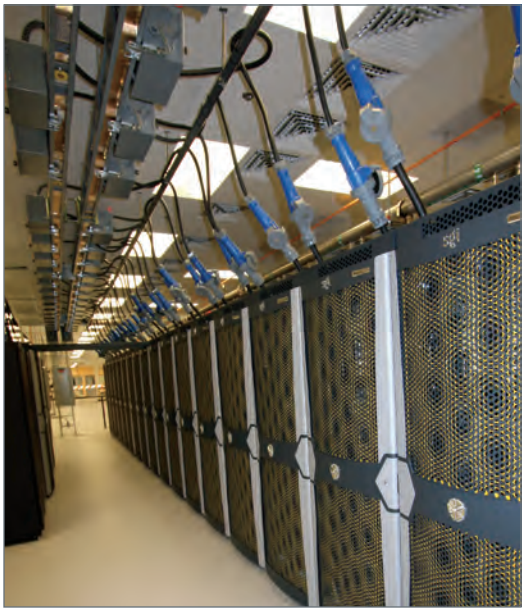
GROWING NEW MEXICO'S CLEAN TECH ECONOMY:

Strategies to Strengthen Technology Commercialization



September 30, 2010

Prepared to fulfill a requirement of Executive Order 2010-001

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report is the result of the work of the Clean Technology Commercialization Working Group between March 2010 and September 2010. This advisory group of experts from across New Mexico was convened by the Economic Development Department to provide input and review, and to fulfill Executive Order 2010-001 Section III 1 c. Additional input was provided by a range of stakeholders through a public review period.

The goal of this report is to identify how we can create and sustain increasing numbers of clean technology ventures and jobs in New Mexico, leveraging the research investment at our universities and national laboratories.

New Mexico has a chance to grow a significant number of high-wage clean technology jobs, but it must reallocate state R&D resources to strengthen support for technology commercialization to seize this opportunity. The experience of other states and successful past New Mexico efforts like the Centers of Technical Excellence show that this is an investment that can generate a return to the state that exceeds 10 to 1. This return will come in the form of a stronger and more diverse state economy, plentiful high wage jobs, and a larger and less volatile state tax base. While times of recession confront the state with difficult choices, investments like those proposed in this report accelerate recovery, revive tax revenues and restore services more quickly.

New Mexico benefits from nation-leading federal R&D spending that creates an opportunity for technology based economic development. Unfortunately, our state technology economy currently lags peer states, as does our state investment in developing this sector. Other states are investing significant amounts of money in technology commercialization, and obtaining an economic development return several times their initial investments. New Mexico is well positioned for clean technology job creation, but there is strong competition between states for these jobs. New Mexico must invest more in technology commercialization to successfully compete for these jobs.

New Mexico has had a variety of technology-based economic development initiatives over the past several decades, to greater and lesser effect. Investing wisely will require learning from these past efforts, continuing what has worked and addressing what has not.

Technology commercialization is the process that turns research into marketable products, new businesses and jobs. It is not something that happens accidentally and requires attention and coordination to ensure that it is functioning properly. There are many players involved in this process.

New Mexico has many resources in its technology commercialization ecosystem on which we can build. There is strong evidence that these resources are already making significant contributions to the state's economy that could be expanded. However, some key gaps remain and this is where state efforts should be emphasized.

We must refocus state spending on technology commercialization to make the most of our research assets in the state. *Technology maturation* is particularly important, to create a bridge between "bench top" research at our institutions and commercially demonstrated technologies that private investors and entrepreneurs are willing to invest in bringing to market.

While investments should be made wherever there are "micro-clusters" of existing businesses and related technologies, perhaps the technology area that will produce the greatest economic development benefits for New Mexico in the near-term is "Energy Sustainability." Additional emphasis should be placed here to best leverage limited state resources.

There are a variety of specific recommendations from the Clean Technology Commercialization Working Group which, if implemented, will greatly accelerate technology commercialization, creating more high-tech business and high-wage jobs.

The four high-priority recommendations are:

1. **Improve statewide coordination, promotion, evaluation and monitoring and technology commercialization**

   - Establish an institution to provide statewide coordination, promotion, evaluation and monitoring. Secure sustained funding support

2. **Expand incentives to stimulate technology commercialization and industry engagement at our research institutions**

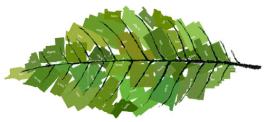
   - Legislatively create a state matching fund for technology maturation and provide recurring funding
   - Legislatively expand the New Mexico Small Business Assistance Program
   - Work with university administrations and faculty to evaluate and incentivize industry-funded research and develop Proof of Concept centers
   - Amend the law authorizing state Research and Public Service Program (RPSP) funds to require that 10% of these funds go to support technology commercialization activities in state-identified priority areas
   - Coordinate education and workforce programs with these economic development goals and policies

3. **Strengthen incentives to attract angel, venture capital and business R&D investments. Retain existing incentives and programs**

   - Improve the Angel Investment Tax Credit (AITC) and remove its sunset provision
   - Reenact an improved Research and Development Tax Credit
   - Retain and expand existing State Investment Council New Mexico targeted programs
   - Defer taxes from the sale of ownership in a startup if that money is reinvested in another New Mexico startup within 2 years

4. **Cultivate the market for targeted technology products in New Mexico**

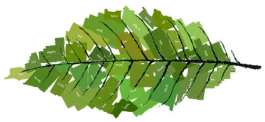
   - Encourage and support the growth of New Mexico's Energy Sustainability economy broadly, by continuing initiatives like the Green Jobs Cabinet



Detail on these recommendations and other supporting recommendations can be found in the body of the report.

Efforts to support technology commercialization should be guided by the following strategies and principles:

- **Technology-based economic development works**: It creates jobs and shows a return on investment of three to ten times or more on what states invest. Existing non-state efforts across New Mexico are working. However, state investments are critical to accelerating technology commercialization and associated job growth.
- **Market intelligence must be at the core**: *Market-pull* and experienced business leadership are essential to ensure that state efforts are leveraged by private investment and become self-sustaining. Ensure that cash-strapped small businesses can benefit from any programs established. Business sector leadership can help to ensure that initiatives are sustained across state leadership changes.
- **Leverage assets and address key gaps**: New Mexico is home to an array of important assets that support technology commercialization. Coordinated state effort is needed to address key gaps without duplicating existing programs.
- **Target micro-clusters to compete globally**: Supporting the growth of micro-clusters, where cohorts of existing technology businesses in the state intersect with specific technology assets, will best leverage limited state resources and foster New Mexico businesses that can compete in the global marketplace. These micro-cluster should be identified and supported.
- **Benchmark and continuously improve**: Using measurable goals and performance metrics, evaluate efforts year to year and against peer states to ensure programs are effective. Seek input from outside New Mexico to avoid a myopic perspective. Adopt best practices and address any gaps identified. Foster peer learning and coordination among related organizations in our state.



ABOUT THE CLEAN TECHNOLOGY COMMERCIALIZATION WORKING GROUP

The Clean Technology Commercialization Working Group

The Clean Technology Commercialization Working Group (CTCWG) is a project of the Green Jobs Cabinet, formed to fulfill an action item from Governor Richardson's Executive Order 2010-001.[1] The CTCWG is an advisory group of experts convened to develop recommendations to create and sustain increasing numbers of clean technology ventures and jobs in New Mexico, leveraging the research investment at our national laboratories and universities. These experts represent the state's three research universities, its two national laboratories, professional venture capitalists, economic developers and successful New Mexico entrepreneurs.[2] The Working Group was the primary source of input and review for this report, but additional input and comments were provided by other stakeholders from around New Mexico. The Economic Development Department Cabinet Secretary chairs both the CTCWG as well as the Governor's Green Jobs Cabinet.

New Mexico Green Jobs Cabinet

The New Mexico Green Jobs Cabinet (GJC), formed by Governor Richardson through Executive Order 2009-002, convenes eight state agencies and engages non-profit and business partners to foster green economic and workforce development statewide and support national energy independence. The GJC has developed a Green Economy Report including an inventory of assets and opportunities and a strategic plan to leverage them.[3] This report identified five bold strategic goals with detailed supporting recommendations: 1) be the leader in renewable energy export, 2) be the center of the North American solar industry, 3) lead the nation in Green Grid innovation, 4) remain a center of green building and energy efficiency excellence, 5) develop a highly skilled and ready-to-work workforce. Executive Order 2010-001 outlined 13 action items to advance this agenda.

Working Group Process and Timeline

The CTCWG met bimonthly between March 2010 and September 2010 to develop this report. A draft report was circulated for public comment in October and the final report was submitted to the Green Jobs Cabinet and the Governor in October 2010. Brendan Miller, the Director of the Office of Science and Technology at the Economic Development Department, provided staff support to the group, interviewed a range of stakeholders for additional feedback, and was the primary author of this report under the guidance of the CTCWG.

This Report is a Roadmap

This report is intended to provide an overview of New Mexico's technology commercialization ecosystem and a policy roadmap to accelerate technology-based economic development. While it is unlikely that all of the recommendations could be enacted immediately due to financial and other limitations, the policies described should have enduring value and should be implemented as soon as practically possible. Each additional recommendation implemented will accelerate the development of New Mexico's technology economy and ensure that the state remains competitive relative to its peer states. Furthermore, the principles and best practices identified should be given consideration in the design of any programs to support the

[1] http://www.governor.state.nm.us/press/2010/jan/011210_01.pdf
[2] See Appendix A for a complete list of participants.
[3] http://www.edd.state.nm.us/greenEconomy/overview/index.html

state's technology economy. Until New Mexico's technology economy has grown substantially and a new assessment of the state's strengths and weaknesses is necessary, the recommendations and principles outlined here should continue to be valuable.

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NEW MEXICO MUST FOCUS ON GROWING ITS TECHNOLOGY ECONOMY

New Mexico benefits from nation-leading federal R&D spending

Research and Development (R&D) is an extremely important part of New Mexico's economy. R&D represents 8.4% of New Mexico's economy, a larger percentage than in any other state. Furthermore, most of this R&D is federally funded: the federal government invests $3.3 billion in New Mexico annually, and more in each of our science and engineering workers than anywhere else in the country.[4]

While a portion of this research is performed at our three research universities, New Mexico State University, New Mexico Tech and the University of New Mexico, the lion's share goes to the two national laboratories located in New Mexico: Los Alamos National Laboratory and Sandia National Laboratory. These two laboratories are both under the National Nuclear Security Administration of the U.S. Department of Energy and have a primary mission of managing national nuclear security but also perform a variety of other research, much of which is the best in the country in their particular areas of expertise.

