents risks of blackouts and outages, especially in congested high-population areas. Furthermore, despite the push toward renewable sources for electricity generation, the lack of available transmission facilities and lines connecting renewable resource areas with utilities and downstream customers have limited the development of the renewable energy sector. One of the reasons for the underdeveloped grid is that utilities have historically planned and developed the siting, renovation, and construction of transmission lines for their direct markets only, resulting in disparate regional webs surrounding major population centers, with few lines running through rural areas and across state borders (see graphic above). Complications over cost allocation among regional utilities arise as no one is willing to pay the upfront investment costs of improving or expanding the grid. As a result, wind energy farms in the Midwest and solar energy farms in Nevada are often not connected to the grid because there are no transmission lines running through remote areas where these renewable resources are located.[184]

State and local politics have also prevented electricity infrastructure to develop across state borders and connect supply centers with demand centers. For instance, due to state laws that allow the benefits of transmission lines to accrue for in-state providers and consumers only, Nevada and California are unable to plan and build an interstate transmission line. Given Nevada's renewable energy resources and California's ambitious RPS targets, the lack of an interstate transmission grid represents a missed opportunity to meet the high demand for renewables in California with the high supply of renewables in Nevada.[185]

In addition, because of the intermittency of renewable resources, renewable energy must be stored and managed with other generation sources to supply a stable and consistent flow of energy to consumers. Without connections to the grid, renewable energy will never become a commercially viable energy source because it is unable to hedge low production in one location with high production in another. On the positive side, the American Recovery and Reinvestment Act of 2009 allocated $11 billion for upgrades to the nation's power grid.[186]

MARKET TRENDS IN SELECTED SUB-SECTORS

SOLAR ENERGY & MANUFACTURING

The solar energy sub-sector is a nascent industry that consists of firms that generate solar power using photovoltaic panels or solar thermal power stations. In 2011, this sub-sector had only 71 establishments and produced $79.1 million in revenues in the United States. The push toward electricity diversification, along with growing concerns about climate change, energy supply self-

[184] Matthew Slavin, "No Grid, No Gain: Untangling the Transmission Tie-up," *RenewableEnergyWorld.com*, 15 April 2011.
[185] Ibid.
[186] Mark Clayton, "For a spiffier electric grid: $11 billion," *The Christian Science Monitor*, 27 January 2009.

sufficiency, and volatile fossil fuel prices, are all factors that have spurred the industry to grow exponentially over the past five years (15.9% CAGR for U.S. revenues from 2006-2011).[187] From 2011-2016, the sub-sector is expected to continue its strong growth trends in the United States, with an average annual growth rate of 7.9% in revenues and 7.3% in the number of firms. Though solar power output is still expected to account for a tiny fraction of total U.S. electricity production, its capacity is projected to increase by more than 50%.[188] Likewise, solar panel and cell manufacturers, who generated $4.2 billion in revenues in 2011, are expected to grow at an average annual growth rate of 9.3%, after having soared by 34.8% (CAGR) over the previous five years.[189]

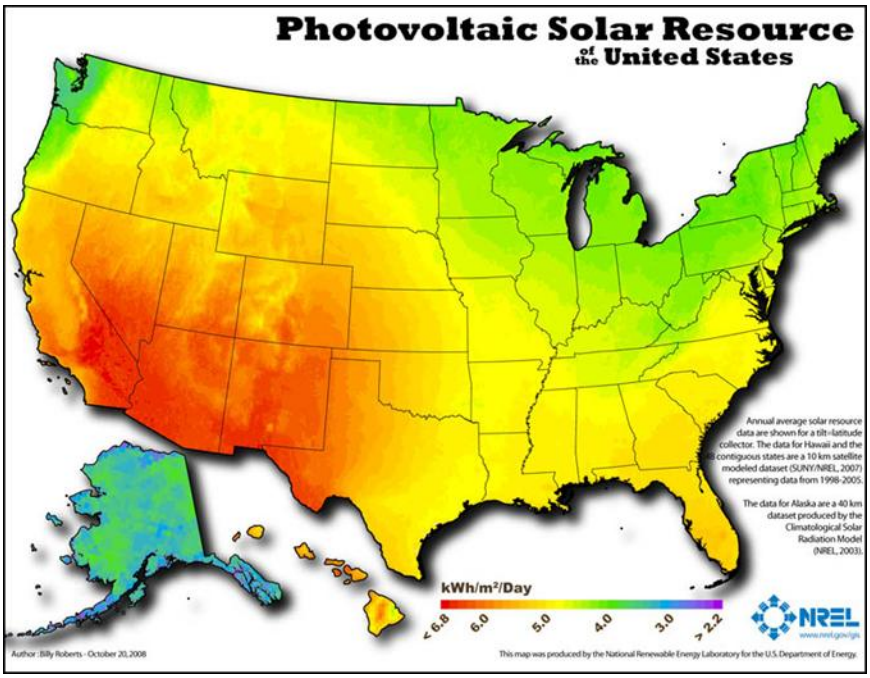
With government assistance, solar panel and cell technologies have been rapidly changing and improving to make solar power a more competitive and sustainable source of energy. The majority of power generated in this sub-sector uses photovoltaic (PV) power from solar panels (63% of solar power generated), which are interconnected solar cells that use semiconductor devices to generate electricity from direct sunlight. Because PV panels are easily customized and attached to buildings, PV power has dominated the residential and commercial market segments. Solar power is also generated using advanced concentrating solar power (CSP) devices, which are responsible for 37% of the solar power generated in the United States. CSP technology uses mirrors (often shaped into large curved dishes) to focus sunlight and heat on a particular surface to convert to electricity. Advances in CSP technology have made it more efficient, scalable, and cost-competitive in converting sunlight to electricity compared to photovoltaic devices (in terms of cost per kilowatt-hour). The U.S. Dept. of Energy recently announced a $737 million loan guarantee to help finance construction of the Crescent Dunes Solar Energy Project, a solar power generating facility in Nye County, Nevada. The facility will use concentrated solar power to generate 110 megawatts of power.[190]

Compared to traditional forms of energy, technologies in the solar industry are still too expensive to manufacture and set up, making it difficult for small operators to stay competitive. Solar energy production costs are also still too high, despite the low operational costs needed to maintain the facilities and equipment. Therefore, government assistance in the form of tax credits, grants and low-interest loans is needed to subsidize a good percentage of the costs of research, construction, and operation of solar firms. Moreover, solar firms typically locate where there is an abundance of sunlight and land, as well as ambitious renewable portfolio standards, such as in California and Nevada. Nevada's RPS dictates that the state reach 25% renewable electricity generation by 2025, while California aims to reach 33% by 2020. As a result, California accounts for about 67% of the nation's solar capacity, while Nevada accounts for nearly 6%.[191] There are also some pockets of

[187] IBISWorld, *IBISWorld Industry Report 22111e: Solar Power in the U.S.*, May 2011.
[188] Ibid.
[189] IBISWorld, *IBISWorld Industry Report 33441c: Solar Power Panels & Solar Cells Manufacturing in the U.S.*, May 2011.
[190] Andrew Restuccia, "Energy Department approves $1 billion in solar energy loan guarantees," *The Hill*, 28 September 2011.
[191] IBISWorld, *IBISWorld Industry Report 22111e: Solar Power in the U.S.*, May 2011.

growth in this industry in New Jersey, Colorado, Arizona, and Florida, but a great bulk of the solar firms have clustered in the West.

A recent study from Bank of America predicts that by 2015, the United States will become the world's largest solar market, installing 6.5 GW of new solar capacity, compared with 5 GW in Germany and 4 GW in China. The study also anticipates that by 2015 the economics of utility-scale photovoltaic energy in sunny areas and residential rooftops in high-cost regions should no longer require government subsidies.[192]



The unique conditions of the industry's upstream and downstream markets will also be important drivers of the solar industry. Electricity consumption in homes and factories fell as consumer spending and business investment decreased during the recent recession, but electricity demand is expected to recover as the economy rebounds. On the upstream end, because solar cells and panels are often the expensive input for solar power generators, the industry is very sensitive to prices in silicon and other components (e.g., steel, drills, pumps, turbines, and inverters) that go into these cells and panels. Since proximity to the downstream market and marginal advantages in performance (due to better R&D and product efficiency) are not as important as minimizing production costs in this market, solar cell and panel manufacturing has increasingly been offshored to low-cost labor countries like China. To compete with foreign manufacturers, U.S. firms will need to better integrate their production vertically to ensure higher profits and exports. Currently, most U.S.-based manufacturers produce only one component of a solar cell or panel due to the ease of

[192] "Bank of America study says U.S. solar market will survive near-term clouds to become world's biggest," *Energy & Environment News*, 11 October 2011.

shipment and final assembly at the downstream market. Vertical integration will save their downstream customers the costs of buying parts from multiple parties and can be achieved through mergers and acquisitions of different firms to increase a firm's manufacturing capabilities.

GEOTHERMAL ENERGY & MANUFACTURING

Defined as heat from the earth, geothermal energy has generally two categories of end-use: electricity generation and direct use. The largest share of geothermal energy is used to generate electricity through hydrothermal and low-temperature technologies. Hydrothermal technologies, which have been in existence for many years in flash and steam power plants, extract steam from geothermal fluids to power the plant's turbines and generators; meanwhile, low-temperature technologies exchange heat from geothermal water to another fluid that boils at a lower temperature than water, allowing steam to be more efficiently extracted from the working fluid at lower temperatures. To save costs, geothermal firms are also integrating their technologies with existing oil infrastructure to co-produce heated water with oil and gas firms.[193] Looking forward, enhanced geothermal systems (EGSs) represent the future of the industry because they allow for geothermal-based electricity generation even in areas without hydrothermal resources. EGS technology can be deployed anywhere there are naturally occurring hot sedimentary rocks located deep in the Earth's crust, which are injected with water to produce and deliver heated water back to the plant for steam extraction and electricity generation.[194]

Commercial and residential clients are the other major end users of geothermal energy. Direct-use applications involve heating and cooling using geothermal heat pumps (GHPs) for pools, spas, water and space heating, aquaculture, crop drying, greenhouses, and snow melting. GHPs essentially pump geothermal heat through a loop and distribute it through conventional duct systems for various direct-use applications. These applications constitute a very small portion of the overall geothermal market, though the United States holds the world's largest GHP installed base, which has doubled over the past 15 years. Iceland, Turkey, and Japan represent high-potential international markets for direct-use applications.

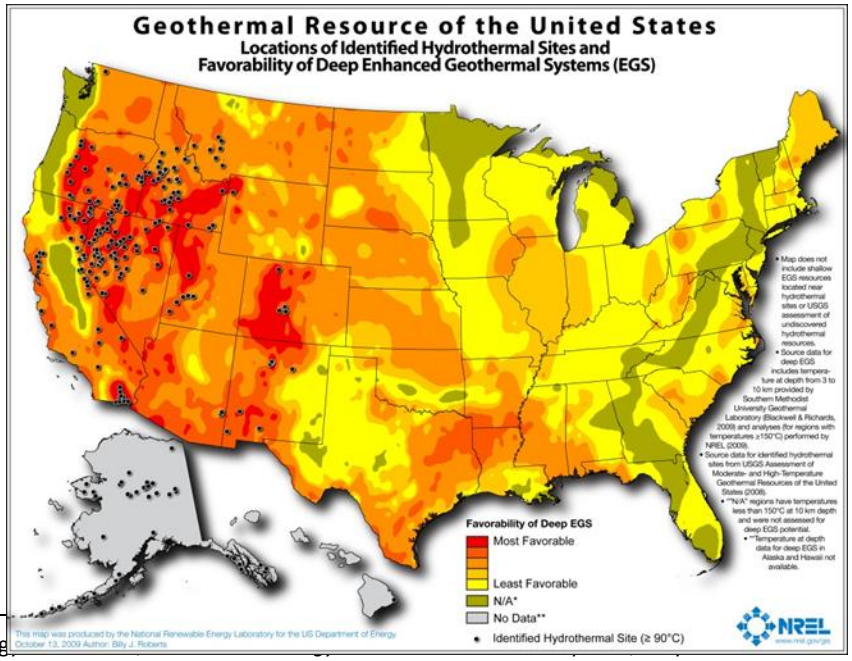
The combination of rising energy prices and climate change concerns has renewed interest in geothermal energy as a source for electricity generation. Geothermal resources accounted for 0.4% of total U.S. electrical production and 12.1% of electricity generated from renewables (excluding hydropower) in 2008.[195] Since last year, the Geothermal Energy Association (GEA) reported that the number of geothermal projects and prospects in the United States increased by 12%, from 152 in 2010 to 170 in 2011.[196] Going forward, the International Geothermal Association forecasts global geothermal capacity to increase from 10,715 MW in 2010 to 18,500 MW by 2015, a nearly 73%

[193] U.S. Department of Energy, *Geothermal Energy Production with Co-produced and Geopressured Resources*, July 2010.
[194] Massachusetts Institute of Technology, *The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century*, 2007.
[195] U.S. Department of Energy, *2008 Geothermal Technologies Market Report*, July 2009.
[196] Geothermal Energy Association, *Annual U.S. Geothermal Power Production and Development Report*, April 2011.

increase over five years.[197] The GEA estimates that the geothermal industry supported around 5,200 construction and operation jobs and 13,000 supporting jobs in 2010, with each new successful geothermal project (i.e., exploration, drilling, construction, and operation) adding up to 850 more jobs.[198]

The economic recession caused a slowdown in the growth of geothermal projects as overall electricity demand fell. GHP manufacturers especially suffered, with a -5% decline in shipments and a -2% decline in shipment capacity from 2008-2009. That was the first decline in GHP shipments since 2003, though industry revenue remained the same at $319.5 million.[199] In the long run, the industry must also tackle certain industry-wide challenges that threaten to limit its growth, such as low consumer awareness of geothermal energy, insufficient market delivery infrastructure, and extremely high installation and capital costs involved in exploration and drilling.

Internationally, the United States is the global leader in geothermal power generation with over 2,600 MWe in installed capacity, followed by Philippines, Indonesia, and Mexico. A large portion of the installed geothermal capacity is concentrated in western states due, to their hydrothermal resources in designated "hot" zones.[200] In 2008, Nevada had 333 MWe of all installed geothermal capacity and 15.4% of all identified hydrothermal reservoirs in the United States, trailing only California in both categories (2,605 MWe and 59.7%, respectively).[201] Utah, Hawaii, Idaho, Alaska, Wyoming, and New Mexico also produce geothermal power, while geothermal power resources are being developed in a number of other states. As more low-temperature and co-produced resources are developed, there is potential for more eastward expansion of geothermal energy production.