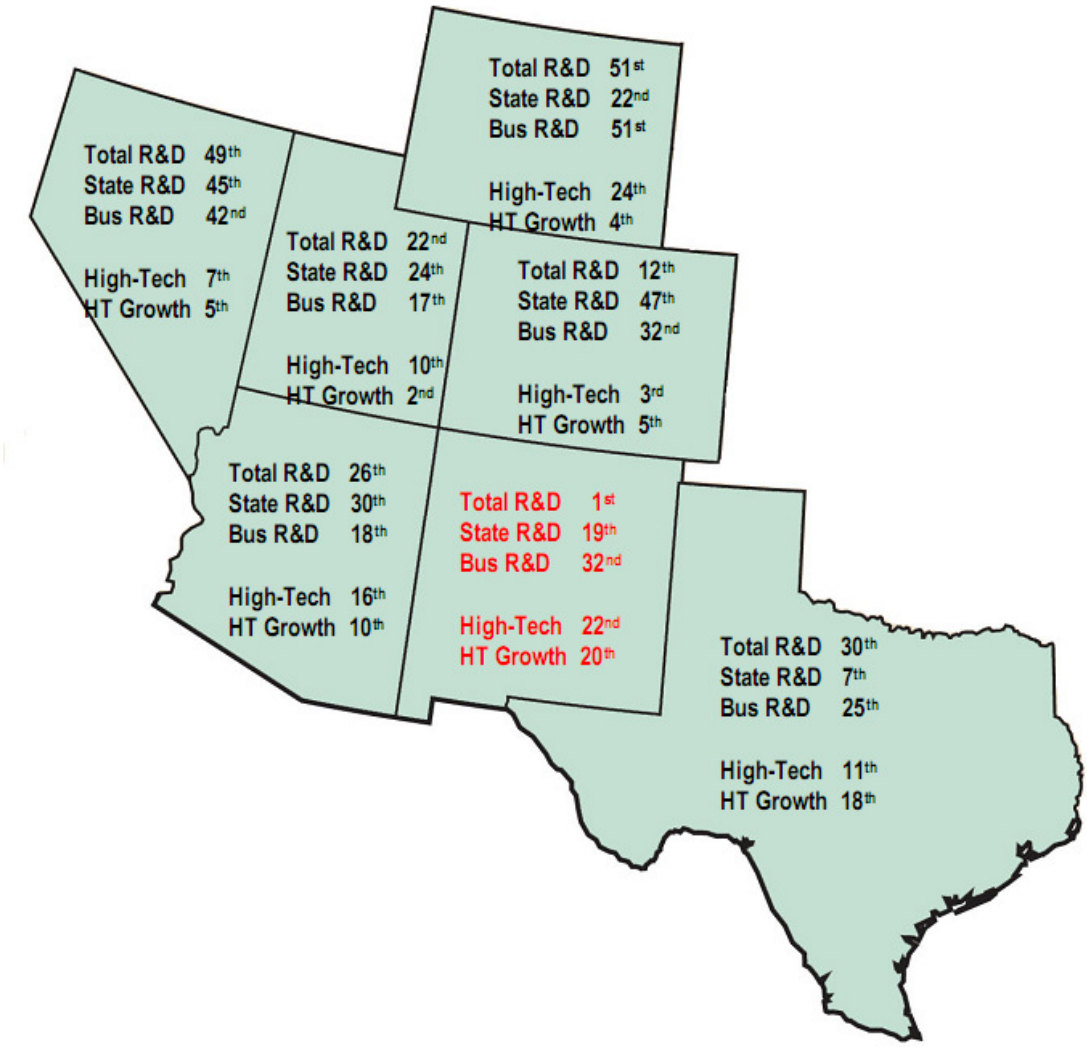
Given the critical national security mission of these laboratories, much of their research is classified, literally "behind the fence," and difficult if not impossible for industry to access. Furthermore, these labs have a national mission and cannot privilege assistance to any particular state, even their home state, by federal statute.

Despite these limitations, both laboratories have invested millions of their own funds to support New Mexico's economic development through a variety of successful partnerships and programs, like Northern New Mexico Connect, the New Mexico Small Business Assistance Program and the Sandia Science and Technology Park, that will be described later in this report. But there remains a need for New Mexico to develop initiatives that work within the constraints of their mission in order to fully leverage these truly unique assets. Some specific initiatives are discussed below.

New Mexico's lags peer states in growing a market-based technology economy

State-level investments in applied R&D, particularly in commercializing technologies in which a state has a strong cluster of research expertise, stimulate the growth of a thriving and sustainable market-based high-tech economy. These investments generate growth in the high-tech economy as technologies are turned by new companies into products, which are then sold for a profit. These profits allow high-tech businesses to begin to continuously reinvest in developing new products, resulting in a sustainable market-based economy that becomes much less dependent on government grants over time. The experience of peer states over the past several decades provides evidence of these benefits, as described in this section below.

[4] [4] National Science Foundation State Indicators Data, 2010. http://www.nsf.gov/statistics/seind10/c8/c8s7.htm



R&D Spending and the High-Tech Business Sector in Peer States[5]

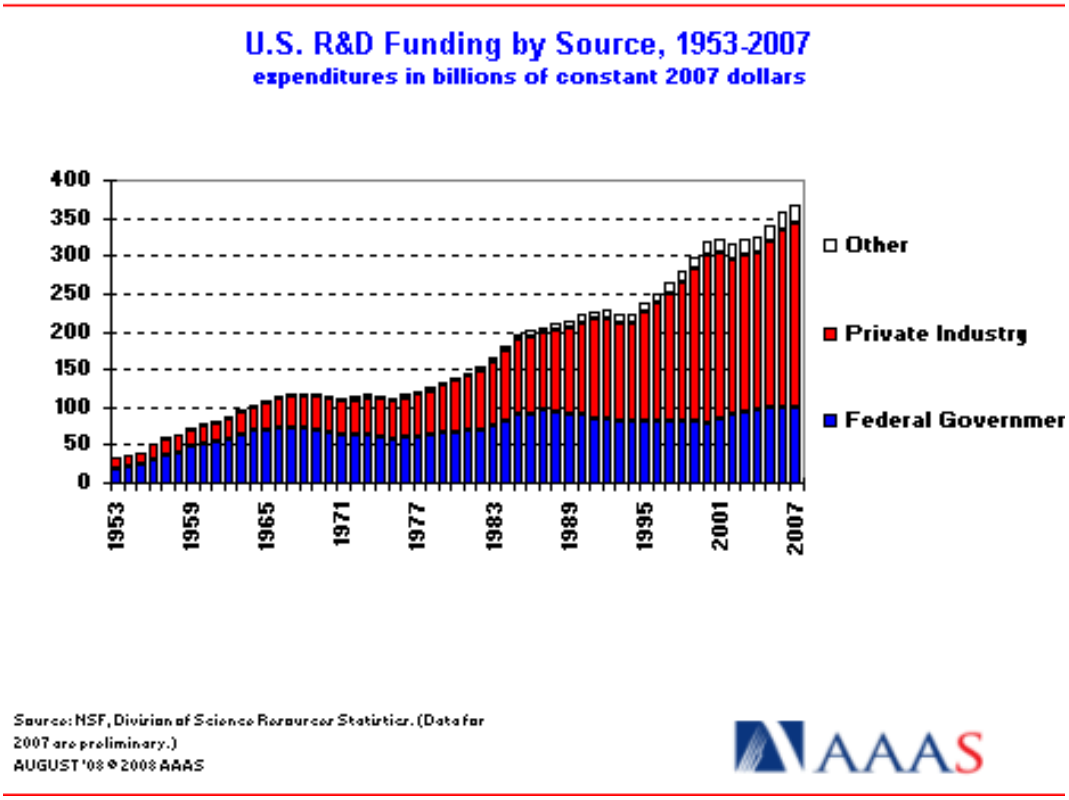
Unfortunately, while New Mexico benefits from substantial federal and state R&D spending, additional attention to applied R&D and technology commercialization activities is needed to encourage new high-tech business formation. As more high-tech businesses focused on selling products to the marketplace begin operating in New Mexico, a virtuous cycle of increasing business R&D and product innovation will commence. This will form the foundation of a sustainable market-based technology economy.

State spending on technology commercialization, through technology maturation programs and targeted funding of applied R&D with industry partners, is the necessary catalyst to develop a thriving technology economy. Of course, a good quality of life, available workforce, infrastructure and other assets are very important, but New Mexico largely has these. What is missing is the emphasis and spending on technology commercialization.

As the technology economy grows and matures, stimulated by state efforts, more and more R&D is done directly by the business community. Funded out of their own

[5] See Appendix B for additional details and sources.

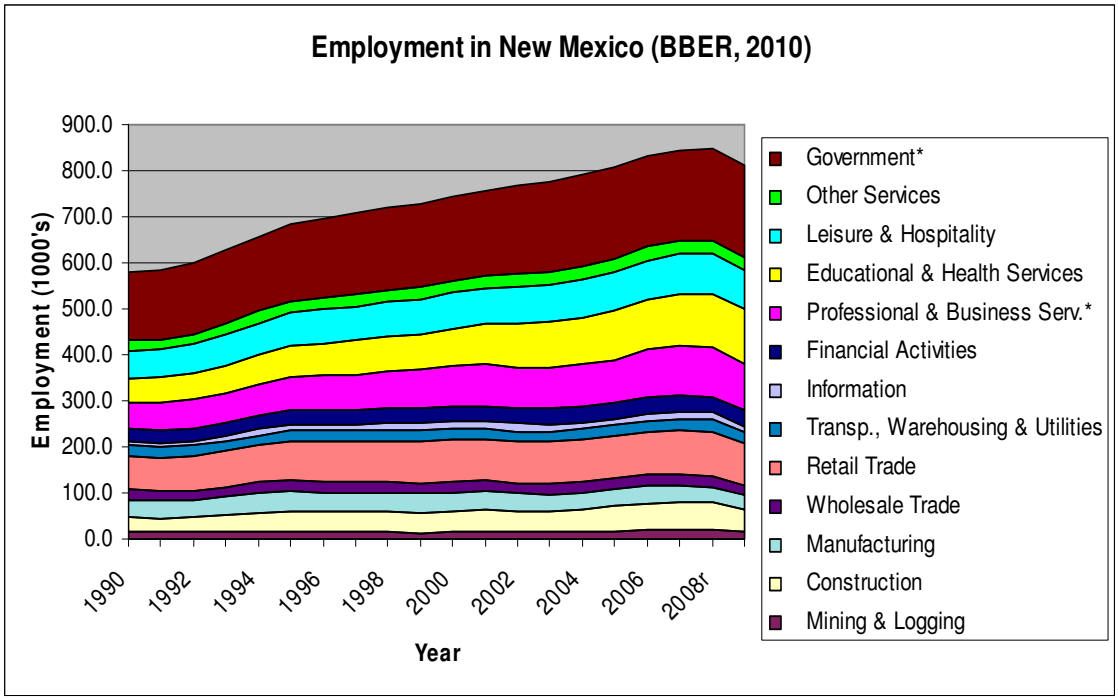
profits, this business R&D creates a sustainable engine of innovation, generating new technology products and businesses. This has been true nationally. Since the 1950's industry has been responsible for a larger and larger share of total R&D spending in the U.S.[6]