[197] Geothermal Energ
[198] Geothermal Energy Association, *Green Jobs Through Geothermal Energy*, October 2010.
[199] Energy Information Administration, *Geothermal Heat Pump Manufacturing Activities, 2009*, December 2010.
[200] USGS, *Geothermal Energy – Clean Power From the Earth's Heat*, 2003.
[201] U.S. Department of Energy, *2008 Geothermal Technologies Market Report*, July 2009.

Already, low-temperature power generation using binary power plants is gaining in popularity. As for GHP manufacturers, most are based in the United States and are concentrated in Indiana and Oklahoma, which comprise 57% of all GHP production.[202]

Though many geothermal reservoirs have been identified in western states, there are still a number of undiscovered resources according to geological analyses. The highest risks and costs lie at the exploration and drilling phases of the geothermal value chain, where firms may fail to uncover a geothermal reservoir despite favorable geological data. This uncertainty leads to long project lead times and a high risk-related markup, along with the high capital costs of exploration and drilling of test wells, costing up to five years and up to $10 million in lost time and money.[203] During these early stages, equity financing (i.e., seed and venture capital) and tax equity financing predominate, as traditional debt lenders are turned away by the high risk, though exploration and resource verification only constitute 10% of overall project costs.[204] Nonetheless, the risk premium drops significantly once the geothermal reservoir has been confirmed and financing for production well drilling and plant construction are much easier to obtain. In fact, the fairly low plant operating costs and high capacity factor make geothermal energy production very cost-competitive with other conventional and renewable sources, once firms are able to pass the initial stages of exploration and drilling.

The high installation and capital costs and high risk-level of exploratory drilling cause firms in this industry to be heavily dependent on government assistance, private philanthropy, and international partnerships. In addition to state-level renewable portfolio standards (RPSs) that require a certain percentage of electricity to be generated from renewable sources, there have been a number of encouraging federal developments that will support growth in geothermal energy. The U.S. Department of Energy revived the Geothermal Technologies Program (GTP) in 2008 to award funds for geothermal R&D and technology demonstration. For FY2009, the GTP committed $44 million to developing EGSs and oil and gas well co-production and resource assessments.[205] The U.S. Department of Energy recently announced loan guarantees for several renewable energy projects in Nevada. A $350 million loan will support a geothermal power generation project, sponsored by Ormat Nevada, Inc., which is expected to produce up to 113 megawatts of baseload power from three geothermal power facilities (Pershing County, Lander County, and Elko County). Loan guarantees such as this one are often used to fund geothermal projects because of the risks inherent in new geothermal development: drilling new wells can take several years, and the power output at new wells is not guaranteed until the work is complete.[206]

[202] Energy Information Administration, *Geothermal Heat Pump Manufacturing Activities, 2009*, December 2010.
[203] Jenny Mandel, "Short on Cash and Know-How, U.S. Geothermal Industry Stumbles," *New York Times*, 12 July 2011.
[204] U.S. Department of Energy, *2008 Geothermal Technologies Market Report*, July 2009.
[205] Ibid.
[206] U.S. Department of Energy, "Energy Department Finalizes Loan Guarantee for Ormat Geothermal Project in Nevada," 23 September 2011, http://energy.gov/articles/energy-department-finalizes-loan-guarantee-ormat-geothermal-project-nevada.

The U.S. Department of Interior's Bureau of Land Management also recently increased the federal land available for geothermal exploration and development and is working to streamline the permitting and leasing process. In 2008, the Emergency Economic Stabilization Act extended production tax credits (PTCs) for geothermal energy production through 2011 and reinstituted the 30% individual tax credit for qualifying GHPs.

In addition, the U.S. signed the International Partnership for Geothermal Technology (IPGT) with Iceland and Australia, two other pioneer nations in geothermal energy, to advance joint technology development efforts that reduce R&D costs and increase the level of expertise through collaboration. On the private side, venture capital and private equity investments in geothermal have been on the rise, growing rapidly from around $50 million in 2007 to $250 million in 2008. Notably, Google.org emerged as a leading philanthropist in support of geothermal energy production by giving over $10 million in grants. However, the collapse of Iceland's Glitnir Bank eliminated an important source of geothermal financing.

ENERGY EFFICIENCY UPGRADING

Energy efficiency and conservation have emerged as a shorter-term solution to rising energy costs until utility-scale energy from alternative sources (such as solar, wind, and tidal energy) becomes commercially viable. Investments that improve the efficiency of buildings or machinery reduce energy costs and often recuperate their initial installation cost over the longer term. If all commercial space built as of 2010 were included in a 10-year retrofit program, the energy cost savings could reach up to $41.1 billion a year.[207] Energy efficiency retrofits also provide greenhouse gas reductions, energy independence, green branding, property valuation, and productivity.

As a result, the market for energy efficiency upgrading in commercial buildings is projected to have strong growth in revenue over the next decade. In 2004, the United States invested $178 billion in improving energy efficiency in buildings, and the American Council for an Energy Efficient Economy (ACEEE) projects the country's annual investment in efficiency will increase through 2030.[208] The markets for energy management systems (EMS) and energy storage for commercial buildings are forecasted to reach $6.8 billion by 2020[209] and $4.9 billion by 2016,[210] respectively. With lighting accounting for 17.5% of global electricity use, adoption of light emitting diodes (LEDs) as more energy efficient lighting in commercial buildings is expected to reach 46% penetration of the U.S.

[207] Pike Research, "Energy Efficiency Retrofits for Commercial Buildings Could Save $41.1 Billion per Year in Energy Costs," Press Release, 22 July 2010.
[208] American Council for an Energy Efficient Economy. *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture*, 2008, http://www.aceee.org/research-report/e083.
[209] Pike Research, "Energy Management Systems for Commercial Buildings will Garner $67 Billion in Investment by 2020," Press Release, 18 November 2009.
[210] Pike Research, "Revenue from Energy Storage for Commercial Buildings to Reach Almost $5 Billion by 2016," Press Release, 2 November 2011.

market for lamps in these buildings by 2020.[211] Like the commercial side, the residential energy efficiency market, which includes upgraded electrical systems, appliances, HVAC systems, roofing replacements, and window and door replacements, is also expected to increase in revenue from $38.3 billion in 2009 to $50.2 billion by 2014.[212]

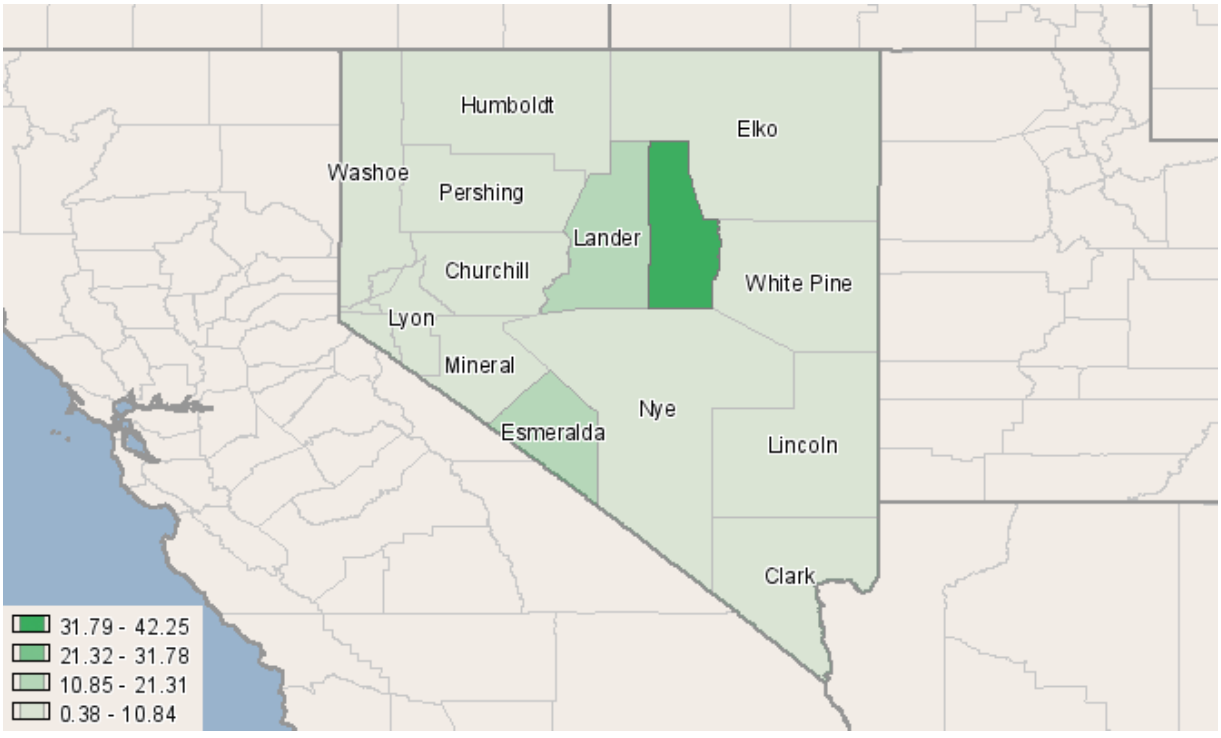
[211] Pike Research, "LED Lighting Penetration to Reach 46% of the Commercial Building Lamp Market by 2020," Press Release, 5 May 2010.
[212] Pike Research, "Residential Energy Efficiency Market Poised for Strong Growth During the Economic Recovery," Press Release, 2 February 2010.

APPENDIX E: MINING, MATERIALS, & MANUFACTURING

A. INDUSTRY PROFILE IN NEVADA – *MINING & MATERIALS*

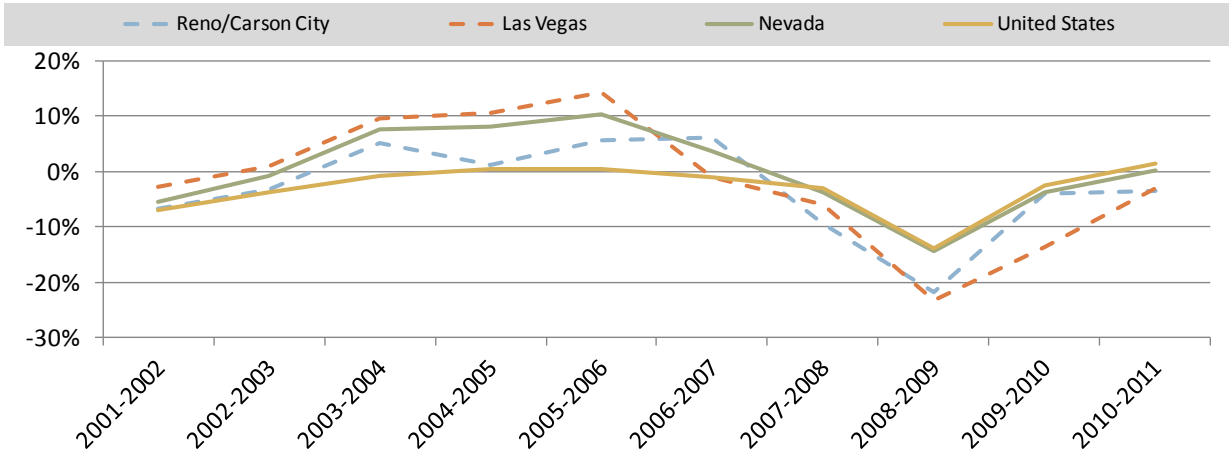
The *Mining & Materials* cluster in the State of Nevada employs 23,914 workers in high-wage, medium-skill jobs. Comprised of activities such as mining, production of chemicals and raw materials, and related manufacturing operations, *Mining & Materials* is more concentrated in rural Nevada than in the Reno/Carson City and Las Vegas metro areas (see figure below). While requiring, on average, only medium skill levels, the *Mining & Materials* industry in Nevada offers high average wages, with average annual pay of $79,794 (compared to the state average of $48,077).

Concentration of Jobs in the Nevada *Mining & Materials* Cluster, 2011
Map of location quotients by county



As depicted in the chart on the following page, employment in Nevada's *Mining & Materials* cluster grew significantly during the economic expansion of 2002-2007, but contracted dramatically during the recent 2007-2009 recession and has not yet fully recovered. This boom and bust trend in *Mining & Materials* employment also characterizes the cluster's growth cycle over the past ten years in Nevada's major metro areas (Reno/Carson City and Las Vegas). In the United States, growth was not strong even during the 2002-2007 expansion period, and employment contracted during the recent recession (2007-2009).

State of Nevada *Mining & Materials*
Annual Employment Growth Rates, 2001-2011

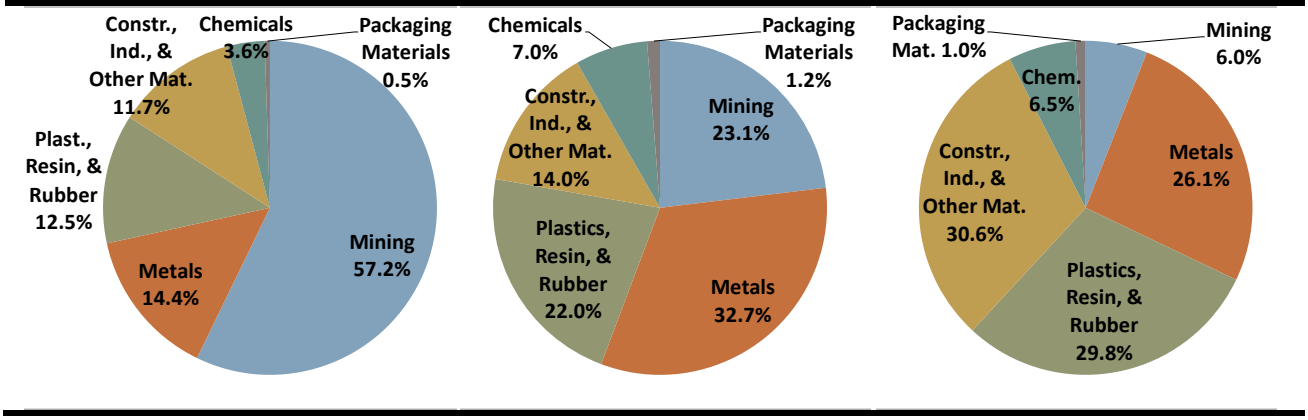


MINING & MATERIALS SUB-CLUSTERS

Mining makes up 57.2% of Nevada's employment in the *Mining & Materials* cluster, employing 13,678 workers in 248 establishments. *Mining* employment is ten-times more concentrated in Nevada than the national average (location quotient=10.205), and is heavily concentrated outside the major metro areas (location quotient=137.29). The Reno/Carson City metro does have an above-average employment concentration in mining (location quotient=3.774), but in Las Vegas the industry is not concentrated (location quotient=0.367). Wages in *Mining* are very high, with average annual pay of $94,568 (compared to a state average of $48,077). Nevada's mining industry is diverse, but over two-thirds of *Mining* sub-cluster employment is in the highly concentrated industry (location quotient=70.046) of *Gold Ore Mining (NAICS 212221)*, which employs 9,349 workers. This is followed by *Support Activities for Metal Mining (NAICS 213114)*, with 1,945 jobs, and *Copper Ore and Nickel Ore Mining (NAICS 212234)*, with 648 employees.

Metals is the second largest *Mining & Materials* sub-cluster with 3,440 workers, and includes foundries, forging, metal manufacturing, and other related activities. The industry has a very low concentration in the State of Nevada, with a location quotient of 0.384. The industry is slightly more concentrated in Reno/Carson City (location quotient=0.799), and very low in Las Vegas (location quotient=0.250). Wages in the *Metals* sub-cluster are high, with average annual pay of $60,647. The *Metals* sub-cluster is comprised of 39 different NAICS codes, the three largest (in terms of employment) of which are: *Sheet Metal Work Manufacturing (NAICS 332322)* with 824 jobs; *Ornamental and Architectural Metal Work Manufacturing (NAICS 332323)* with 564 jobs; and *Primary Smelting and Refining of Nonferrous Metal, except Copper and Aluminum (NAICS 331419),* employing 488 workers.

State of Nevada *Mining & Materials* Sub-cluster Employment, 2011



Plastics, Resin, & Rubber employs 2,997 workers in Nevada, representing 12.5% of employment in the *Mining & Materials* cluster. The industry is far less concentrated than the national average in Nevada (location quotient=0.490), as well as in the Reno/Carson City (location quotient=0.789) and Las Vegas (location quotient=0.417) metro areas. Wages in *Plastics, Resin, & Rubber* are roughly equal to state average pay, with annual earnings per worker of $48,380. Plastics industries comprise a large portion of employment in the sub-cluster, with the three largest NAICS as follows: *All Other Plastics Product Manufacturing (NAICS 326199)* with 1,041 workers; *Plastics Bag and Pouch Manufacturing (NAICS 326111)* with 798 workers; and *Plastics Pipe and Pipe Fitting Manufacturing (NAICS 326122)*, with 294 jobs.

Construction, Industrial, & Other Materials accounts for 11.7% of *Mining & Materials* employment in Nevada, with 2,805 jobs across 174 establishments. The sub-cluster is slightly less concentrated than the national average in Nevada (location quotient=0.811) and in the two major metro areas. Wages in the *Construction, Industrial, & Other Materials* sub-cluster are generally high, with an average annual pay of $62,846. The *Construction, Industrial, & Other Materials* industry includes 27 different NAICS codes, with the highest number of jobs in the following: *Ready-Mix Concrete Manufacturing (NAICS 327320)*, with 891 jobs; *Other Concrete Product Manufacturing (NAICS 327390)*, employing 465 workers; and *Gypsum Product Manufacturing (NAICS 327420)*, accounting for 385 jobs and with a location quotient of 4.890. Note that all of these segments are related to the construction industry, which has been a driver for much of Nevada's manufacturing activities during the state's housing and economic boom period.

State of Nevada *Mining & Materials* Sub-Cluster Industry Data, Q2 2011										
	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Chemicals	872	350	396	0.284	0.501	0.182	35	20	12	$90,060
Metals	3,440	1,628	1,584	0.384	0.799	0.250	197	66	102	$60,647
Plastics, Resin, & Rubber	2,997	1,098	1,807	0.490	0.789	0.417	87	39	41	$48,380
Constr., Industr., & Other Mat.	2,805	697	1,857	0.811	0.885	0.758	174	37	109	$62,846
Packaging Materials	122	62	60	0.277	0.618	0.192	5	2	3	$51,303
Mining	13,678	1,151	363	10.205	3.774	0.383	248	69	26	$94,568
Total Cluster	**23,914**	**4,986**	**6,067**	**1.023**	**0.937**	**0.367**	**746**	**233**	**293**	**$79,794**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

Chemicals accounts for 872 jobs in Nevada, approximately 3.6% of the state's *Mining & Materials* cluster. The *Chemicals* sub-cluster has a very low concentration in Nevada (location quotient=0.284). The sub-cluster is slightly more concentrated in the Reno/Carson City metro area, but still has a location quotient of only 0.501 in that region. Wages are very high in the *Chemicals* sub-cluster, with annual average pay of $90,060. The NAICS codes in *Chemicals* with the highest employment in Nevada are *Paint and Coating Manufacturing (NAICS 325510)*, with 181 jobs, and *All Other Basic Inorganic Chemical Manufacturing (NAICS 325188)*, with 143 jobs.

Packaging Materials accounts for only 0.5% of *Mining & Materials* employment, with 122 jobs. The sub-cluster has a very low concentration in Nevada (location quotient=0.284) and Las Vegas (location quotient=0.182), and is moderately un-concentrated in Reno/Carson City (location quotient=0.618). Wages in *Packaging Materials* are very slightly above the state average, at $51,303 per worker per year. Nearly all of Nevada's employment in this sub-cluster falls in the *Coated and Laminated Paper Manufacturing* NAICS (322222), with 122 jobs.

MINING & MATERIALS SUB-CLUSTER TRENDS

Nevada's *Mining & Materials* industry cluster has experienced a net decline in employment over the past five years (2006-2011), contracting at an average annual rate of -3.85%. Job losses were concentrated in the *Construction, Industrial, & Other Materials*; *Metals*; and *Plastics, Resin, & Rubber* sub-clusters, both in Nevada and the two major metro areas. Las Vegas also saw a substantial decrease in *Mining* employment over this period, as well as smaller declines in *Chemicals* and *Packaging Materials* sub-clusters. In Nevada overall, as well as the Reno/Carson City metro

area, employment in *Mining* and *Packaging Materials* grew, even as these sub-clusters declined nationally.

According to EMSI projections, the *Mining & Materials* cluster in Nevada is expected to grow in the coming five years (2011-2016), at an average annual rate of 1.65%. Much of this net growth is expected to occur in the *Mining* sub-cluster, and only the *Packaging Materials* sub-cluster is expected to contract over the next five years in Nevada. The *Mining & Materials* cluster in Reno/Carson City is expected to grow at an average annual rate of 0.83% over the next five years, driven largely by growth in the *Mining* and *Chemicals* sub-clusters. The *Mining & Materials* cluster in Las Vegas is also projected to grow, at an average annual rate of 1.36%, driven by growth in the *Plastics, Resin, & Rubber* sub-cluster.

While the growth and contraction of different segments of the *Mining & Materials* cluster are distributed across a large number of businesses and activities, some industries have experienced particularly dramatic expansion and contraction in Nevada over the past five years. Within the *Construction, Industrial, & Other Materials sub-cluster*, the NAICS code *Ready-Mix Concrete Manufacturing (327320)* lost 1,611 jobs (-18.66% CAGR) from 2006-2011. The NAICS codes with the highest net additions of jobs in Nevada were: *Gold Ore Mining (NAICS 12221)*, adding 769 jobs (CAGR=1.73%); *Support Activities for Metal Mining (NAICS 213114)*, adding 731 jobs (CAGR=9.89%); and *Plastics Bag and Pouch Manufacturing (NAICS 326111)*, adding 538 jobs (CAGR=25.14%).

State of Nevada *Mining & Materials* Sub-Cluster Industry Growth Rates

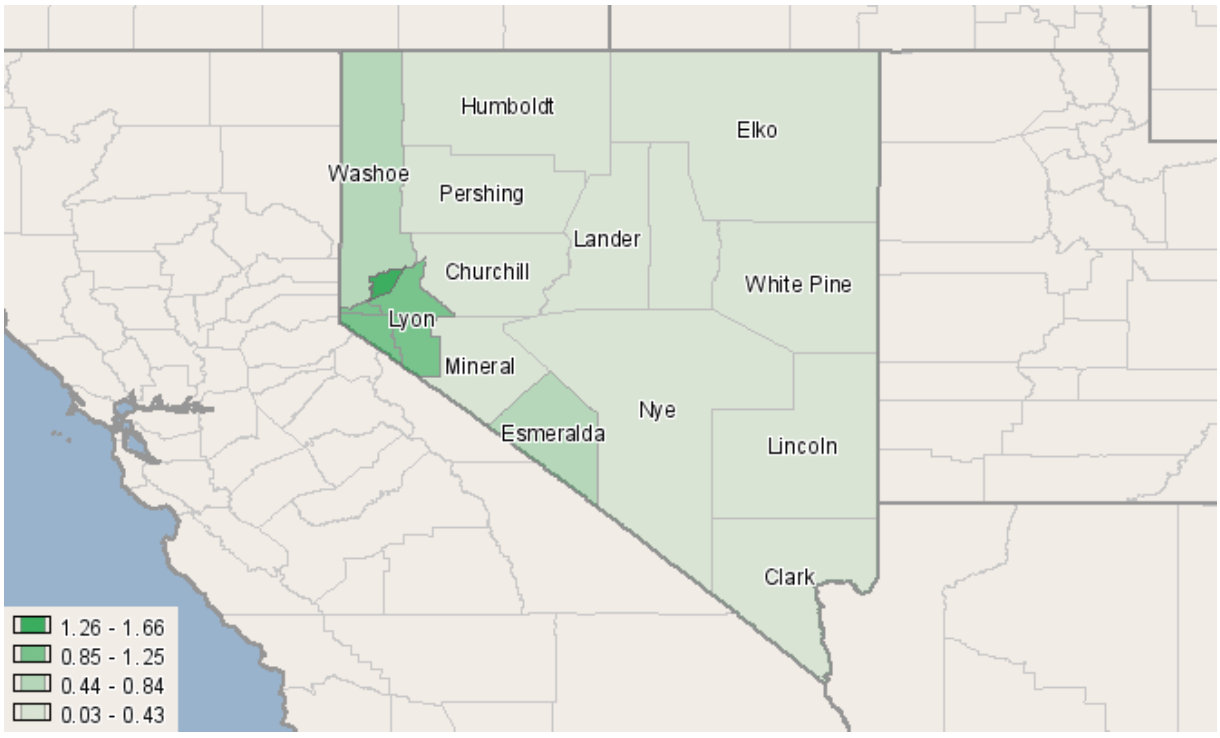
	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Chemicals	-0.30%	0.70%	-2.13%	-2.36%	2.40%	4.44%	0.10%	-0.76%
Metals	-7.58%	-8.94%	-5.20%	-3.97%	0.60%	0.52%	0.71%	-0.80%
Plastics, Resin, & Rubber	-7.30%	-10.04%	-5.67%	-4.42%	2.23%	-0.50%	3.88%	-1.33%
Constr., Industrial, & Other Materials	-14.80%	-11.17%	-16.86%	-6.10%	0.58%	0.74%	0.25%	-0.84%
Packaging Materials	1.01%	4.40%	-0.97%	-1.98%	-1.35%	-0.99%	-1.37%	-1.01%
Mining	2.04%	1.38%	-5.04%	-0.33%	1.96%	1.45%	-1.83%	0.01%
Total Cluster	**-3.85%**	**-7.05%**	**-9.76%**	**-4.00%**	**1.65%**	**0.83%**	**1.36%**	**-0.89%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

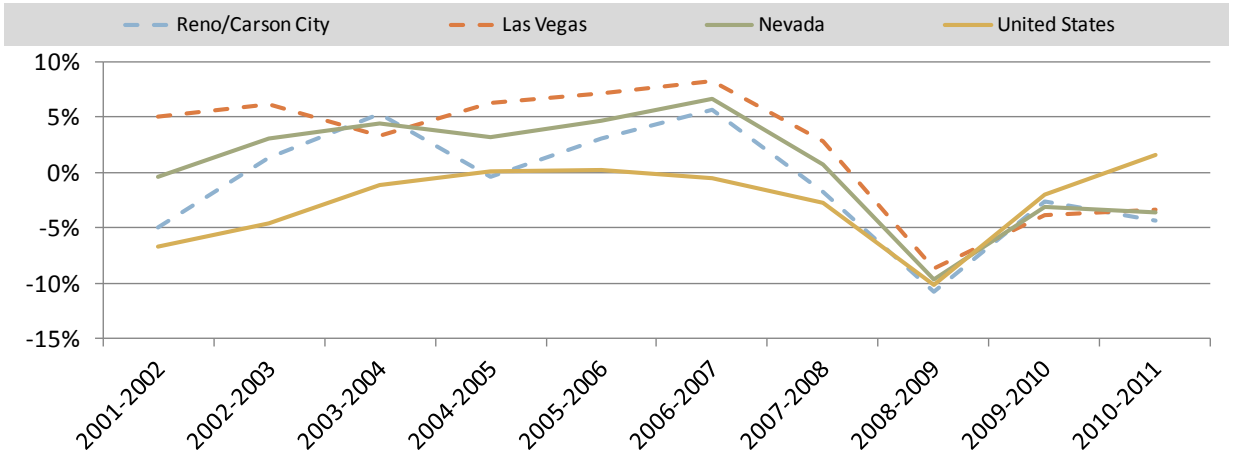
B. INDUSTRY PROFILE IN NEVADA – *MANUFACTURING*

The State of Nevada's *Manufacturing* cluster employs 23,429 workers across 1,135 establishments, generally in high-wage jobs. The overall concentration of *Manufacturing* employment is relatively low in the State of Nevada compared to the national average (0.465 location quotient), though in the Reno/Carson City metro area it is roughly on-par with the U.S. overall (0.972 location quotient). As illustrated by the chart on the following page, employment in Nevada's *Manufacturing* cluster posted positive growth during the economic expansion of 2002-2007, significantly outpacing U.S. growth rates. However, the *Manufacturing* industry cluster contracted dramatically during the recent recession (2007-2009) in Nevada, and has not yet recovered. The *Manufacturing* industry cluster is expected to grow over the next five years (2011-2016) in Nevada, at an annual rate of +2.04%, while the cluster is expected to decline slightly at the national level. Wages in *Manufacturing* are relatively high in Nevada, with average annual pay at $69,152 per worker.