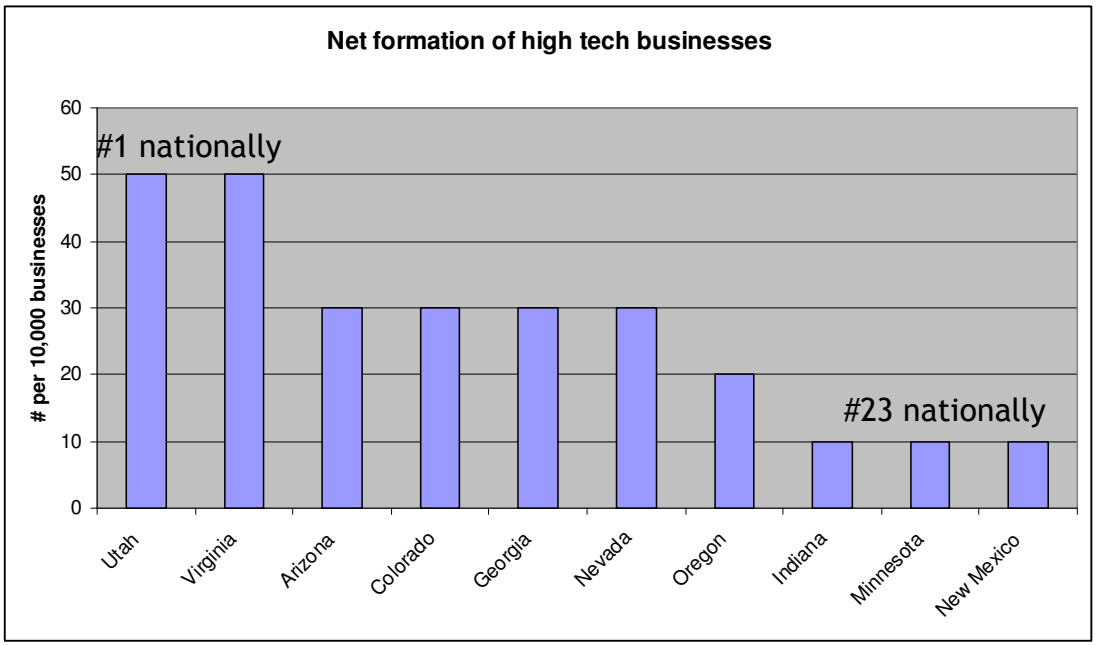
Several states and regions have made significant investments in their technology economies in times of economic recession or crisis and have produced very positive results over the past several decades. California's investment in the University of California system, Texas' technology investment after the oil crash, Denver's and San Diego's investments in innovation in the 1980's all have helped to build strong technology economies that pulled them out of recession and enriched their citizens.

Our substantial R&D base does not represent a competitive advantage for New Mexico unless it fully leveraged by a focus on commercialization and industry partnerships. And unlike some other states with advanced technology economies, for example Colorado, Texas and California, our technology business sector is not sufficiently developed to support a broad base of business performed R&D (New Mexico ranks 32nd in this category). This gap between total basic R&D and applied business R&D rankings indicates a disconnect between our government supported R&D and market-based private industry.[7] The result is that New Mexico's high-tech economy is smaller than peer states, more dependent on government grants, and not growing as quickly.

[6] NSF Division of Science Resources Statistics, 2007.
[7] See Appendix B for detailed state data and rankings.



New Mexico's economy remains overly dependent upon relatively low wage and slow-growth sectors like government, government contracting and agriculture, and volatile industries like the extractive industries and tourism. Even within our technology economy there is hidden weakness. Intel alone accounts for nearly 50% of New Mexico's total exports, demonstrating a need to expand and diversify our exports and our technology sector.[7]



Source: Milken Institute, 2009. 2004 data.[8]

[7] *Trade in the Cyberstates 2009* report and information from Intel. http://www.techamerica.org/trade
[8] http://www.milkeninstitute.org/publications/publications.taf?function=detail&ID=38801224&cat=resrep

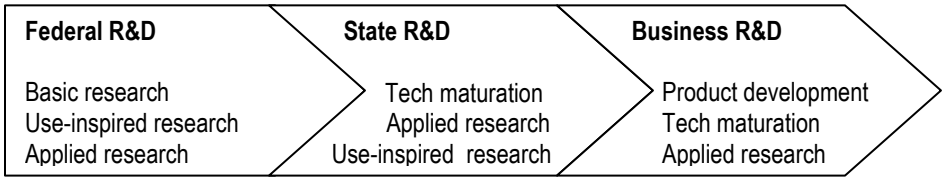
Rankings of New Mexico's economy (as a percentage of GDP)[9]:

- 8th largest government sector
- 4th largest non-industrial/non-technological (e.g. agriculture and extractive industries)
- 41st in manufacturing
- 37th in information business

In a broader context, globalization has shifted the competitiveness of leading developed countries like the United States away from the production of commodities and standardized manufacturing and toward knowledge-based innovation according to a Kauffman Foundation report[10]. In addition, Economist Lester Thurow has noted, "The world is moving from an industrialized era based on natural resources into a knowledge-based era based on skill, education, and research and development."[11] While New Mexico's manufacturing sector currently benefits from a comparatively low cost of business compared with many other states, this advantage is slowly being eroded by constant cost pressure from countries with significantly lower labor costs. Competing on cost is not a sustainable strategy. Innovation and a technology economy serving a global marketplace will be needed to ensure New Mexico's future prosperity.

New Mexico must invest more in technology commercialization

Unlike other states that do not have such a large federal R&D investment, New Mexico need not invest heavily in developing a pool of basic research: this resource is already available.



How R&D Funders Can Support Technology Development

What is lacking in New Mexico is the strategic state spending in technology maturation and applied research with industry to leverage this research base and turn it into marketable products, high-tech business and sustainable jobs. Wise state investment can help to build a base of technology businesses serving the global marketplace that will quickly achieve self-sufficiency.[12]

Strategically spending state funds to stimulate our technology sector has several advantages for New Mexico:

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[9] As a percentage of total GDP. See Appendix C for additional information.

[10] *Proof of Concept Centers: Accelerating the Commercialization of University Innovation*. Kauffman Foundation, January 2008.

[11] Ibid.

[12] This section uses the terms "funding," "spending" and "investment" interchangeably but it is important to distinguish these types of state support. State funding and spending refers to line items in the state budget to be spent. These funds are not directly repaid. True investments (like those made by the State Investment Council) are expected to be repaid and generate a financial return. Both spending and investments can generate economic development returns to the state more broadly (e.g. job creation and new tax revenue).

- Stimulates development of new products and startup companies.
- Diversifies and balances our economic base by expanding a new sector of our economy.
- Increases and stabilizes state revenues. The state budget is currently dangerously dependent on oil and gas prices, which can create significant fluctuations. Oil and gas royalties accounted for 18% of total state revenues in 2006.[13] It is estimated that each dollar drop in the price of oil results in $3.4M in lost revenue and each 10 cent decline in natural gas prices causes a $11M decrease to state revenues.[14]
- Creates well paid, sustainable jobs and raises the average New Mexico wage. The average wage in New Mexico is $36,700 and our median family income ranks 43rd in the nation.[15] The average high-tech job in New Mexico pays $73,600, nearly double the average wage.[16] In addition, recent Kauffman studies show that startups are responsible for *all* net job growth in the U.S. economy.[17]

Although New Mexico's state budget has been negatively impacted by the global recession, like all states, creating these jobs will require investing state resources to catalyze growth in this sector. As Intel Chairman Craig Barrett has noted, "You can't save your way out of a recession – you have to invest your way out."[18]

Keeping pace with other states

While large population states like Texas and Colorado can invest large sums more easily, we must keep in mind that competing globally will require making comparable investments regardless of population difference, at least in selected strategic areas. New Mexico must be more focused with its spending in order to compete to win in key areas.

Other states in the West, including Arizona, Utah and Texas, invest heavily in technology-based economic development through private-public partnership organizations. Across the country, these efforts are all demonstrating the ability to leverage non-state contributions and generate a return on investment (ROI) in terms of economic development of anywhere between 3 and 10 times or more on their state investment.[19] Investing multiple tens of millions of dollars in these partnerships is fairly common. New Mexico has not had a successful private-public partnership like these to cultivate its technology-based economy. In comparison, the Office of Science and Technology at the Economic Development Department has a budget of only $108,000 for 2010.

Return on Investment of Initiatives in Other States[20]

State	Initiative	Return on Investment

[13] http://newmexicoindependent.com/18244/forging-an-energy-policy-that-benefits-all-of-new-mexico
[14] legis.state.nm.us/lcs/lfc/lfcdocs/finance%20facts%20oil%20and%20**gas**.pdf
[15] 2007-2008 data, http://www.census.gov/hhes/www/income/statemedfaminc.html
[16] Average wage and average high-tech wage from *Trade in the Cyberstates 2009* report.
[17] http://www.kauffman.org/newsroom/u-s-job-growth-driven-entirely-by-startups.aspx
[18] *Fortune* Magzine, September 2009.
http://money.cnn.com/2009/01/19/magazines/fortune/do_gooder.fortune/index.htm
[19] See Appendix E.
[20] See Appendix E for more information.

Arizona	Science Foundation Arizona	3 to 1
Colorado	Colorado Collaboratory	6 to 1
Ohio	Ohio Third Frontier	10 to 1
Pennsylvania	Ben Franklin Technology Partners	3.5 to 1
Washington	Washington Technology Center	11 to 1

More generally, the national non-profit State Science and Technology Institute (SSTI) has identified seven key elements of a technology-based economy, drawn from the experience of leading centers like Silicon Valley, the Research Triangle in North Carolina, and Route 128 in Massachusetts.[21] New Mexico must monitor and invest in the areas that are weaker in order to remain competitive and make the most of our assets. The areas identified by SSTI are:

- An intellectual infrastructure, i.e. universities and public or private research laboratories that generate new knowledge and discoveries.
  Very strong in New Mexico.
- Mechanisms for transferring knowledge from one individual or institutions to another or from one company to another.
  Adequate: Room for improvement.
- Physical infrastructure that includes high quality telecommunications systems and affordable high speed Internet connections
  Needs improvement: No broadband access in many rural areas.
- Highly skilled technical workforce
  Needs improvement: Educational attainment and science, technology, engineering and math skills can be strengthened.
- Sources of risk capital
  Adequate: Room for improvement
- Quality of life
  Good overall: Public schools and health care need improvement
- Entrepreneurial culture
  Improving: Can be significantly expanded

Learning from past and current state initiatives

> "New Mexico's historical inability to capitalize fully on its resource advantages threatens again to export high technology to the greater economic benefit of other states." *Enhancing New Mexico's Leadership in High Technology Industry Development*, **1982**

> "The [**1989** Science and Technology Commercialization Commission] plan stressed the need for New Mexico to move from what it called a 'grants economy' to a market economy. It emphasized the New Mexico's traditional industries were in decline (agriculture and extractive industries), growing very slowly (the federal sector), or very low paying (tourism). " *Science and Technology in New Mexico*, Report to New Mexico EPSCoR State Committee, 2003.