Concentration of Jobs in the Nevada *Manufacturing* Cluster, 2011
Map of location quotients by county



State of Nevada *Manufacturing*
Annual Employment Growth Rates, 2001-2011

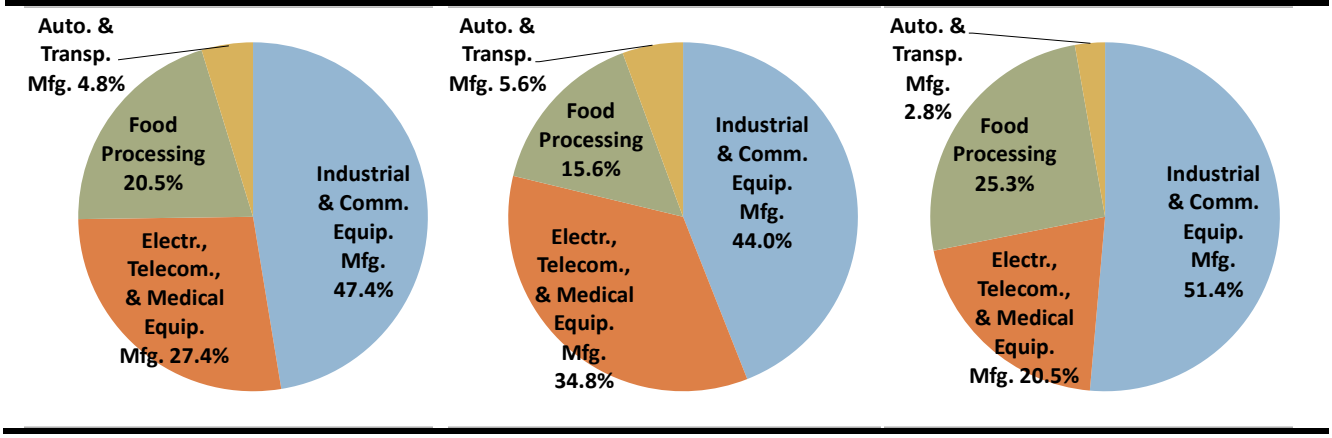


MANUFACTURING SUB-CLUSTERS

Industrial & Commercial Equipment Manufacturing makes up nearly half of Nevada's employment in the *Manufacturing* industry cluster, with 11,109 jobs across 407 establishments. While employment in the sub-cluster is not highly concentrated overall in the state (location quotient=0.819), the employment concentration in the Reno/Carson City metro area is well above the national average (location quotient=1.588). Wages in *Industrial & Commercial Equipment Manufacturing* are high, at $69,152 in average annual pay (compared to the state average of $48,077). Consisting of more than sixty NAICS codes, *Industrial & Commercial Equipment Manufacturing* includes a diverse array of businesses and activities in Nevada. The largest of these are *All Other Miscellaneous Manufacturing (NAICS 339999)*, employing 5,489 workers, and *Sign Manufacturing (NAICS 339950)*, with 1,333 jobs.

Electronics, Telecommunications, & Medical Equipment Manufacturing employs 6,413 workers in the state, accounting for 27.4% of all *Manufacturing* cluster employment in Nevada. Employment concentration is low in Nevada's *Electronics, Telecommunications, & Medical Equipment Manufacturing* sub-cluster compared to the United States overall (location quotient=0.420), though it is slightly above the national average in Reno/Carson city (location quotient=1.114). Sub-cluster wages are high, with an average annual pay of $62,232 – well above the state average wage. *Electronics, Telecommunications, & Medical Equipment Manufacturing* includes employment from forty-five different NAICS codes, the largest of which (in terms of employment) are: *Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers (NAICS 423450)*, with 966 workers; *Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables (NAICS 334513)*, with 836 workers; and *Computer and Office Machine Repair and Maintenance (NAICS 811212)*, with 661 jobs.

State of Nevada *Manufacturing* Sub-cluster Employment, 2011



Food Processing employs 20.5% of Nevada's *Manufacturing* workforce, with 4,792 workers across 178 establishments. The concentration of employment in this sub-cluster is very low in Nevada (location quotient=0.357), as well as in the two major metro areas. Wages in Nevada's *Food Processing* sub-cluster are roughly on-par with average state wages, with an annual average income of $48,917 per worker. Leading NAICS codes (by employment) in Nevada include: *Commercial Bakeries (NAICS 311812)*, with 926 workers; *Ice Cream and Frozen Dessert Manufacturing (NAICS 311520)*, with 491 employees; and *Retail Bakeries (NAICS 311811)*, with 484 jobs.

State of Nevada *Manufacturing* Sub-Cluster Industry Data, Q2 2011

	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Food Processing	4,792	1,740	2,883	0.357	0.569	0.303	178	41	109	$48,917
Automotive & Transp. Mfg.	1,115	626	316	0.137	0.339	0.055	53	26	8	$57,218
Electr., Tel., & Medical Equip. Manufacturing	6,413	3,873	2,331	0.420	1.114	0.216	497	172	295	$62,232
Industrial & Commercial Equip. Mfg.	11,109	4,905	5,846	0.819	1.588	0.609	407	164	189	$83,072
Total Cluster	**23,429**	**11,144**	**11,376**	**0.465**	**0.972**	**0.319**	**1,135**	**403**	**601**	**$69,152**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

Automotive & Transportation Manufacturing employs 1,115 workers in Nevada, about 4.8% of the state's *Manufacturing* jobs. Nevada's employment concentration in this sub-cluster is extremely low (location quotient=0.137), and *Automotive & Transportation Manufacturing* is not concentrated in either of the state's major metro areas. Wages in the sub-cluster are high, with average annual pay of $57,218. The largest NAICS clusters in *Automotive & Transportation Manufacturing*, in terms of employment, are: *Motorcycle, Bicycle, and Parts Manufacturing (NAICS 336991)* and *Gasoline Engine and Engine Parts Manufacturing (NAICS 336312)*, with 136 and 110 workers, respectively.

MANUFACTURING SUB-CLUSTER TRENDS

The *Manufacturing* cluster has contracted over the past five years (2006-2011) in Nevada and its two major metro areas, as well as nationally. The only *Manufacturing* sub-cluster to experience positive growth over this period in Nevada was *Food Processing* (+0.61% CAGR). Reno/Carson City saw growth of +3.42% CAGR in *Food Processing*, and in Las Vegas *Electronics, Telecommunications, & Medical Equipment Manufacturing* grew at +1.07% CAGR (though it declined in the state overall). While the *Manufacturing* industry has suffered job losses in recent years, the cluster is expected to grow in Nevada from 2011-2016, at a rate of +2.04% (CAGR). Projected growth is also positive for all *Manufacturing* sub-clusters in Nevada, while in the United States each of these sub-clusters is expected to decline.

State of Nevada *Manufacturing* Sub-Cluster Industry Growth Rates

	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Food Processing	0.61%	3.42%	-0.18%	-0.45%	1.32%	2.07%	1.37%	-0.10%
Automotive & Transportation Mfg.	-6.40%	-10.27%	-5.44%	-6.77%	0.27%	-1.38%	3.59%	-1.78%
Electronics, Telecomm., & Medical Equipment Mfg.	-0.16%	-0.99%	1.07%	-1.90%	2.32%	2.05%	2.81%	-0.69%
Industrial & Comm. Equipment Mfg.	-3.36%	-4.85%	-2.18%	-3.51%	2.34%	0.98%	3.24%	-1.24%
Total Cluster	**-1.94%**	**-2.89%**	**-1.17%**	**-2.87%**	**2.04%**	**1.40%**	**2.70%**	**-0.85%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

C. MARKET TRENDS

MARKET OVERVIEW

The ***Mining*** industry is defined as activities involving the extraction of valuable geological minerals from the earth (excluding oil and gas) that are critical raw materials that feed the manufacturing, construction, and energy industries. Generating approximately $435 billion in revenue in 2010,[213] this industry can be divided into four primary segments: coal mining made up the largest share of U.S. economic output by this industry with 36% of revenues in 2008, followed by non-metallic minerals mining at 30%, metal ore mining at 27%, and mining support activities at 7%. The mining industry also directly employs approximately 564,400 employees in more than 15,000 operations,[214] with coal, metal ore, and non-metallic mineral mining comprising 31%, 16%, and 47% of the industry's employment levels respectively. On average, a miner makes a base annual salary of $64,000, with coal and metal ore miners making well over the industry average and non-metallic mineral miners making well below it.[215]

The largest downstream market for mining has been primary metals manufacturers and construction companies, who purchased $14.8 billion and $9.8 billion worth of mined outputs (e.g., vanadium, iron ore, and zinc), respectively, in 2008. Given that electricity generation accounts for more than 90% of coal use,[216] utilities also represent a major downstream market for the mining industry, purchasing around $7.9 billion worth of mined products. Furthermore, while Texas, California, and Pennsylvania are the states with the highest levels of absolute employment in the industry by far, they are not as dependent on the mining industry as other states. As a share of total state employment, the mining industry is the largest in Wyoming with 8.6%, followed by 6.6% in West Virginia, 3.8% in Montana, 3.2% in Nevada, and 2.9% in Kentucky.[217]

Although it has been shrinking in recent years, ***Manufacturing*** still constitutes a significant industry in the United States. *Manufacturing* is defined as the production of a wide range of goods ranging from intermediate products such as metals, chemicals, materials, and industrial equipment, to more complex, end-user products such as food, apparel, electronics, appliances, and automobiles. In addition to its upstream linkages with the *Mining* industry, *Manufacturing* is a broad industry with downstream connections to agriculture, construction and real estate, energy, financial services, professional services, transportation and distribution, and wholesaling. Establishments in this sector can range from mass-producing plants, factories, or mills that use machinery and materials-handling equipment, to small producers or "mom and pop" operations such as bakeries and custom tailors. In

[213] PricewaterhouseCoopers, *Mine 2011 The game has changed: Review of global trends in the mining industry*, 2011.
[214] Direct effects include economic activity from mine operations, mine operation support, and transportation companies that carry mining outputs to downstream markets. Estimates for indirect effects would be larger because it includes economic activity from suppliers of capital goods for mining operations.
[215] PricewaterhouseCoopers, *The Economic Contributions of U.S. Mining in 2008*, National Mining Association, October 2010.
[216] IBISWorld, *IBISWorld Industry Report 21211: Coal Mining in the U.S.*, June 2011.
[217] PricewaterhouseCoopers, *The Economic Contributions of U.S. Mining in 2008*, National Mining Association, October 2010.

2009, this industry employed 11.8 million workers, generated 11% of U.S. GDP ($1.57 trillion), and accounted for 57% of U.S. exports.[218] The average annual wage for the U.S. manufacturing industry in 2009 was $44,560.[219]

MARKET DYNAMICS AND TRENDS

Every year, each individual American consumes nearly 40,000 pounds of newly mined materials through electricity usage and purchases of a host of different products. Meanwhile, the emergence of fast-developing nations such as China, India, Brazil, and Indonesia has also created a new middle class of consumers demanding primary resources, causing mineral supplies to become increasingly stretched as the identification and production of minerals have not matched the growth rate of new consumer demand. As a result, mining companies have been exploring more remote, unfamiliar, and sometimes politically uncertain areas to secure new mineral supplies. The situation is also exasperated by the shortage of skilled labor, growing complexity of development projects, and government involvement (i.e., taxation/royalties and regulations), all of which have contributed to recent increases in commodity prices.

Despite these concerns, PricewaterhouseCoopers reports that mining companies are confident in the future of the industry.[220] The mining industry has grown at a double-digit rate in terms of industry revenue since 2002, with a brief drop in revenue in 2009. The economic recession depressed consumer incomes and business revenues, causing industry revenues to fall by 6.9%, from $349 billion in 2008 to $325 billion in 2009. However, with the United States expected to recover economically and with the emergence of new international markets, industry revenues roared back up to $435 billion in 2010, a more than 33% increase from the previous year. In addition, as a sign of good things to come, nearly $300 billion was spent on capital investments to build new mines and expand existing ones in 2011, up from $120 billion in 2010.[221] Going forward, the National Mining Association projects the need for 55,000 additional miners to fulfill the minerals demand over the next 5-10 years and replace the retiring mining employees.

Another important market trend is that numerous downstream companies are moving to vertically integrate their operations with their upstream suppliers. Over the past 30 years, mining companies were able to dictate prices over their more fractured downstream markets. But as the demand pool has increased, securing stable supplies of increasingly scarce mining assets has grown in importance, even higher in priority than costs. Metals manufacturers and power producers have been recently acquiring upstream assets (or have entered off-take agreements) to exert greater control over their production input prices, while leaving themselves some resources to explore additional sources of

[218] U.S. Bureau of Labor Statistics, *B-1 Employees on nonfarm payrolls by major industry sector, 1961 to date*.
[219] U.S. Bureau of Labor Statistics, *May 2009 National Industry-Specific Occupational Employment and Wage Estimates: Sectors 31, 32, and 33-Manufacturing*.
[220] PwC's *Mine 2011* report surveyed the top 40 mining companies (in terms of market capitalization) in the world to draw industry-wide estimates and projections.
[221] PricewaterhouseCoopers, *Mine 2011 The game has changed: Review of global trends in the mining industry*, 2011.

raw materials. Although, looking closer, these downstream customers have mostly acquired undeveloped tier 2 and tier 3 assets, suggesting that these companies are more interested in acquiring the infrastructural assets to ensure supply rather than acquiring the actual mining operation. On the other hand, there are some potential limitations to this increased M&A activity, such as overstretched management overseeing an increasingly complex organization, decreased flexibility to react to changing market conditions, and diversion of capital away from business expansion opportunities.[222]

Since manufacturers are the largest downstream markets for the *Mining* industry, the *Manufacturing* industry's market dynamics and trends are also important to the success of mining firms. The U.S. manufacturing industry has contracted significantly over the past 30 years as the national economy has become more service-oriented, as manufacturing operations have moved offshore, and as productivity has grown. Since its peak employment level of 19.4 million workers in 1979, the U.S. manufacturing industry has lost approximately 7.5 million jobs over the subsequent 30 year period.[223] Manufacturing's share of U.S. GDP has also declined significantly, falling from 50% of GDP in 1950, to 15% in 1999, and to 11% in 2009.[224] Foreign competition from emerging economies has contributed to the decline in domestic manufacturing by offering lower costs. Between 1999 and 2007, the growth of imported manufactured goods outpaced that of manufactured exports – with imports growing by $692 billion (78%), versus exports growing by $334 billion (58%), during that time period.[225]

In the short-term, the U.S. manufacturing industry has also taken a significant hit from the recent economic recession. Because the broad industry is a function of consumer and corporate spending, it is extremely sensitive to business cycles – it contracts during recessions and booms during periods of growth. Furthermore, according to a 2008 Congressional Budget Office (CBO) analysis, there are concerns of structural unemployment trends rather than cyclical ones, since recent job losses in the manufacturing industry have led to longer spells of unemployment and greater loss of income than in previous eras. The CBO cites rapid gains in productivity and increased competition from foreign producers as long-term trends that will continue to affect the industry's employment outlook.

Despite the overall decline of manufacturing employment in the United States, there are signs of recovery in the immediate aftermath of the recession and potential growth opportunities in the long-run. In addition, a growing number of U.S. manufacturing companies are considering re-shoring production, especially those in high-precision manufacturing. According to a quarterly MFG.com survey, 25% of North American manufacturers reported in Q4 FY10 that their company has re-shored production back to North America, up significantly from Q1 FY10 (12%). Looking forward,

[222] Ibid.
[223] U.S. Bureau of Labor Statistics, *B-1 Employees on nonfarm payrolls by major industry sector, 1961 to date*.
[224] U.S. Bureau of Economic Analysis.
[225] CBO, *Economic and Budget Issue Brief: Factors Underlying the Decline in Manufacturing Employment Since 2000*, December 2008.

32% of survey respondents indicated that they will explore moving production back to the United States over the next three months.[226]

MARKET TRENDS IN SELECTED SUB-SECTORS

LITHIUM MINING

Lithium is a soft, silver metal that is mined from continental brines or hard-rock ores and is sold as brines, compounds, metals, or mineral concentrates based on its end use, which include lubricating greases, air treatment, continuous casting, rubber and thermoplastics, and pharmaceuticals. Ceramics and glass manufacturing has traditionally been and currently still is the leading end-use of lithium, constituting 31% of U.S. lithium consumption in 2009. Historically, primary aluminum production was also one of the dominant downstream markets for lithium, but its share of lithium consumption has fallen in 2009 to 6% of U.S. lithium consumption. Comprising 23% of U.S. lithium consumption in 2009, batteries are the downstream application of lithium with the greatest potential going forward. Lithium-ion batteries represent nearly 75% of portable rechargeable batteries, while global sales for rechargeable batteries are projected to increase by 13% annually, from $7.7 billion in 2009 to nearly $12 billion in 2013, after having grown by more than 20% per year over the past few years.[227] However, despite strong overall industry growth figures, the lithium mining industry does not employ a significant number of people; in the United States, the industry employed 68 people from 2007-2010.

The high demand for electronics, portable devices, and hybrid electric vehicles has underscored the need for high-tech companies to secure a steady and sufficient supply of lithium materials to manufacture these products. Chile and Australia are the leading producers of lithium, each constituting around 35% of world production, followed by China (18%) and Argentina (11%).[228] The United States mostly produces value-added lithium materials and lithium carbonate from its brine operations in Nevada.[229] As one of the world's top destination end-use markets for lithium materials and compounds, the United States is a high net importer, relying on imports for nearly 50% of its domestic lithium consumption. Lithium concentrates, which are extracted from ores and used to manufacture ceramics and glass, are not produced in the United States and are therefore imported, mostly from South America. On the other hand, lithium carbonates, which are consumed in industrial applications and used as a raw material in other lithium compounds, are extracted mostly from subsurface brines in Nevada, though the United States does import some from major brine operations in Chile and Argentina.

[226] MFG.com, *MFGWatch Quarterly Survey of North American Manufacturers*, January 2011.
[227] USGS, *2009 Minerals Yearbook: Lithium*, 2009.
[228] USGS, *Mineral Commodities Summary: Lithium*, January 2011.
[229] U.S. lithium production data was withheld because only one company (Chemetall Foote Corporation) responded to the USGS survey. Data for lithium is also difficult to measure because lithium is combined with a number of other compounds.

Due to depressed consumer demand during the recession, lithium consumption and production fell significantly both in the United States and worldwide from 2008-2010. Lithium (metal equivalent) consumption in the United States dropped from 2,500 metric tons in 2006 to 1,000 metric tons in 2010 (representing a 60% drop).[230] On the positive side, worldwide lithium resource exploration doubled during the height of the recession in 2008-2009, in anticipation of an imminent economic recovery. Worldwide, there are an estimated 33 million tons of identified lithium resources, with nearly 4 million tons in the United States. South America (i.e., Bolivia, Chile, Argentina, and Brazil) represents the highest potential market with approximately 20 million tons of lithium identified, followed by China with 5.4 million tons available. Furthermore, with consumer incomes expected to increase, worldwide consumption of lithium is also expected to rise by 48% from 2009-2013. In 2010, approximately 25,300 metric tons of lithium were mined and produced, up from 18,800 metric tons the previous year.[231]

Advances in nanotechnology should continue to push the industry's rapid growth going forward. Already, research is being conducted in nanotechnologies that alter nanostructures of the anodes and cathodes inside lithium-ion batteries, which demonstrate significant gains in a battery's storage capacity, output power, lifespan, and stability, while decreasing time needed to recharge. The results are already showing dividends in applications using lithium-ion batteries. These reengineered lithium-ion batteries enable greater acceleration in hybrid-electric vehicles (HEVs) than in HEVs using other types of batteries. Power tools also demonstrate ten times greater power using nanotechnology-enabled lithium-ion batteries, leading to wider adoption of lithium-ion batteries over the previously used nickel-cadmium batteries.[232]

Lithium-ion batteries in hybrid electric vehicles, plug-in hybrid electric vehicles, and electric vehicles should also become one of the leading drivers for the worldwide expansion of this industry, but its growth will depend heavily on government assistance in the early stages of research and development. In 2009, most lithium-ion batteries were manufactured in Asia, with Japan manufacturing 39% of the global share, China with 36%, and South Korea with 20%.[233] To move the United States ahead in battery manufacturing, the American Recovery and Reinvestment Act of 2009 made available $1.5 billion in grants and awards to develop battery manufacturing for electric-drive vehicles and battery recycling operations. The stimulus program also included funds for Smart Grid demonstration and other energy storage projects. Likewise, the Department of Energy's Advanced Technology Vehicles Manufacturing Incentive Program also provides loans to cultivate battery manufacturing for next-generation vehicles. As a result, industry partnerships between automobile and battery manufacturers have significantly increased to ramp up production of batteries. Despite the limited release of lithium-ion batteries in hybrid vehicles in 2009, almost every major automobile manufacturer was scheduled to release a few lines of vehicles powered by

[230] Ibid.
[231] USGS, *Mineral Commodities Summary: Lithium*, January 2011.
[232] USGS, *2009 Minerals Yearbook: Lithium*, 2009.
[233] Ibid.

lithium-ion batteries in 2010. With these government incentives and continued advances in battery technology, the worldwide market for lithium-ion batteries for transportation is expected to increase exponentially from $876 million in 2010 to $8 billion in 2015.[234]

VANADIUM MINING

Vanadium mining consists of the production of ferrovanadium (FeV), vanadium pentoxide (V_2O_5), vanadium metal, vanadium chemicals, and vanadium-bearing alloys recovered from industrial materials, such as petroleum residues, spent catalysts, utility ash, and pig iron slag. Vanadium is usually a byproduct or co-product drawn significantly from bauxite and carboniferous materials like coal, crude oil, oil shale, and tar sands. To a lesser extent, usually comprising less than 2% of the entire rock, vanadium also occurs in deposits of phosphate rock, titaniferous magnetite, and uraniferous sandstone and siltstone.

Vanadium in the form of FeV is primarily used as a hardening agent for iron and steel to ensure material strength and toughness, particularly in the United States where 97% of all vanadium consumption serves metallurgical applications.[235] Consequently, the vanadium industry is heavily influenced by steel production, which has applications in construction, energy, aerospace, and automotives. Vanadium is also used for non-metallurgical purposes primarily as a catalyst for production of maleic anhydride and sulfuric acid, but it also has applications in ceramics, electronics, and vanadium chemicals. In addition, though vanadium recycling constitutes a very small percentage of total vanadium production, vanadium recovery from industrial waste materials is the leading source of vanadium production for the United States.

The performance of the vanadium mining industry is affected primarily by downstream demand rather than by vanadium supply. With more than 63 million tons in identified vanadium resources and 13 million metric tons in vanadium reserves, the world has enough vanadium to meet vanadium demand for the next century at current consumption rates.[236] Therefore, because vanadium feeds the steel industry, vanadium consumption and production fell as steel output declined by 8% from 2008-2009 during the recession. Reduced demand for steel applications in construction, aerospace, high-speed drilling, power plants, rail cars, and automobiles caused worldwide vanadium production to fall by 7.5%, from 58,500 metric tons in 2007 to 54,100 metric tons in 2009. U.S. vanadium consumption also fell slightly from 5,170 metric tons in 2008 to 5,000 metric tons in 2009, though it recovered slightly in 2010.[237] Moreover, there were no major production facilities built in 2009, and the redevelopment of Windimurra Mine was cancelled as a result of the recession. According to the World Steel Association, however, steel production is projected to increase by 8% in 2010 and 6% in 2011, leading to a recovery in vanadium mining activities.

[234] Ibid.
[235] USGS, *Mineral Commodities Summary: Vanadium*, January 2011.
[236] Ibid.
[237] USGS, *2009 Minerals Yearbook: Vanadium*, 2009.

The major vanadium producing nations are China, South Africa, and Russia, which are responsible for 41%, 32%, and 25% of vanadium production in the world, respectively. Meanwhile, with only seven vanadium mining companies in the United States, domestic vanadium production levels are withheld to avoid disclosing company proprietary data. The United States also relies heavily on imports for its vanadium consumption, with 69% of apparent U.S. consumption coming from imports in 2010. The United States imports 38% of FeV from South Korea, 30% from the Czech Republic, 20% from Canada, and 9% from Austria, while it imported 39% of V_2O_5 from South Africa, 32% from Russia, and 28% from China. In 2010, vanadium exports from the United States were valued at $25.2 million and imports at $29.7 million.[238]

The global quest for fuel efficiency and effective battery technologies represent growth opportunities for this industry. As commercial aircrafts, rail cars, and automobiles aim to improve their fuel efficiency with lighter-weight vehicles, different applications of vanadium and other materials are being explored in the microalloy and low-alloy metals used to construct them. In addition, the vanadium redox battery (VRB), currently in the early stages of commercialization, presents another growth opportunity. Its high-capacity, flexible battery storage technology is well-suited for applications with high variability in energy flows. Consisting of an assembly of power cells with two vanadium-based electrolytes separated by a proton exchange membranes, VRBs have nearly unlimited capacity, can be left completely discharged for long periods of time with no ill effects, can be recharged by simply replacing an electrolyte, suffer no permanent damage if electrolytes are accidentally mixed, and have the least ecological impact among all energy storage technologies.[239]

COMPOSITES MANUFACTURING

Composites are broadly defined as the combination of two or more different materials to enhance the new material's properties (e.g., lighter in weight, non-corrosive, non-conductive, flexible and durable, and low maintenance). In general, there are two major classes of composite materials: resins accounted for $8.8 billion and fibers accounted for $7.7 billion in 2011. As a superior input with more than 30,000 product applications, the composites industry serves a diverse range of downstream end-uses. The marine industry accounts for the highest share of composite material purchases at 68%, followed by wind energy at 38%, aerospace at 10%, and transportation at 10%. Other downstream markets include sporting equipment, building materials, body armor, and bridges.

As a whole, the global composite materials industry was valued at $17.7 billion in 2010, growing by 10.3% in revenues from the previous year. Continuing its robust growth trends, the composites industry is projected to grow by 7.8% annually from 2011-2016, to reach $27.4 billion in industry revenues. Prepregs (used in aerospace and renewable energy applications), unsaturated polyester

[238] USGS, *Mineral Commodities Summary: Vanadium*, January 2011.
[239] USGS, *2009 Minerals Yearbook: Vanadium*, 2009.

resins (used in wind energy and construction applications), and carbon fibers (used in commercial aircraft and sporting equipment) are all expected to grow by at least 10% annually from 2010-2015.[240][241][242] In addition, by 2016, the composite end-products are expected to reach $78 billion in revenues, up from $50.2 billion in 2011.[243]

The worldwide demand for composite materials declined during the economic recession as downstream customers struggled with depressed consumer spending. Decreasing by 3% annually from 2007-2009, the worldwide composites market fell from 8.1 metric tons in shipments in 2007 to 7.6 metric tons in 2009, though the industry is already beginning to show signs of recovery. Looking closer, however, the recession had an uneven impact in the different downstream market segments. While transportation, aerospace, and construction suffered, the wind energy market enjoyed over 30% growth annually from 2007-2009 in large part due to renewable energy policies.[244]

In addition, the global economic downturn caused a dramatic shift of power in this industry, as Asia surpassed North America as the worldwide industry leader. In 2007, North America represented 38% of the market's value, ahead of Asia at 32%, Europe at 23%, and the rest of the world at 6%. From 2007-2009, North America fell dramatically in terms of composite material shipments (by 8% CAGR), causing its world market share to drop to 34%. Meanwhile, Asia amassed 37% in world market shares in 2009 through an average annual growth rate of 4% in composites volume from 2007-2009.[245]

Lucintel predicts that the wind energy market (particularly that of China and to lesser extent that of Germany and the United States) will predominantly drive the growth of the composite materials market. Though China lacks the grid connectivity for its existing wind turbines, its wind energy market is projected to grow by 23% per year through 2015. The growth of composites technology in wind turbine blades is driven by the replacement of steel and aluminum inputs with far superior composite materials such as carbon fiber prepregs (a glass or carbon fiber reinforcement that is impregnated with epoxy resin), which are more cost-effective for very large-diameter blades, are lower in weight, and have greater stiffness and strength.[246] Going forward, the wind energy industry is moving toward larger turbines with longer blades to produce more energy while driving costs down. To meet those future demands, either wind blade manufacturers will need to change the blade design or the composite materials suppliers will need to develop composites with increased flexural stiffness.[247] In 2007, the wind blade manufacturing market was valued at $5.9 billion, but is

[240] Lucintel LLC, *The Global Prepreg Market 2010-15: Trend, Forecast and Opportunity Analysis*, August 2010.
[241] Lucintel LLC, *The Global Unsaturated Polyester Resin Market 2010-15: Trend, Forecast and Opportunity Analysis*, February 2010.
[242] Lucintel LLC, *Growth Opportunities in the Carbon Fiber Market 2010-15*, April 2010.
[243] Lucintel LLC, *Growth opportunities in global composites: 2016 and beyond*, Composites Technology, 1 April 2011.
[244] Ibid.
[245] JEC Composites, *Overview of the worldwide composites industry 2010-15*, 2010.
[246] Hexcel, *Hexcel's Composite Materials for Wind Turbine Blades*, May 2003.
[247] Wind Systems. *Composite Materials for Wind Blades*, September 2010.

projected to increase to $34 billion by 2017[248]; by extension, composite material manufacturers have an opportunity to supply these wind blade manufacturers with blades with superior material properties.