> "Unlike many states, New Mexico has a head start in developing the technological resources needed for economic development – nearly 50 years of federal R&D investment. The combination of the three federal laboratories…with the three research universities…represents one of the

[21] *A Resource Guide for Technology-based Economic Development*, SSTI, 2006. http://www.ssti.org/Publications/Onlinepubs/resource_guide.pdf

greatest concentrations of R&D resources in the nation." *High-Tech Jobs for New Mexico: A Call for State Action*, **1992**

"New Mexico has a long history of science and technology and an equally long history of attempting to exploit its science and technology resources for the greater benefit of the state and its economy…Despite more than 20 years of promoting technology-based economic development, New Mexico has achieved only marginal success…[However,] in the last 20 years, the landscape of science and technology industry in New Mexico has changed considerably…Intel and other semiconductor firms established an electronics manufacturing base in the Albuquerque area, while a host of informatics companies have made Northern New Mexico their home…A number of industry associations have formed to promote the interest of technology companies…At least 12 venture capital firms have offices in New Mexico, whereas 20 years ago there were none." *Science and Technology in New Mexico*, Report to New Mexico EPSCoR State Committee, **2003**.

These citations from 1982, 1989, 1992, and 2003 provide strong caution that leveraging our unique R&D resources is not a new idea or an easy task. A variety of both plans and funded initiatives have been produced every several years, to greater and lesser effect. A summary table of these initiatives can be found in the appendix.[22] Any initiative to grow our technology economy must learn from these previous efforts, incorporating successful features and correcting weaknesses. Such an initiative must also incorporate national best practices, which will be discussed later in this report.

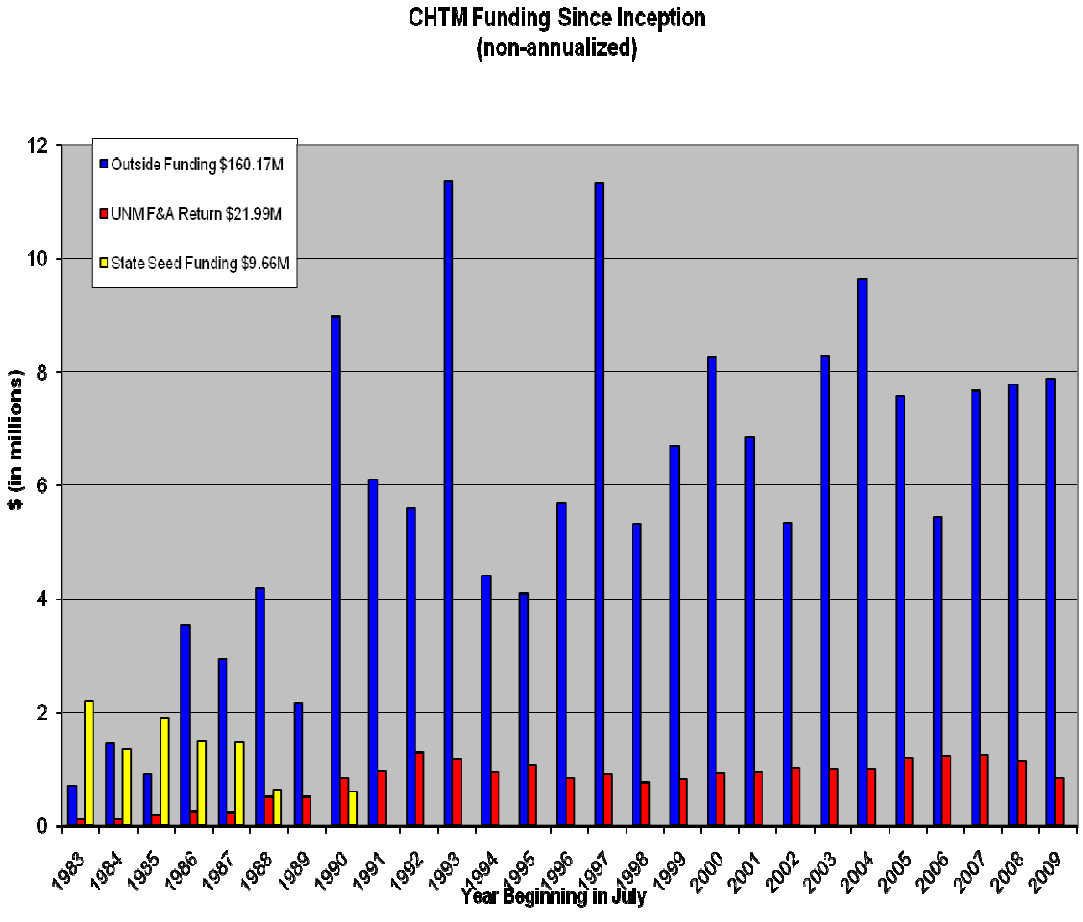
Some lessons are suggested from a review of these past New Mexico initiatives:

1. **Fund and implement plans:** Plans must be fully funded and fully implemented. Many of these plans were never implemented.
2. **Involve the private sector meaningfully in decision making:** Only private sector businesspeople with daily experience meeting market needs understand where opportunities exist to develop successful products and businesses.
3. **Institute strong conflict of interest policies**: Ensure that those who could benefit from funding must recuse themselves from decisions about that funding. This applies to individuals and organizations both.
4. **Provide multi-year appropriations:** Multi-year initiatives must be funded with multi-year appropriations to allow long term planning, guarantee continuity and ensure complete implementation. Participating businesses need predictability in order to partner and make their own investments, and multi-year appropriations provide that stability. In addition, research projects generally take at least 2-3 years to show real progress.
5. **Use a targeted portfolio approach to manage risk:** Not all technologies can be successfully turned into profitable products and there are many challenges at every stage of the commercialization process. Using a portfolio approach means that while any particular investments may fail, well-designed programs will succeed and have a positive return on investment overall. An appreciation for a portfolio approach is critical for ensuring ongoing stakeholder support for these types of programs.

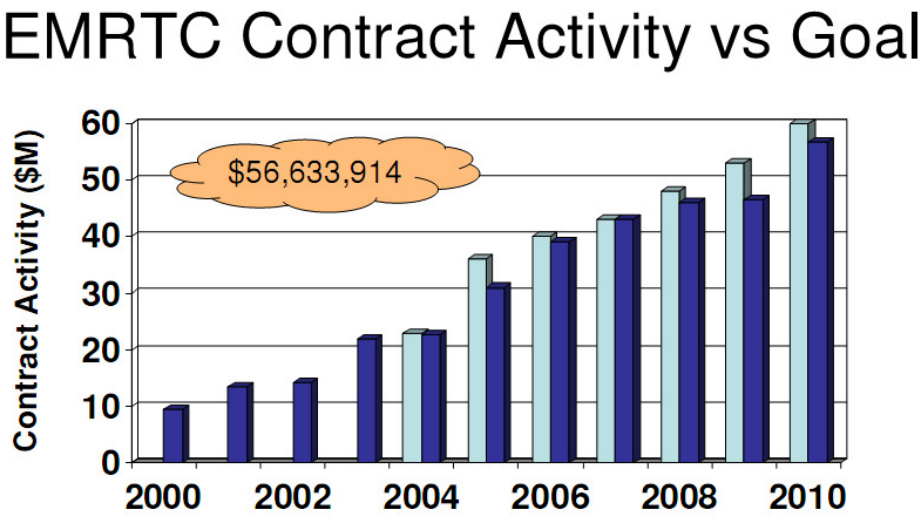
Centers of Technical Excellence: New Mexico's most successful initiative?

[22] See Appendix D.

Perhaps the most successful initiative in New Mexico was the Centers of Technical Excellence (CTEs) program established in the mid-1980's during a recession. This effort established five research centers at New Mexico universities, two of which continue strongly today: the Center for High Tech Materials at UNM and the Energetic Materials Research and Testing Center at New Mexico Tech. In addition, the Center for Non-Invasive Diagnostics at UNM led to the creation of the successful Mind Research Network in Albuquerque, which had a $77M research budget in 2010, mostly from federal sources.[23] Multiyear funding was appropriated equivalent to approximately $60 million in 2010 dollars. Viewed as a portfolio, the CTEs have been very successful, returning at least 10:1 in new non-state research funds on the initial state investment, employing many scientists and researchers and generating additional indirect economic benefits. The UNM center has been responsible for 20% of the total patents at UNM, generating $5 million in royalties annually, and spun off 10 new high-tech ventures.[24] The NM Tech center generated $57 million in non-state research investment in 2009 alone with similar performance in previous years. Over 450 people are employed through this NMT center.[25]



[23] http://www.themindinstitute.org/
[24] Presentation provided by Dr. Steve Brueck, Director of the UNM CHTM, 2010.
[25] Presentation provided by Dr. Chuck Cormier, Assistant Director of the NMT EMRTC, 2010.



No other technology based economic development initiative has had such a demonstrated positive impact in the past several decades in New Mexico, although some recent initiatives like the New Mexico Computing Applications Center (NMCAC) and Green Grid Initiative are showing strong promise. The substantial funding provided through a multiyear appropriation is certainly a contributing factor to the success of the CTEs. One weakness was the lack of meaningful private sector involvement at inception which has contributed to these centers remaining academically focused rather than driving industry growth in the state. The research is beginning to result in new technology businesses in New Mexico, for example 10 spinoff businesses at CHTM, but there is much more research available to be commercialized. Technology commercialization initiatives, like the STC.UNM program, have made a large contribution to these successes.

Recent initiatives show promise: The Supercomputer and Green Grid Initiative

More recently, the NMCAC has stimulated $111 million in new research funding since 2007 off of a $19.9 million state investment. The state's supercomputer is the fastest non-federal research computer in the nation and is attracting significant interest from industry partners in digital media, aerospace, bioscience and other fields.[26] Representatives from Intel and Cerelink, two private companies, sit on the Board of Directors, helping to ensure the market relevance of the Center. Additional non-state investments are anticipated.