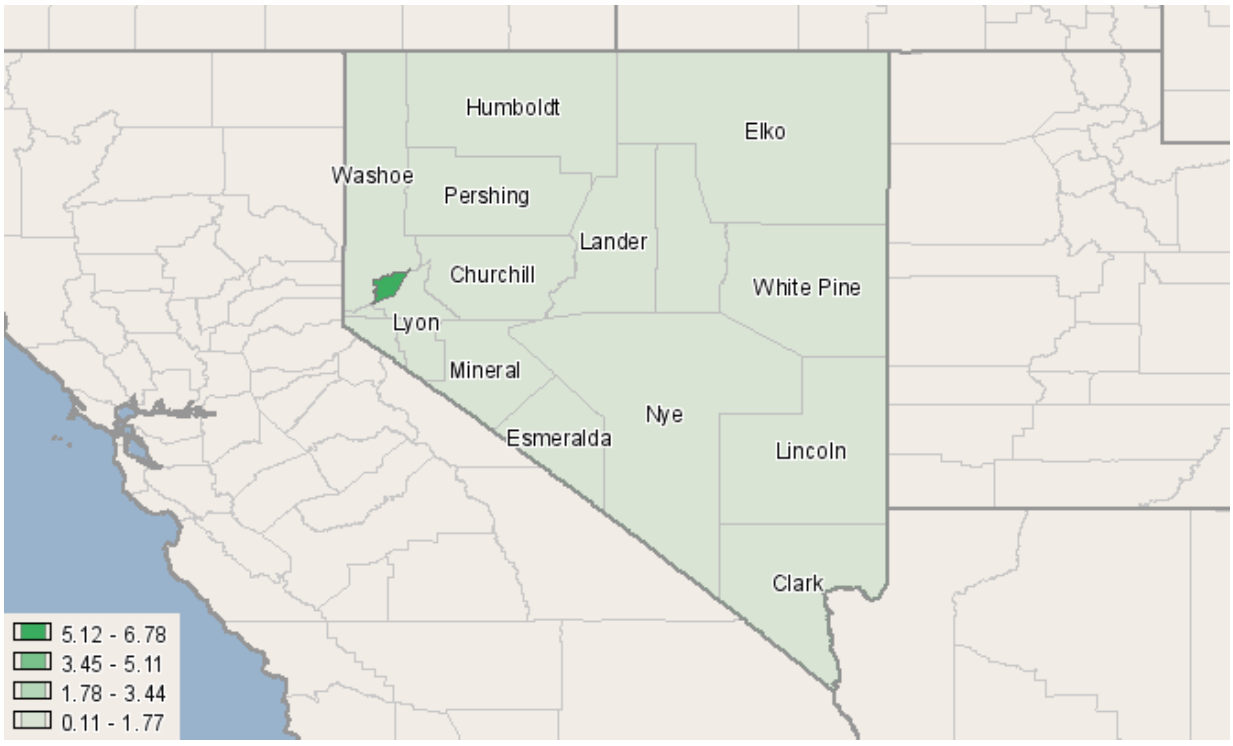
[248] Composites Technology, *Wind turbine blades: Big and getting bigger*, 1 June 2008.

APPENDIX F: LOGISTICS & OPERATIONS

A. INDUSTRY PROFILE IN NEVADA

The State of Nevada's *Logistics, Distribution, & Transportation*[249] cluster employs 85,653 workers across 6,848 establishments, generally in medium wage jobs. The concentration of employment in the *Logistics, Distribution, & Transportation* cluster is roughly on-par with the United States overall (location quotient=0.919), and is slightly higher in the Reno/Carson City metro area (location quotient=1.128) and slightly lower in the Las Vegas metro area (location quotient=0.869). As depicted in the chart below, the industry is most concentrated in Storey County (location quotient=6.74), followed by Lander (location quotient=1.52) and Washoe (location quotient=1.34) counties. Average annual pay in Nevada's *Logistics, Distribution, & Transportation* cluster is $56,974, well above the state average wage of $48,077.

Concentration of Jobs in the Nevada *Logistics, Distribution, & Transp.* Cluster, 2011
Map of location quotients by county

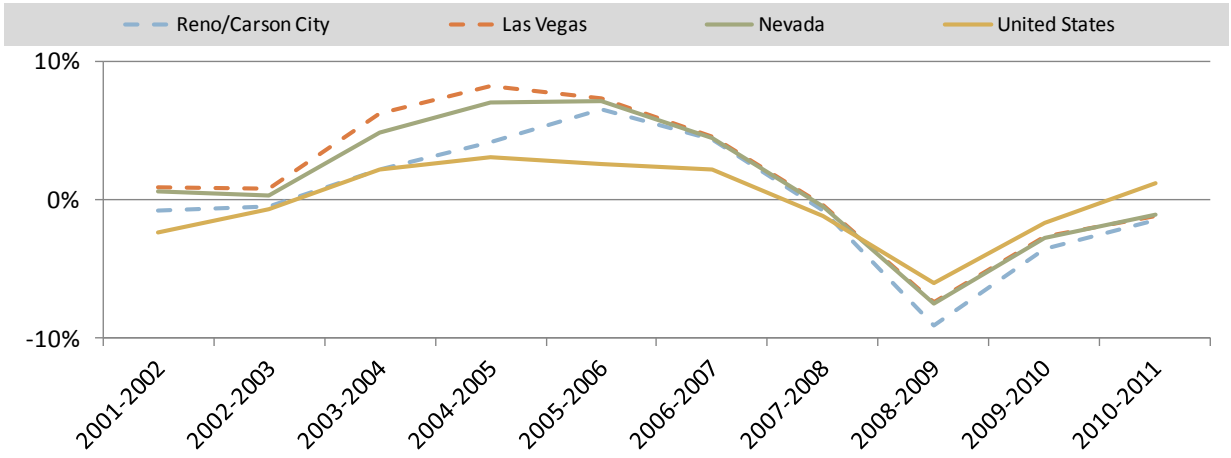


As illustrated in the chart on the following page, the *Logistics, Distribution, & Transportation* cluster experienced strong growth in Nevada during the 2002-2007 period of economic expansion, followed

[249] *Note:* As it is not possible to define and measure the "Related Manufacturing Operations" opportunity segment using standardized industry data, the industry-level presented here (and in *Section VIII.B* below) only covers the warehousing, distribution, logistics, and transportation (ground/air/water/rail) components of this industry.

by a sharp decline during the recent recession (2007-2009), and experienced a similar growth pattern in both the Reno/Carson City and Las Vegas metro areas. Nationally, over the same period, the *Logistics, Distribution, & Transportation* cluster underwent a similar cycle, but saw less growth during the 2002-2007 expansion and a slightly more moderate contraction during the recession (2007-2009).

State of Nevada *Logistics, Distribution, & Transportation*
Annual Employment Growth Rates, 2001-2011



LOGISTICS, DISTRIBUTION, & TRANSPORTATION SUB-CLUSTERS

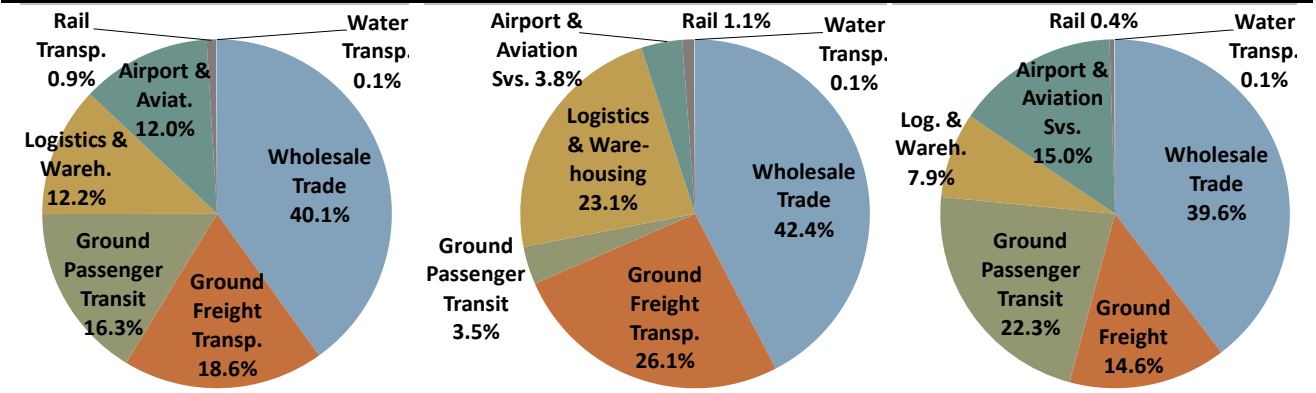
Wholesale Trade is the largest sub-cluster (in terms of employment) within Nevada's *Logistics, Distribution, & Transportation* cluster, comprising about 40.1% of employment with 34,325 jobs. Employment in *Wholesale Trade* is not highly concentrated in Nevada (location quotient=0.721), although the sub-cluster concentration in Reno/Carson City is close to the national average (location quotient=0.935). In general, jobs in *Wholesale Trade* are high-skill, high-wage positions – the average annual pay for workers is $71,485. Wholesale Trade is comprised of sixty-five different NAICS code, the largest of which is *Wholesale Trade Agents and Brokers (NAICS 425120)*, which employs 6,015 workers. High-employment NAICS with concentrated employment in the State of Nevada include: *Wine and Distilled Alcoholic Beverage Merchant Wholesalers (NAICS 424820)*, with 1,230 workers and a location quotient of 1.930, and *Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers (NAICS 423810)*, with 1,193 jobs and a location quotient of 1.806.

Ground Freight Transportation employs 15,963 workers in the State of Nevada, accounting for 18.6% of *Logistics, Distribution, & Transportation* employment in the state. *Ground Freight Transportation* is not highly concentrated in Nevada (with a location quotient of 0.699, it falls well

below the national average), nor in the Las Vegas metro area (location quotient=0.762). In Reno/Carson City, the *Ground Freight Transportation* sub-cluster is somewhat more concentrated than the national average, with a location quotient of 1.200 and 6,237 employees. With average annual pay of $46,542, wages in the *Ground Freight Transportation* sub-cluster are roughly on-par with the state overall average ($48,077). The sub-cluster spans ten different NAICS codes, the largest of which (in terms of employment) are: *Couriers and Express Delivery Services (NAICS 492110)*, with 4,256 employees; *General Freight Trucking, Long-Distance, Truckload (NAICS 484121)*, with 2,758 jobs; and *General Freight Trucking, Long-Distance, Less Than Truckload (NAICS 484122)*, with 2,382 workers.

Ground Passenger Transit employs 13,930 people in 163 establishments in the State of Nevada, comprising 16.3% of the *Logistics, Distribution, & Transportation* cluster's workforce. Employment in Nevada's *Ground Passenger Transit* sub-cluster is much more concentrated than the national average (location quotient=2.503), largely due to a high concentration of employment in the Las Vegas metro area (location quotient=3.251); 92% of *Ground Passenger Transit* employment in Nevada is in the Las Vegas metro area. Sub-cluster wages are generally low, with an average annual pay of $32,662. *Taxi Service (NAICS 485310)*, with 7,800 employees, and *Limousine Service (NAICS 485320)*, with 2,360 employees, comprise the bulk of employment in the sub-cluster.

State of Nevada *Logistics, Distribution, & Transportation* Sub-cluster Employment, 2011



Logistics & Warehousing makes up 12.2% of employment in Nevada's *Logistics, Distribution, & Transportation* cluster, with 10,330 workers in the state. Moderately concentrated in the state overall (location quotient=1.230), the bulk of the state's *Logistics & Warehousing* sub-cluster is in the Reno/Carson City metro area, which employees 5,514 workers and has a location quotient of 2.885. Sub-cluster employment in the Las Vegas metro area is less-concentrated than the national average, with a location quotient of 0.762. Wages in *Logistics & Warehousing* are moderate, at $42,486 per worker per year (compared to $48,077 overall in the state). More than three-quarters

of Nevada's employment in *Logistics & Warehousing* is in *General Warehousing and Storage (NAICS 493110)*, which employs 8,978 workers and has a location quotient of 1.720.

Airport & Aviation Services employs 10,292 workers in Nevada, about 12.0% of all employment in the *Logistics, Distribution, & Transportation* cluster. Employment in the *Airport & Aviation Services* sub-cluster is highly concentrated in the State of Nevada (location quotient=1.820), largely due to high employment in the Las Vegas metro area (location quotient=2.152 and 8,616 employees). Wages in *Airport & Aviation Services* are high, with average annual pay at $69,640. The majority of sub-cluster employment is in *Scheduled Passenger Air Transportation (NAICS 481111)*, which employs 5,672 workers in Nevada.

State of Nevada *Logistics, Distribution, & Transportation* Sub-Cluster Industry Data, Q2 2011

	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Water Transp.	80	22	45	0.076	0.092	0.061	4	0	2	$75,645
Rail Transp.	733	259	251	0.358	0.556	0.173	0	0	3	$91,048
Ground Freight Transportation	15,963	6,237	8,366	0.699	1.200	0.517	974	341	527	$46,542
Logistics & Warehousing	10,330	5,514	4,528	1.230	2.885	0.762	486	228	250	$42,486
Ground Passenger Transit	13,930	840	12,805	2.503	0.663	3.251	163	28	124	$32,662
Airport & Aviation Services	10,292	911	8,616	1.820	0.708	2.152	269	66	185	$69,640
Wholesale Trade	34,325	10,130	22,690	0.721	0.935	0.673	4,952	1,226	3,506	$71,485
Total Cluster	**85,653**	**23,913**	**57,301**	**0.919**	**1.128**	**0.869**	**6,848**	**1,889**	**4,597**	**$56,974**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

Rail Transportation employs 733 workers in Nevada, about 0.9% of all employment in *Logistics, Distribution, & Transportation*. This sub-cluster has a very low concentration of employment in the State of Nevada (location quotient=0.358) and the two major metro areas, with Reno/Carson City (0.556) somewhat more concentrated than Las Vegas (location quotient=0.173). Wages in *Rail Transportation* are very high, with an average annual pay of $91,048. Employment is broken down into two NAICS codes: *Rail transportation (NAICS 482110)*, employing 713 workers, and *Support Activities for Rail Transportation (NAICS 488210)*, with 20 jobs.