The Green Grid Initiative is a consortium of New Mexico's research universities, labs, utilities, rural electric co-ops, the NMCAC, Intel and other private sector companies, and the Japanese government. It seeks to establish our state as the

[26] Information provided by Dr. Thomas Bowles, Chair of the Board of the NMCAC.

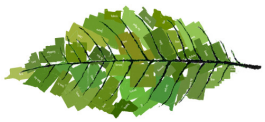
preeminent test bed for smart grid solutions and result in the first statewide smart grid with high renewable energy penetration in the nation. The Japanese government has invested $30 million of its own funds into two demonstration projects in New Mexico based on the strength of our research and other assets. New Mexico is the only state with such an international partnership. Over $100 million in additional investments has been stimulated by this Initiative and work is ongoing. This includes a multi-million dollar investment from Intel, which has established its Energy Systems Research Center in New Mexico to leverage the state Supercomputer and the Green Grid Initiative.

New Mexico is making progress

Generally speaking, New Mexico has made slow but steady progress over the years, partly through state efforts and partly through private sector activities. A few addition highlights include:

- Several strong university research centers have been formed.
- Technology transfer and maturation has improved at our universities and laboratories.
- Industrial partnerships with our research institutions have expanded.
- New entrepreneurial services were established through organizations like Technology Ventures Corporation and Northern New Mexico Connect.
- Venture capital invested in New Mexico has grown, from nothing to several hundred million dollars, stimulated by State Investment Council programs put in place by the state legislature in the mid 1990's. New Mexico's growth has been the fastest in the U.S.[27]

[27] http://www.abqjournal.com/AED/292779nm03-12-08.htm

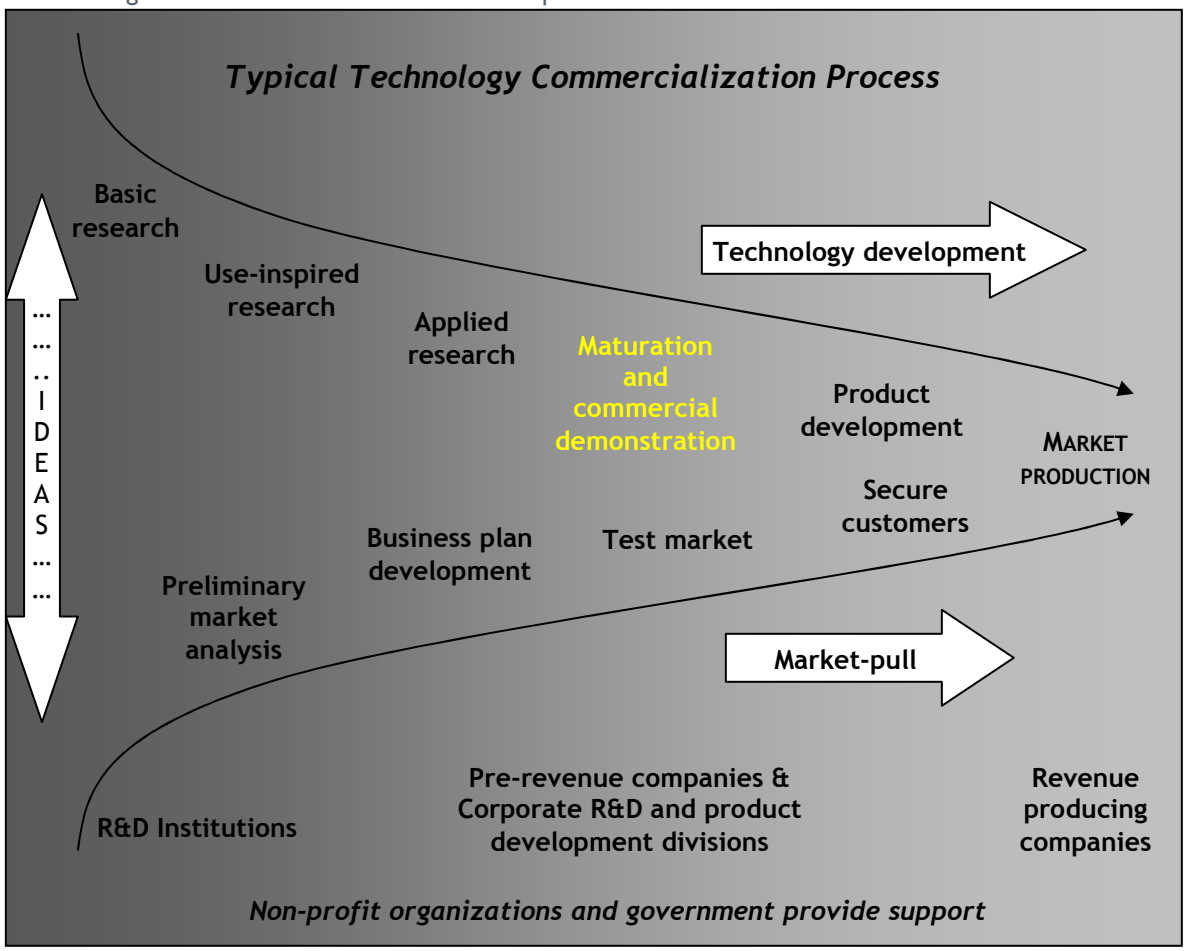


WHAT IS TECHNOLOGY COMMERCIALIZATION?

Technology commercialization is the process of maturing a technology, evaluating market potential, and introducing the resulting product into the marketplace. Technology commercialization is what technology startups do, and according to recent studies by the Kauffman Foundation net job growth in the U.S. economy occurs *only* through startup firms.[28] If New Mexico is interested in growing its economy, supporting the establishment and growth of startup firms is of paramount importance.

> Net job growth in the U.S. comes *only* through startup firms.

There are many organizations that can play a role in this process and there many pathways to the market, but the diagram below provides an overview of the typical process. All technology starts from basic research, and those technologies with a demonstrated *market-pull* eventually become products sold to customers. *Technology maturation* refers to an important stage of commercialization that moves research from the lab "bench top" to the point at which private investors are willing to invest in continued development.



[28] http://www.kauffman.org/newsroom/u-s-job-growth-driven-entirely-by-startups.aspx

The importance of Market-Pull

Market-pull is often distinguished from *technology push*. Market-pull emphasizes that technology maturation efforts should not be wasted on technologies for which there is no market need. Customers and the business professionals who understand them best must be consulted in a systematic way to evaluate market need to demonstrate market-pull. Technology push refers to the practice of starting with the technology that you have and developing it in the vague hope that it will result in market acceptance. It is possible to spend nearly unlimited amounts of money on technology push efforts without creating a sustainable business.

Scientists and research institutions are often guilty of technology push because technology is what they know and work with every day. Aside from some rare exceptions, they have almost no experience in marketing and selling products. In addition, researchers are usually compensated through a stable and often very comfortable salary.

This is in contrast to entrepreneurs who very frequently must defer their own compensation and suffer cash shortages for several years while they work long hours developing a product that customers are willing to pay for. A larger gap in incentive structure and risk tolerance between the typical institutional researcher and entrepreneur would be difficult to find. Unfortunately, technology commercialization requires that these two groups somehow manage a very delicate handoff on the road to market.

In parts of the country with an established entrepreneurial community, for example Silicon Valley or the Route 128 Corridor in Massachusetts, researchers and entrepreneurs have learned over many years how to work together. The need for market-pull is respected by all parties and they all know what they need to do and what they must not do.

This is not the case in New Mexico, although there is a small but growing pool of experienced and successful entrepreneurs who have commercialized technologies from our research institutions. With our nation-leading research community but much smaller market-based technology business sector, New Mexico tends fall to back on technology push, because research and technology are what we know best. This is borne out in the review of New Mexico's previous initiatives: almost all of them have lacked significant private sector involvement. As individuals and as a state, we must admit what we don't know well, which is the market, and seek assistance from those who do.

Global technology market experience is needed

Not only is there a need to learn about the market generally, there is a need to learn about the global technology market specifically. Technology products generally cannot achieve profitability serving a local market like New Mexico alone: they must be sold, and compete, globally. While we have many successful business people in the state who do understand their particular markets (e.g. in real estate, tourism, oil and gas, government contracting), the number of people in the state who have successfully brought a new technology product to market is probably under 50 individuals.[29] Nor does New Mexico have many large and established companies

[29] It should be noted that there may be a larger number of such individuals in the state if those with second homes or who vacation in New Mexico are counted. Unfortunately, few of these business people

familiar with the product development, marketing and sales process at scale to draw upon (e.g. Microsoft, Johnson & Johnson, General Electric).

There can be a tendency in New Mexico to overlook this lack of experience and assume that we can navigate the global marketplace without having spent enough time there. In interviews with stakeholders, this tendency was often referred to as "New Mexico myopia," which can affect investors, scientists, officials and entrepreneurs alike.

This myopia seems to work both ways: investors and entrepreneurs from outside New Mexico do not know much about the research resources and opportunities here. The New Mexico Venture Capital Association, the Technology Ventures Corporation and others are working to address this lack of awareness, but there is much more to be done in this area.

Some outreach to centers of technology commercialization expertise around the country could make a significant difference here. The good news is that buried within our huge research base are likely many technologies with market value that could earn experienced investors and entrepreneurs an attractive profit. And New Mexico's quality of life assets provides an incentive for them to spend time or relocate here.

By disseminating information on these opportunities through trusted peer networks nationally, and welcoming and seeking partnerships with these experts, New Mexico may be able to increase its market knowledge and train a larger pool of local talent more quickly, accelerating the growth of our technology economy.

Moving technology into the marketplace

There many ways for technology to enter the marketplace, but there are a few general pathways that help us understand the process and choices involved.