Water Transportation employs only 80 workers in the state (0.1% of the cluster's employment), and it has an extremely low concentration compared to the national average, both statewide (location quotient=0.076) and in both major metro areas. Wages in *Water Transportation* are high, at $75,645

per worker per year. The largest NAICS code (in terms of employment) in the *Water Transportation* sub-cluster is *Inland Water Passenger Transportation (NAICS 483212)*, with 30 employees.

LOGISTICS, DISTRIBUTION, & TRANSPORTATION SUB-CLUSTER TRENDS

Nevada's *Logistics, Distribution, & Transportation* industry cluster has contracted somewhat over the past five years (2006-2011), largely due to the dramatic job loss experienced during the recent economic recession (2007-2009). The *Wholesale Trade*, *Ground Freight Transportation*, and *Rail Transportation* sub-clusters contracted at the state level, as well as in both major metro areas over this period, and both the *Ground Passenger Transit* and *Airport & Aviation Services* sub-clusters declined in Reno/Carson City. The *Logistics & Warehousing* sub-cluster posted strongly positive growth from 2006-2011, in the state (CAGR=2.49%), in Reno/Carson City (CAGR=2.86%), and in Las Vegas (CAGR=1.40%). *Water Transportation* grew at high rates from 2006-2011 in Nevada, but this represents only a small net increase in employment (30 jobs), as the cluster is so small. According to EMSI projections, Nevada's *Logistics, Distribution, & Transportation* cluster is expected to grow at an average annual rate of +1.61% over the coming five years.

State of Nevada *Logistics, Distribution, & Transportation* Sub-Cluster Industry Growth Rates

	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Water Transportation	9.86%	11.10%	9.95%	0.23%	0.25%	-3.93%	1.72%	0.60%
Rail Transportation	-4.75%	-4.26%	-8.06%	-1.66%	-0.41%	0.53%	-2.96%	0.20%
Ground Freight Transp.	-2.97%	-0.79%	-4.52%	-2.27%	1.27%	1.22%	1.44%	0.47%
Logistics & Warehousing	2.49%	2.86%	1.40%	1.05%	2.13%	1.66%	2.27%	2.20%
Ground Passenger Transit	0.38%	-3.13%	0.56%	1.73%	1.17%	1.09%	1.16%	1.22%
Airport & Aviation Services	2.66%	-6.22%	3.33%	-0.85%	1.15%	-0.07%	1.13%	0.72%
Wholesale Trade	-3.63%	-4.70%	-3.31%	-1.33%	1.97%	1.29%	2.21%	0.73%
Total Cluster	**-1.56%**	**-2.21%**	**-1.50%**	**-1.16%**	**1.61%**	**1.29%**	**1.69%**	**0.82%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

Growth patterns across different segments of the *Logistics, Distribution, & Transportation* industry cluster are highly varied, but a handful stand out for dramatic losses/gains in employment in Nevada. Major losses in employment from 2006-2011 were experienced in: *Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers (NAICS 423310)*, which lost 1,257 jobs; *Couriers and Express Delivery Services (NAICS 492110)*, which lost 570 jobs; and *Specialized Freight (except Used Goods) Trucking, Local (NAICS 484220)* lost 554 jobs. Net employment growth was highest from 2006-2011 in *General Warehousing and Storage (NAICS 493110)*, which added 939 jobs,

followed by *Scheduled Passenger Air Transportation (NAICS 481111)*, adding 851 jobs, and *Other Support Activities for Air Transportation (NAICS 488190)*, which added 789 jobs.

B. MARKET TRENDS

MARKET OVERVIEW

Logistics, Distribution, & Transportation is an important industry that makes globalization possible and allows other goods-producing industries to deliver their products to end-use consumers. This industry is defined as all the activities involving the physical storage and movement of goods (via air, ground, rail, or water) among manufacturers, wholesalers, and retailers. Establishments within this industry also provide logistical support services for sellers and buyers, including supply chain management, warehousing, storage, inventory management, and freight forwarding. Because today's globalized economy relies on speed, reliability, low costs, and seamless execution, *Logistics, Distribution, & Transportation* are no longer viewed as "stand-alone" functions separate from manufacturing, wholesaling, and retailing.

The U.S. transportation and warehousing industry was valued at $1.75 trillion in 2010, accounting for 10% of U.S. economic activity and employing 4.2 million people.[250] According to Plunkett Research, truck transportation comprised the largest segment of the industry and generated $229 billion in revenue in 2006, followed by outsourced logistics & warehouse services ($120 billion), warehousing & storage ($21 billion), and agency & brokerage services for freight transportation arrangement ($20 billion).[251]

MARKET DYNAMICS AND TRENDS

Closely linked with consumer disposable income, the *Logistics, Distribution, & Transportation* industry's performance tends to fluctuate with the broader economy. Due to the recent economic recession, industry employment nationwide declined by -0.6% annually from 2005 to 2010. In addition, as a mature industry composed of mostly small firms, the industry-wide employment, establishments, and wages have been mostly flat or have slightly decreased nationally. Like other mature industries, this industry has seen increased use of sub-contractors and merger and acquisition activity, rather than growth and expansion into new geographical locations. Larger firms enjoy greater negotiating power, offer diverse product ranges, have greater resources to afford technological upgrades, and provide more effective inventory and contract management. They also have better ability to mitigate the effects of volatile fuel prices and secure long-term contracts with

[250] Plunkett Research, *Introduction to the Transportation, Supply Chain & Logistics Industry*, 2011.
[251] Precise and comparable breakdowns of revenues for all transportation and logistics sub-sectors are not available because some segments report by revenue ton-miles or revenue ton-kilometers rather than dollar figures.

major manufacturers and retailers (such as Wal-Mart), all of which have put small firms and new entrants at a disadvantage.

Foreign competition and the internalization of warehousing, logistics, and wholesaling by some large companies is a long-term industry trend that has increased competition among U.S. firms. As manufacturing operations have increasingly moved offshore, logistics and storage have also moved offshore and more companies are emphasizing just-in-time (JIT) inventory management, with U.S. facilities becoming just a brief stopping point.[252] Though, in light of recent natural disasters and extreme weather conditions (e.g., droughts, flooding, and earthquakes), companies relying on JIT inventory management has suffered supply chain disruptions due to their lack of a buffer inventory.

Some large companies have also established private warehouses or wholesale divisions to integrate their operations and create better control and customization of supply chains. Internalization, however, does not pose as large a threat as foreign competitors, because outsourcing to third-party storage and logistics providers maintains certain advantages, including: offering lower costs and better customer service, deferring union problems to contractors, and allowing companies to focus on their core business. Due to the overall higher level of competition, the industry is highly price sensitive, and U.S. firms have had to offer complementary services to differentiate themselves, such as technical support, marketing, customer service, financial services, and installation and repair services. Some firms have even begun to offer value-added distribution that expands their traditional purview of services to also include quality control, testing and verification, final assembly and customization, and light manufacturing.

Another key industry-specific driver is the technological advances that have lowered labor costs and increased operational efficiency. Due to the premium placed on time-definite delivery, establishments in this industry have increasingly adopted radio frequency identification (RFID) tags and supply chain event management (SCEM) technologies, which allow firms to track and monitor in real-time the exact location of a given carton or container of goods or of a specific transportation unit as it is moving toward its destination. Combined with software and sensors, firms can predict demand fluctuations, eliminate long-term storage and stock-outs, map out and manage complex supply chains, and provide postponement and cross-docking services. Furthermore, the advancement of voice recognition in these technologies has eliminated language barriers among workers and has provided hands-free capabilities that are particularly useful in refrigerated facilities. As microchips become smaller and cheaper, RFID tags will be increasingly used to track individual products. These technological advancements, however, will pose a challenge for small firms and new entrants that cannot afford the capital investments needed to adopt this technology.

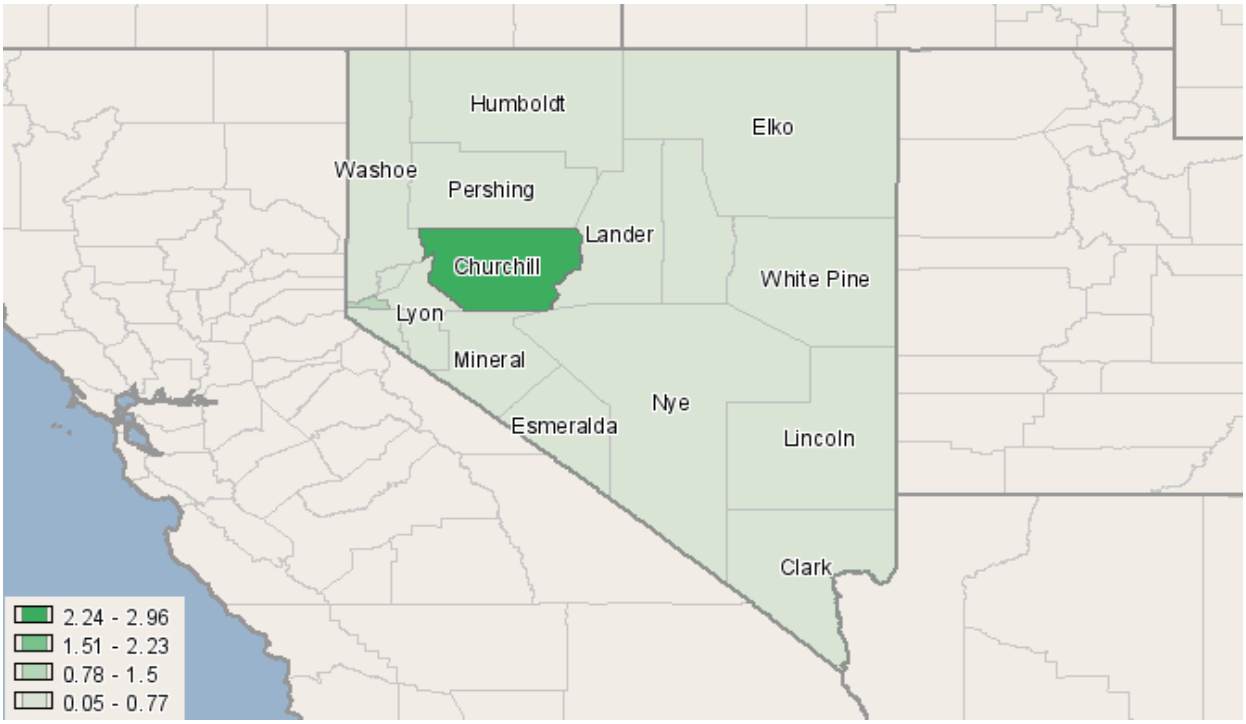
[252] David Broyles, Jennifer Beims, James Franko, and Michelle Berman, *Just-In-Time Inventory Management Strategy & Lean Manufacturing*, Kansas State University, April 2005.

APPENDIX G: AEROSPACE & DEFENSE

A. INDUSTRY PROFILE IN NEVADA

The *Aerospace & Defense* (A&D) industry cluster employs 15,655 workers in the State of Nevada, largely in *Federal Military* activity. Nevada's employment in *Aerospace & Defense* is less concentrated than the national average (location quotient=0.682), and concentrations in the two major metro areas are also below average. While A&D manufacturing activities are concentrated around Reno, the map on the following page shows that employment concentration in the A&D industry as a whole is well-distributed across the State of Nevada. Only Churchill County in Nevada has a location quotient greater than one (2.94); all other counties have *Aerospace & Defense* clusters that are less concentrated than the national average. Wages in the cluster are generally high, with average annual pay of $78,764 (compared to state average pay of $48,077).

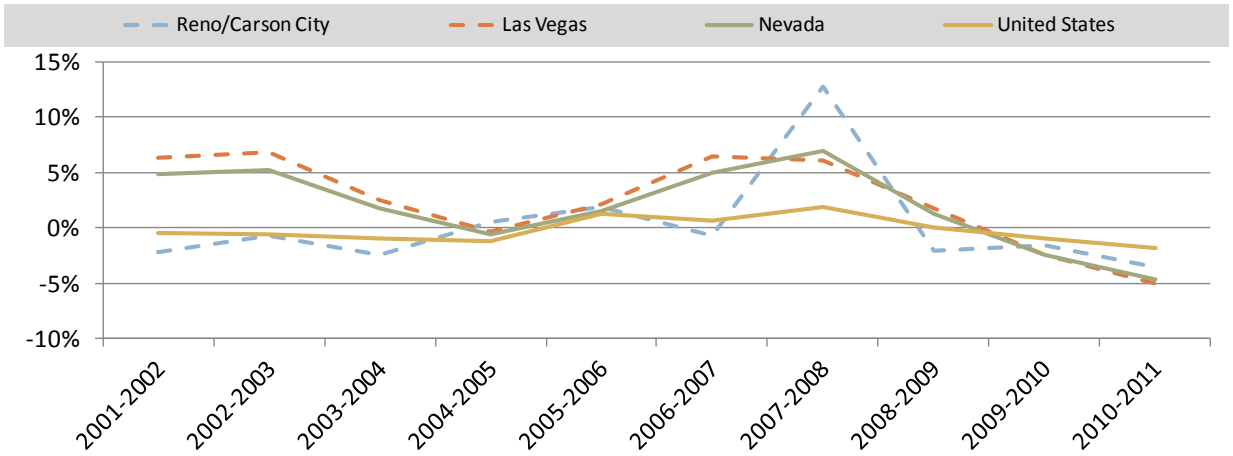
Concentration of Jobs in the Nevada *Aerospace & Defense* Cluster, 2011
Map of location quotients by county



Nevada's annual employment growth in *Aerospace & Defense* has, on average, been moderate but positive over the past decade, but has contracted over the past two years (2009-2011). From 2002 through 2009, Nevada's *Aerospace & Defense* industry outstripped national job growth rates, but has since fallen behind. Cluster employment growth in Las Vegas has closely followed state trends, while Reno/Carson City has been somewhat more volatile.

Please note that the data presented in this section does not capture activities such as aerospace and defense training and testing that are highlighted in *Section IV.G* of this report. Such activities cannot be isolated using the EMSI dataset, as services related to A&D engineering, drafting, and testing are subsumed within broader research and engineering-related NAICS codes.

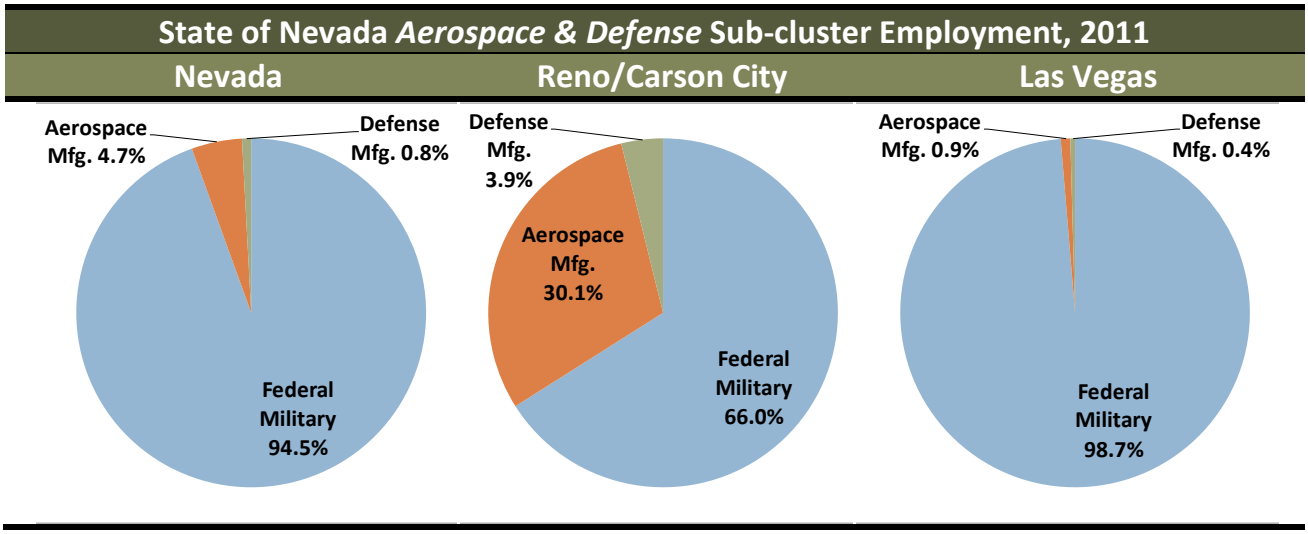
State of Nevada *Aerospace & Defense*
Annual Employment Growth Rates, 2001-2011



AEROSPACE & DEFENSE SUB-CLUSTERS

Federal Military comprises 94.5% of *Aerospace & Defense* employment in the State of Nevada, with 14,782 jobs in the state. The sub-cluster is moderately less concentrated in Nevada than in the United States overall (location quotient=0.858), although employment is roughly on-par with the U.S. average in Las Vegas (location quotient=1.003). Average wages are high in the *Federal Military* sub-cluster, with $78,764 in annual earnings per worker. Note that all employment in this cluster represents persons who are in the armed forces.

Aerospace-Related Manufacturing employs 731 workers in the State of Nevada, comprising about 4.7% of the state's *Aerospace & Defense* cluster. This sub-cluster has a very low employment concentration in Nevada as compared to the United States overall (location quotient=0.139), and while Reno/Carson City is slightly more concentrated than the state, both major metro areas have location quotients well below one. Average annual pay in *Aerospace-Related Manufacturing* is high, with an average annual wage of $78,072. The majority of Nevada's employment in *Aerospace-Related Manufacturing* is in *Aircraft Engine and Engine Parts Manufacturing (NAICS 336412)*, with 478 jobs.



Defense-Related Manufacturing employs 132 workers in Nevada, approximately 0.8% of total employment in the state's *Aerospace & Defense* cluster. While *Defense-Related Manufacturing* employment is less concentrated than the U.S. average in both Nevada and its two major metro areas, it is somewhat higher in Reno/Carson City (location quotient=0.726) than in the state overall. The average annual pay in Nevada for *Defense-Related Manufacturing* is $49,534, just slightly above the state average pay of $48,077. Most of Nevada's employment in this sub-cluster is in *Small Arms Manufacturing (NAICS 332994)*, with 114 jobs.

State of Nevada *Aerospace & Defense* Sub-Cluster Industry Data, Q2 2011

	2011 Total Employment*			2011 *National* Location Quotient			2010 # of Establishments			2011 Nevada Average Annual Pay
	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	Nevada	Reno/ Carson City	Las Vegas	
Aerospace-Related Manufacturing	731	579	109	0.139	0.484	0.029	15	7	3	$78,072
Defense-Related Manufacturing	132	74	54	0.295	0.726	0.170	6	1	0	$49,534
Federal Military	14,792	1,268	12,235	0.858	0.323	1.003	0	0	0	$79,059
Total Cluster	**15,655**	**1,921**	**12,398**	**0.682**	**0.368**	**0.763**	**21**	**8**	**3**	**$78,764**

** Figures do not include industries or NAICS codes with <10 employees, so actual employment is slightly higher than the figures shown.*
Note: *Aerospace & Defense* (A&D) employment in Nevada is likely higher than the figures shown here. It is extremely difficult to quantify the A&D industry using NAICS-based data, because many A&D-related activities related to electronics, communications, engineering, drafting, testing, etc. are subsumed within broader industry categories and cannot be isolated from other non-A&D activities.
Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

AEROSPACE & DEFENSE SUB-CLUSTER TRENDS

Over the past five years (2006-2011), Nevada has shown low but positive average employment growth in the *Aerospace & Defense* cluster (+1.12% CAGR), with a similar trend in both major metro areas. Growth was positive in all three sub-clusters: *Aerospace-Related Manufacturing* (+1.97% CAGR), *Defense-Related Manufacturing* (+8.45% CAGR), and *Federal Military* (+1.03% CAGR). According to EMSI projections, over the next five years (2011-2016) growth in Nevada *Aerospace & Defense* cluster will fall to +0.43% (CAGR), due largely to a slow-down in *Federal Military* employment growth. Employment growth in the *Aerospace-Related Manufacturing* and *Defense-Related Manufacturing* sub-clusters is expected to be strong in Nevada from 2011-2016, outpacing national growth rates.

The highest net addition of jobs in Nevada's *Aerospace & Defense* cluster from 2006-2011 was in *Federal government, military (NAICS 912000)*, adding 739 jobs. Notable rates of growth were posted for *Small Arms Manufacturing (NAICS 332994)* with +37.73% CAGR (adding 91 jobs); *Other Aircraft Parts and Auxiliary Equipment Manufacturing (NAICS 336413)* with 11.00% CAGR (adding 63 jobs); and *Aircraft Manufacturing (NAICS 336411)*, with +12.03% CAGR (adding 13 jobs).

State of Nevada *Aerospace & Defense* Sub-Cluster Industry Growth Rates

	2006-2011 Average Annual % Employment Growth				2011-2016 *Predicted* Average Annual % Employment Growth			
	Nevada	Reno/ Carson City	Las Vegas	U.S.	Nevada	Reno/ Carson City	Las Vegas	U.S.
Aerospace-Related Manufacturing	1.97%	-1.52%	NA	0.22%	4.98%	4.89%	6.88%	0.23%
Defense-Related Manufacturing	8.45%	9.50%	7.85%	1.52%	6.40%	4.68%	7.07%	1.65%
Federal Military	1.03%	1.57%	1.04%	-0.18%	0.12%	0.13%	0.12%	0.12%
Total Cluster	**1.12%**	**0.81%**	**1.24%**	**-0.06%**	**0.43%**	**1.84%**	**0.22%**	**0.18%**

Source: Economic Modeling Specialists Inc. (EMSI), calculations by SRI

B. MARKET TRENDS

MARKET OVERVIEW

The *Aerospace & Defense* industry encompasses a wide and varied range of economic activities, representing a major source of revenue and employment in the United States and worldwide. Activities related to the development and testing, manufacture, operation, and maintenance of civilian or military aircraft, spacecraft (including launch vehicles), missiles and weapons, other defense-oriented transport vehicles, and related guidance and control systems are typically included

as major elements of this industry. The global *Aerospace & Defense* sector is valued at $920.6 billion, with 71.8% of that value represented by the defense segment.[253] In the United States alone, the *Aerospace & Defense* industry cluster employed at least 2.7 million people in 2011, at an average annual wage of over $89,000 per year.[254]

MARKET DYNAMICS AND TRENDS

The global *Aerospace & Defense* industry experienced positive growth of 0.4% in 2009,[255] a period during which many industries have stagnated or declined. In 2010, the top 100 *Aerospace & Defense* companies saw record revenue levels of $646 billion, a 2% increase from 2009, and generated profits of $58 billion.[256] Many see this as a sign of industry strength, yet the continued downward pressure on U.S. and global defense budgets makes long-term defense industry performance uncertain and difficult to predict. Forecasted to reach $1,190.5 billion in revenue by 2014,[257] *Aerospace & Defense* is projected to experience comparatively higher growth in the demand for aerospace services and products than in the demand from the defense side of the industry.[258] In addition to the possibility of long-term cuts in U.S. and European defense spending, other threats to the industry include increasingly stringent contract terms, as well as cash deployment resulting in credit constraint, the rise in fuel prices, and the uncertainty of the global economic recovery.[259] *Aerospace & Defense* is a highly concentrated industry – the leading player is the Boeing Company, with 7.4% of the market.[260]

While overall defense funding may have limited growth, areas such as Unmanned Aerial Vehicles (UAVs), Unmanned Aircraft Systems (UAS), and robotics are a leading focus of government funding and interest. Advances in sensors, ranging from handheld to those in UAVs/UAS and ground stations, have been a game changing technological field. These advances have the potential to reduce U.S. military casualties, provide early warning systems, and increase data collection. Within both military and commercial aviation there is great interest in making aircraft faster, lighter, and (especially in the commercial case) more fuel efficient. There is, therefore, a growing market not only for research and innovation in these technologies, but also their testing and evaluation, manufacture, assembly, and the refitting and overhaul of existing craft to meet new technological standards.

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[253] Data Monitor, *Aerospace & Defense: Global Industry Guide*, January 2011.
[254] SRI calculations based on EMSI data. The *Aerospace & Defense* industry can be difficult to define and measure using standard, NAICS-based industry datasets, because many companies are classified under more general industry codes related to electronics, navigation instruments, ICT, R&D, engineering, chemical manufacturing, consulting services, and other activities – within these classifications, it is not possible to differentiate between defense-related and non-defense activities. Forecasting is also a challenge in this industry because of limitations of publicly available data and the political nature of future government spending.
[255] Data Monitor, *Aerospace & Defense: Global Industry Guide*, January 2011.
[256] PwC, *Aerospace & Defense: 2010 year in review and 2011 forecast*, 2011.
[257] Ibid.
[258] Standard & Poor's, *Industry Survey: Aerospace & Defense*, 2010, p. 9.
[259] Ibid.
[260] Data Monitor, *Aerospace & Defense: Global Industry Guide*, January 2011.

MARKET TRENDS IN SELECTED SUB-SECTORS

FLIGHT SYSTEMS TESTING

As more aircrafts, missiles, and flight systems are manufactured worldwide, the demand for flight systems testing is also expected to rise. With oversight from the Federal Aviation Administration (FAA) in the United States, every newly manufactured aircraft, aircraft part, or missile must undergo testing, inspection, and quality assurance of engines, propellers, assembly and airworthiness, radars, GPS systems, flight management and landing systems, emergency procedures, and overall aircraft performance. To record and monitor real-time flight performance, flight testing instrumentation and sensors are fitted to aircrafts, which transmit various performance data to sensors placed across a testing range. Significantly, innovations in unmanned aerial vehicles (UAVs) and systems represent a high-potential growth opportunity for this sub-sector because they will require extensive experimental testing to improve the aircraft design and ensure high-precision performance and commercial viability. Worldwide UAV expenditures are expected to increase from $4.9 billion in 2010 to $11.5 billion over the next 10 years.[261] Creech Air Force Base, based in Indian Springs, Nevada, is home to the U.S. mission to develop remotely piloted aviation and serves as the primary aerial demonstration training site for most of the remotely piloted aircraft systems being actively utilized in missions in Pakistan and Afghanistan.

AIRCRAFT MAINTENANCE, REPAIR, & OVERHAUL

In 2011, the U.S. *Aircraft Maintenance, Repair, & Overhaul* (MRO) sector generated $19.7 billion in revenue across 9,009 establishments employing 81,980 workers.[262] The sector includes a wide spectrum of support services and activities related to the aerospace industry, such as: maintenance and repair, overhaul of aircraft and aircraft parts, inspection and testing, sale of parts and supplies, and ferrying of aircraft between gates and runways. Over the past five years the sector has been highly volatile, and on average has contracted slightly (average annual growth rate of -0.2%), due largely to major drops in revenue during 2008 (-5.1% growth) and 2009 (-13.5% growth).[263] From 2006-2011, the number of U.S. employees in the sector fell at an average annual rate of 1.7%, but this was largely due to major contractions in 2008 and 2009, when employment fell by 5.1% and 8.5%, respectively.[264] However, the sector has now stabilized and is projected to grow at an average annual rate of 2.6% from 2011-2016.[265] The global aircraft MRO sector is expected grow to a value of $52.5 billion by the year 2015.[266]

While companies that provide aircraft MRO to the U.S. government must be U.S.-owned, the expected decline in defense spending is also expected to limit the long-term growth of government

[261] Teal Group Corporation, *World Unmanned Aerial Vehicle Systems: Market Profile and Forecast 2010*, 2010.
[262] IBIS World, *Industry Report 48819: Aircraft Maintenance, Repair, & Overhaul in the U.S.*, February 2011.
[263] Ibid.
[264] Ibid.
[265] Ibid.
[266] BizAcumen, *Aircraft Maintenance, Repair And Overhaul (MRO) – A Global Market Perspective*, November 2009.

contracts for MRO. This may be partially offset by increased outsourcing of military MRO services, but as many such services are already contracted out the effect will be limited. Furthermore, other major drivers of aircraft MRO demand include the number of aircrafts in service, air miles traveled, average fleet age, and maintenance regulations, and thus the industry is expected to benefit from the recovery of air travel following the recession. As a mature industry, future growth is expected to be limited and competition strong, and thus consolidation and restructuring by leading players will be important to maintaining profits. International competition is also expected to increase for commercial MRO services, with the highest levels of growth expected in Asia.