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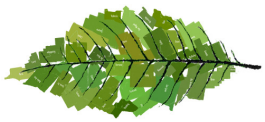
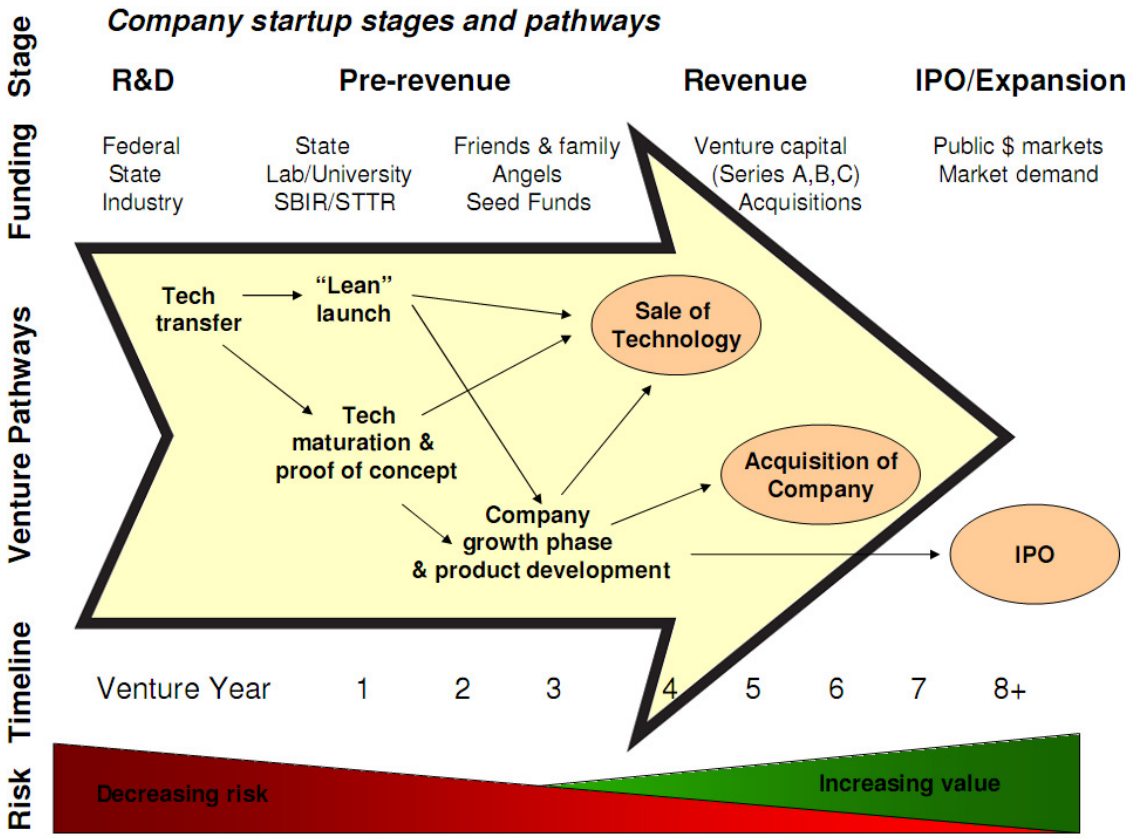
are directly engaged in the state's technology economy. The High Altitude Discovery District is one initiative working to change this and will be described later.





- **Technology transfer:** An R&D institution or a startup company can license an unproven technology they own directly to a company, generally a large and well established company. The idea here is that the institution or company does not have the resources or inclination to bring a technology product to market, and so licenses the technology to a larger company with product development capabilities to commercialize. This large company then either brings it to market or shelves it. Technology can be transferred in a period of several months, but subsequent product development may take several years.
- **Traditional startup:** A venture is started and money from friends and family, angel investors and possibly seed funds is solicited initially. A technology is licensed from an R&D institution or developed by the company directly. The venture proves the concept commercially, secures customers, achieves profitability and seeks additional rounds of growth capital from venture capitalists. The company then either remains privately held, is acquired by a larger company, or the company issues an Initial Public Offering (IPO) of stock and is listed on a stock exchange. Generally the company must be sold or go IPO because investors need a "liquidity event" to exit the company and earn a profit on their investment. IPOs were brought nearly to a standstill during the recession, but are starting to come back.[30] Traditional startups can take 7 or more years to reach exit in normal times. The global recession has delayed exit for many companies by 2 to 4 additional years.[31]
- **Lean launch:** Lean launch is a new model (also known as lean startup) that seeks to take lessons from lean manufacturing, bootstrapped ventures, agile

[30] http://www.foxbusiness.com/personal-finance/2010/08/27/ipo-market-begins-heat/
[31] Stephanie Spong, NM Venture Capital Association President.

programming, and rapid prototyping to very quickly and cheaply develop a "minimum viable product" to enter the market sooner and get customer feedback that can be used to iterate and refine the product. The hope is to reduce the number of years, amount of venture financing and infrastructure that is needed.[32] In this model, growth capital may not pursued and technology can be sold immediately after proof of concept to a larger company. Lean launch aims to reduce the time to exit, allowing limited venture funds to circulate more quickly and support the development of more products.

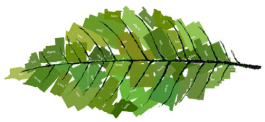
Technology commercialization supporting organizations

Understanding these stages and pathways helps us to understand the role that supporting organizations and initiatives can play in facilitating technology and company development. Generally speaking, the following types of services provide support to the process. Particular organizations and programs may combine multiple services to provide greater integration.

- **Technology transfer offices** are division of, or affiliated with, R&D institutions like national laboratories and universities. Their mission is to license technology to others and their goal is to generate royalties and revenue for the institution. Job creation and economic development are considerations but are usually not their focus. They are the gateway through which companies generally access institutional assets and research.
- **Training and education providers** make it possible for startup employees to reach out and learn what they need to know and develop valuable skills. There are few people in the world who have experience with all the aspects of technology, markets and financing needed to be a successful entrepreneur. While much learning happens on the job, training and education providers are an important source of knowledge. Training and education can be provided by universities and colleges, non-profits, companies and others. It may be either long and comprehensive (e.g. an MBA degree), or short and specific (e.g. seminars and workshops).
- **Business incubators and lab facilities** are programs designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services, developed and orchestrated by incubator management and offered both in the incubator location and through its network of contacts.[33] Technical incubators provide not only office space but laboratory space designed to meet the needs of particular types of technology companies (e.g. "wet" bioscience or materials labs, "dry" electronics labs).
- **Startup assistance** to startup organizations includes everything from market analysis, business plan review, introductions and contacts, human resources and recruiting, legal and accounting assistance, technical assistance and mentoring. These services may be provided by non-profit organization and institutions for free or reduced cost, or by private companies. Some providers have an open door policy and others are selective in who they work with.

[32] Lean startup was coined by serial entrepreneur Eric Ries. http://www.nytimes.com/2010/04/25/business/25unboxed.html Phase One Ventures is seeking to develop this model in New Mexico. http://www.phaseoneventures.com/

[33] http://en.wikipedia.org/wiki/Business_incubator



- **Networks and matchmaking forums** exist to help company executives, investors, scientists, business service providers and other interested parties come together in mutually beneficial ways. These may be general networking organizations and events, or highly targeted forums where companies present to investors, for example.
- **Science and Technology Parks** provide a home for high-tech companies and access to scientists at an associated research institution. The proximity of these companies to each other and the research institution helps to accelerate venture and technology development. S&T Parks are generally for companies beyond the incubator stage, but some also include incubators.
- **Economic development organizations (EDOs)** are associated with state and local governments or chambers of commerce to assist with business expansion and recruitment in their communities. These organizations are generalists who support all interested businesses from their communities and reach out to recruit companies aligned with their community objectives.

Technology commercialization should be supported in rural areas

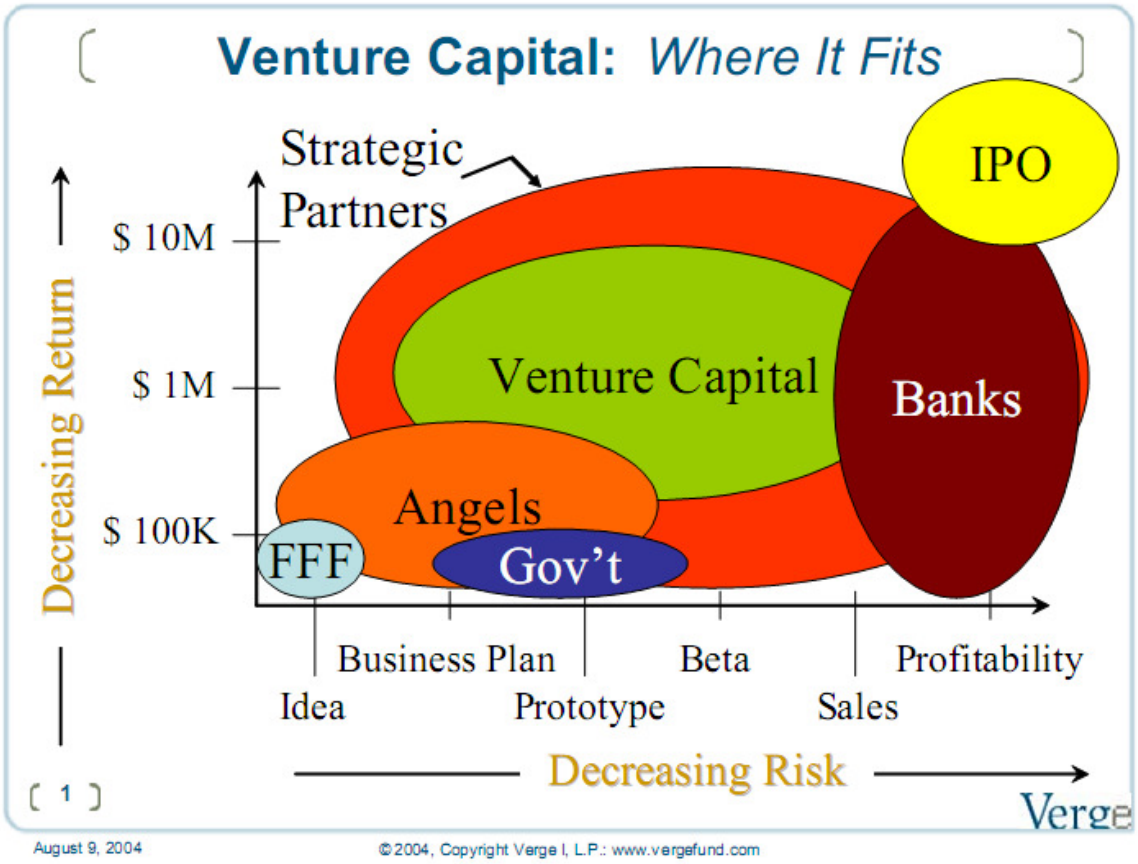
While most new research will continue to be done at NMSU, NMT, UNM, and our national laboratories, the commercialization of technology can occur throughout New Mexico and should be supported wherever there are real market opportunities and committed entrepreneurs. For example, new agricultural, building, renewable energy and extractive industry solutions may find a ready initial market in rural New Mexico. By working with rural incubators, science and technology parks, colleges, agricultural extension offices and economic development organizations, it is possible to build entrepreneurial and commercialization capacity in New Mexico's rural areas. Forms of support could include entrepreneurial training, helping new angel investing groups or technology maturation funds to form, providing information on new technology disclosures, sharing best practices on commercialization, supporting the formation of entrepreneurial peer groups, and so on. It is important to remember that the technology commercialization process, particularly in rural areas, may be led by talented engineers and hands-on technicians rather than Ph.D. level scientists, but their efforts are equally capable of developing new marketable technologies and products in their domains of expertise.

Sources of funding

Funding is a particularly important and challenging need in the technology commercialization process, and involves a range of players specializing at different risk and size levels. The chart below summarizes where various investors fit. These investors are all *equity* investors who demand an ownership stake in the company in exchange for their investment. The ownership stake required is usually larger for earlier stage companies and technology because the perceived risk is higher. Some types of funding are not available until certain milestones are reached, like owning patents and other intellectual property, completion of commercial demonstrations or prototypes, securing customers, or achieving profitability.

Some entrepreneurs try to avoid the need for outside investors by *bootstrapping* their ventures, only growing their companies when there is new revenue to support that growth. This is a slower way to grow and may be impossible for many types of companies that require expensive equipment upfront, unless the entrepreneur has

their own wealth to spend. Each additional investment by outside investors *dilutes* the ownership stake of the entrepreneur, and usually the previous investors as well.



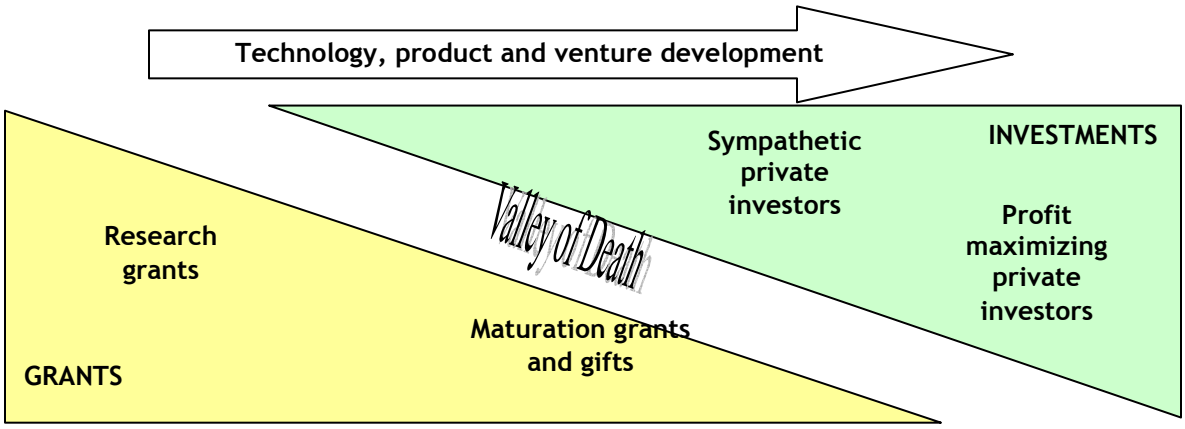
Investment Types & New Mexico Levels

Company Stage	Funding Stage	Investment Range	Sources
Pre-revenue	Technology Maturation	$25,000 to $250,000	Government, Institutions, Friends, Family, Angels
	Seed and Pre-Seed	$250,000 to $2 million	Friends, Family, Angels, Early-Stage Venture Capitalist
Revenue	Series A	$2 million to $5 million	Venture Capitalists
	Series B	$5 million to $20 million	Venture Capitalists (often outside NM)
	Mezzanine and Expansion	$20 million +	Investment bankers, IPO

In addition to these equity investors, companies can also obtain *debt* financing (i.e. loans) to grow their companies and develop their products. The challenge for early stage companies is that loans need to be secured by real assets and/or by a revenue

stream from which the debt can be repaid. Early stage companies may have neither sufficient assets nor revenue, putting debt financing out of reach.

At the earliest stages, only grants from governments, institutions and non-profits may be available. The very difficult challenge of finding grant funding and "soft" investments from sympathetic private investors creates what is called the "Valley of Death." Many ideas, technologies and companies are never able to make it beyond this stage, even when they show long-term promise. This is particularly true in New Mexico.



The gap between grant funding and sufficient / affordable private investment creates the "Valley of Death"

Funding sources

- **Technology maturation funds/programs** provide funding on the order of $25,000 to $250,000, and often expertise, to companies to develop technologies from the research lab "benchtop" through a commercially relevant proof of concept, demonstration or prototype. This funding is usually in the form of a grant from an institution, government agency or non-profit because the technology is so new and unproven that the risk is too high for private investors. This is currently a key gap in New Mexico.
- **Angel investors** provide investments on the order of $100,000 to $500,000, and usually expertise, to early stage companies. Angel investors require an ownership stake.
- **Venture capital** generally provides investments from $500,000 to $20 million or more, provides expertise, requires representation on a company's board and requires an ownership stake. Like angel investors, multiple venture capital companies may partner to fund a single company. Venture capital generally requires that a company have achieved profitability, except for seed funds which work with pre-revenue companies.
- **Investment bankers and institutional investors** include large investment banks (e.g. Goldman Sachs, Bank of America, Citigroup) and large institution investors (e.g. state retirement/pension funds, insurance companies). These equity investors invest in companies with proven revenue and generally at amounts larger than venture capitalists. These companies are generally located in other states.
- **Bankers and lenders** provide debt financing and loans to companies at all stages, so long as sufficient assets and revenue is available to secure the loan. Many and diverse lenders are located in New Mexico, but they may or may not have the expertise with certain types of technology companies and as a result may be more or less inclined to lend to them.

NEW MEXICO'S EXISTING TECHNOLOGY COMMERCIALIZATION ECOSYSTEM

With that general background, we are in a position to understand what organizations are active in New Mexico's technology commercialization ecosystem and where there are gaps. This section outlines our key assets and needs. New Mexico must both continue to grow and build on its assets and address critical gaps.

SWOT Analysis		
	Helpful	***Harmful***
Internal	**Strengths:** • Nation-leading research base and capabilities • Technology transfer offices at all R&D institutions • New Research Applications Center • Startup assistance providers • Angel and venture capital community • State Investment Council programs • Angel and job creation/training incentives • Some technical lab facilities • Networks and match-making forums • Small but growing pool of experienced entrepreneurs • Nation-leading clean energy natural resources • Training and education providers • Science and technology parks • Business incubators • Economic development organizations • Supportive state, federal and local elected leadership	**Weaknesses:** • No statewide evaluation and coordination • Limited pool of experienced entrepreneurs • Insufficient tech maturation funding/programs • Barriers to access technical lab facilities • Limited incubators with technical lab space and associated business services • Missing incentives for venture capital and business R&D • Insufficient incentives for tech commercialization and industry engagement at our research institutions • Insufficient pool of experienced private professional services • Lack of larger venture capital firms • Few large corporations in state with strong global marketing and product development experience • Lack of investment banks in state • State budget deficits • Limited experience with the positive return on investment of successful tech-based economic development

External	**Opportunities:** • State assets could be better leveraged • Opportunity to grow market for Energy Sustainability products in state • Increasing national interest in tech commercialization • Desire for national energy security • Increasing awareness of New Mexico strengths	**Threats:** • Small population limits demand in state and state spending • Other states are investing more in tech-based econ development • Peer states' high-tech sectors are larger and/or growing faster • Current high-tech jobs overly dependent on government grants & contracts

Key assets

Our key assets and strengths are listed below. Additional background information on these organizations is listed in Appendix H.

- ***R&D institutions, research, scientists and technology transfer offices***

  New Mexico is home to two national DOE laboratories: **Los Alamos National Laboratory** and **Sandia National Laboratories**; three research universities: **New Mexico State University**, **New Mexico Tech**, and the **University of New Mexico**; two major DOD research centers: the **Air Force Research Laboratory** and the **White Sands Missile Range**. Together, these institutions represent over $6 billion dollars of research and development in New Mexico.[34] While not all of this R&D spending is accessible by industry due to national security restrictions, a conservative estimate from our research institutions suggests that $1.25 billion or more is. This is an unparalleled amount of research for a state our size. All of these institutions have technology transfer offices. At our universities, **The Arrowhead Center** handles these and other responsibilities at NMSU, the **New Mexico Tech Foundation** at NMT, and **STC.UNM** at UNM.

- ***Startup assistance providers***

  New Mexico has a range of business service groups, both public and private. The **Technology Ventures Corporation** is based in Albuquerque but serves all of the national laboratories in the country. They help startup companies developing out of these labs. **Northern New Mexico Connect** is a project of Los Alamos National Laboratory and offers many services. In addition, startup services are available through six state-certified business incubators and some technology transfer offices.

- ***Angel investors and venture capital companies***

  New Mexico has an active angel investor community and a formal group, **New Mexico Angels.** New Mexico has a strong venture capital association, **The New Mexico Venture Capital Association.** The growth of venture

[34] Source: Dr. Thomas Bowles, Governor Richardson's Science Advisor.

capital has been partially stimulated by co-investments from the State Investment Council.

- ***State Investment Council New Mexico investment programs***
  The State Investment Council has three programs that channel state permanent fund monies to support technology based economic development in the state.

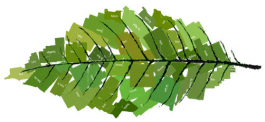
- ***State incentives for angel investments, business growth***
  New Mexico currently has a variety of tax and other incentives that stimulate angel investments (Angel Investment Tax Credit), incentivize the national laboratories to assist small businesses in the state (New Mexico Small Business Assistance Program) and support job creation and training (e.g. the Job Training Incentive Program, High Wage Tax Credit, Technology Jobs Tax Credit, Manufacturers' Investment Tax Credit). See the section on the New Mexico Economic Development Department in Appendix H for more information.

- ***A small but growing pool of experienced entrepreneurs and technology startups***
  Over the past decade, the number of technology startups has increased significantly with the funding support from the angel and venture capital community. The entrepreneurs behind these companies have largely remained in New Mexico to start additional ventures after their initial exit. Examples include In Light Solutions, which then spawned Lumidigm, TrueTouch, Verilight and Lumos Medical. The Bios Group led to Q Forma and others. Executives from Eclipse Aviation are now with Aspen Avionics and other aerospace companies. A number of other entrepreneurs are continuing to be very active in New Mexico, starting new companies and investing in others. These include Chuck Call, John Elling, Michael Emerson, Kristin Martinez, Blake Ridgeway, Rusty Schmit and Waneta Tuttle.

- ***Technical lab facilities***
  New Mexico has several business incubators but no incubators with technical lab space and co-located business assistance for technology-based startups. Some lab facilities, not associated with incubators, are available for a fee at the national laboratories and universities. This fee may be prohibitive for cash-strapped startup ventures. Some ventures report that even when the fee is within financial reach, laboratories can be procedurally difficult to access. These barriers should be addressed.

- ***Relevant natural resources***
  New Mexico has nation-leading renewable energy and conventional energy resources that provide an opportunity to develop a market for related technology products in the state. These will be described in more detail in the next section.

- ***Networking and match-making forums***
  There are a variety of networking organizations and match-making events in the state. These include the **Coronado Ventures Forum**, the **New Mexico Technology Council**, **Ignite NM**, as well as other programs of the universities and national laboratories (see more in Appendix H). In addition, there are several forums including the **TVC Annual Investor**



Forum and the **Venture Capital in the Rockies** conference.

- ***Training and education providers***
  From universities to non-profits to secondary schools, entrepreneurial education is available through a variety of sources in the state. Both NMSU and UNM have business schools, business plan competitions and other targeted training. TVC and Northern New Mexico Connect also offer training, as do some of our business incubators. Both national laboratories provide training to interested scientists.

- ***Science and Technology Parks***
  UNM, NMSU, Sandia and Los Alamos all have affiliated science and technology parks that make it possible for companies to locate next to, and interact, with their scientists.

- ***Business incubators***
  New Mexico has a number of state-certified business incubators around the state. See the Appendix H for more information.

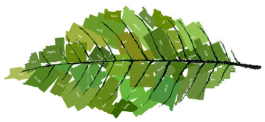
- ***Economic development organizations***
  Most parts of New Mexico are covered by a local EDO as well as the State Economic Development Department. See Appendix G for more information.

Evidence of impact

There is ample evidence that these assets and initiatives are already making significant contributions to the state's technology economy. Some highlights are included here.

- The Technology Ventures Corporation has helped form 100 new companies across the nation, secure more than $1.1 billion in private-sector funding in more than 200 funding events, and created more than 13,000 jobs since its founding in . In New Mexico, these numbers are 86 new companies, more than $750 million in funding, and approximately 8,000 jobs.[35]
- The New Mexico Small Business Assistance Program harnesses the two national laboratories to provide free technical support to New Mexico based small businesses. In 2009, NMSBA assisted 320 companies (226 of which were rural) with technical assistance valued over $4,200,000. Between 2000 and 2008, 1020 jobs and $40 million in new revenue was created, and $28 million in reduced operating costs were realized.[36]
- An analysis of UNM's STC Center in 2004 found an economic impact of $21,300,000 and direct job creation of 73 positions. The impact has certainly increased since 2004 as licensing income has increased eight fold.[37]
- Over the 2009-2010 school year to date, the growing Arrowhead Center at NMSU has completed 25 businesses consultation engagements, engaged over 350 secondary students through partnerships with local schools, and is exceeding its performance metrics.[38]
- The Sandia Science and Technology Park has created 2,284 direct jobs and 7,725 total jobs, resulting in $1,214,344,969 in cumulative new taxable

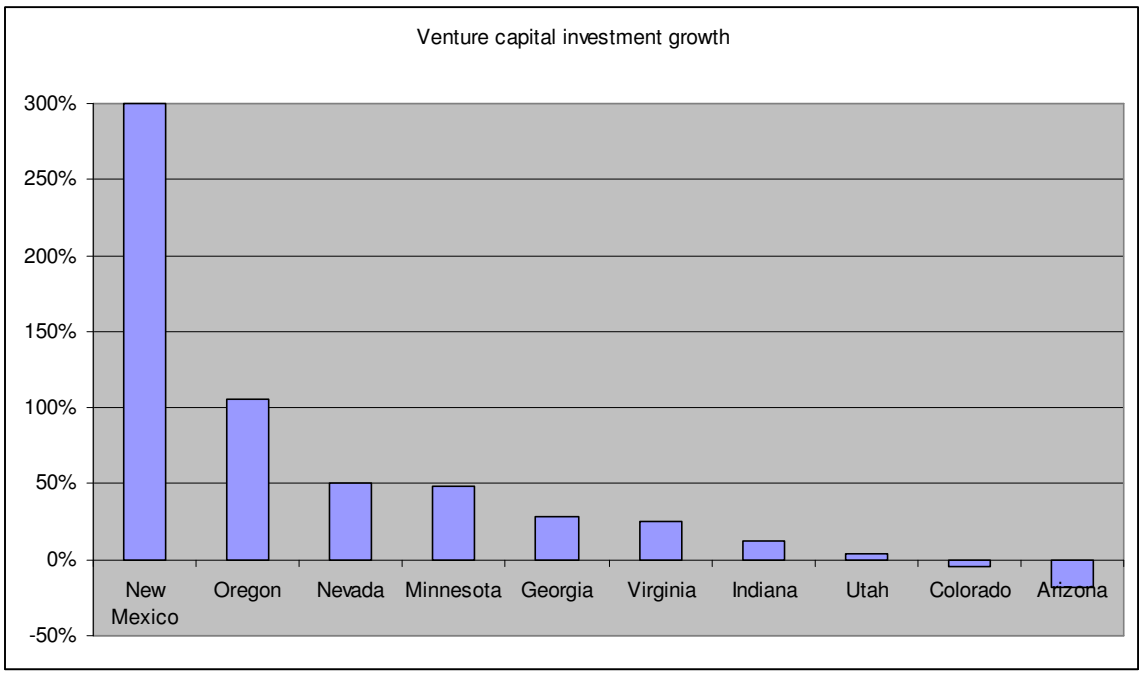
[35] Information provided by Randy Wilson, Program Management Director, TVC.
[36] 2009 Annual Report. http://www.nmsbaprogram.org/content/publications
[37] http://stc.unm.edu/about/metrics.php
[38] Data provided by Dr. Kevin Boberg, NMSU.



economic impact since its founding. The average wage for jobs created is $71,612.[39]

- In 2008, Northern New Mexico Connect created 39 jobs with an average salary of $78,500, retained 6 additional jobs, and attracted $5,375,000 in new investments and funding for participating companies. 79% of companies assisted rated NNMConnect support excellent or good.[40]
- The Sandia Entrepreneurial Separation to Transfer Technology (ESTT) program allows an employee to terminate his or her employment at Sandia to pursue a startup venture or other project with a guarantee of reemployment within two years of termination. A 2009 survey of 16 companies found that 277 jobs were created at an average wage of $60,566 and $22 million in revenue. In addition, 26 companies have done business with Sandia worth $390 million.[41]
- As discussed earlier, the New Mexico Computing Applications Center has leveraged its state investment 5:1 in under three years and continues to advance.
- The State's Centers of Technical Excellence program has attracted several hundred million dollars in additional research dollars, creating hundreds of jobs and leveraging the state's investment by at least 10:1.
- The New Mexico Green Grid Initiative has leveraged over $100 million in non-state investment.

Rapid venture capital growth, stimulated by NM SIC programs



Source: Milken Institute, 2009. 2006-2007 data.

[39] New Mexico Mid-Region Council of Governments analysis: http://www.mrcog-nm.gov/economic-development-mainmenu-65

[40] 2009 Annual Report. http://www.nnmconnect.net/Downloads/tabid/272/Default.aspx

[41] March 2010 brochure. Contact Jim Clinch, jpclinc@sandia.gov.

Venture capital invested in New Mexico has grown, from nothing fifteen years ago to several hundred million dollars today, stimulated by State Investment Council programs. From 1997 to 2007, New Mexico's venture capital growth was the fastest in the U.S.[42] Over 20 venture funds now have equity deployed in New Mexico companies.[43]

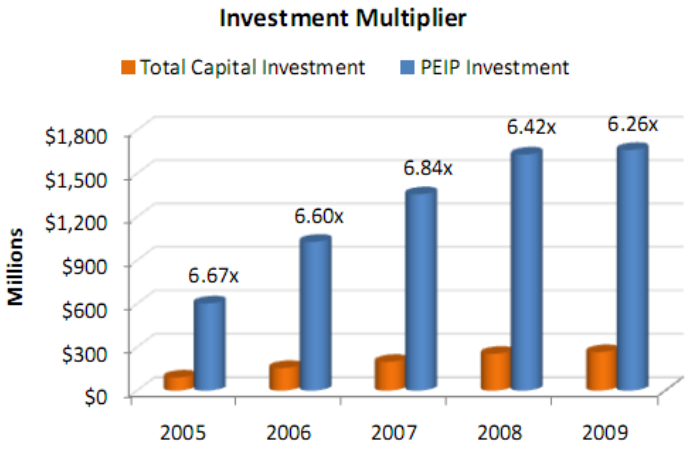
The SIC funds three programs that channel state permanent funds to investments in New Mexico's economy. These are[44]:

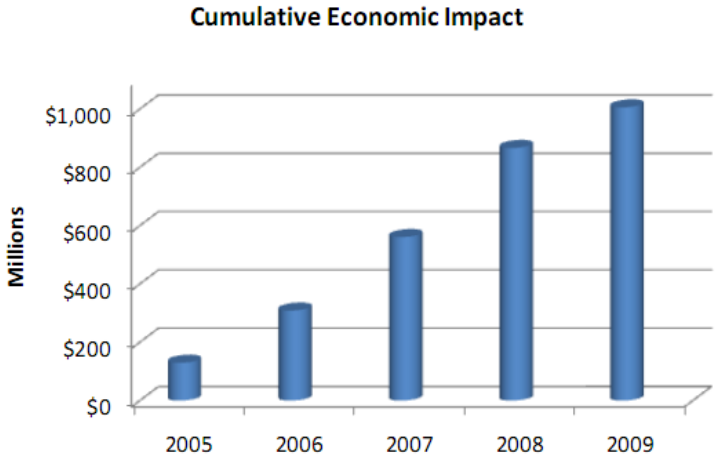
- The Private Equity Investment Program (PEIP)
- The Co-Investment Program
- The Small Business Investment Corporation Program (SBIC)[45]

The NM Private Equity Investment Program NMPEIP is the overall umbrella for the state's efforts to invest in New Mexico venture capital funds and local companies under NMSA section 7-27 which allows differential rate investments.

The program, which began in 1993 and has been expanded by the Governor and legislature several times, most recently in 2006, allows up to 9% of the Severance Tax Fund to be invested in venture funds that are actively working venture capital deals in New Mexico (must have an investment professional & NM office), and which must cause to be invested in New Mexico companies at least as much as the SIC committed to their fund. Standard "prudent investor" rules still apply and protect these funds against misuse.[46]

In 2003, the legislature authorized "direct" investment by the SIC, which is known as the "Co-Investment Program." After some initial experience, the SIC hired an outside fund manager to run a new fund where SIC is the sole limited partner. Fort Washington ran the first Co-Investment Fund, in which the fund manager invests on the SIC's behalf with other qualified co-investors (the SIC can't own 51% of any





[42] http://www.abqjournal.com/AED/292779nm03-12-08.htm. See also Milken index for Risk Capital and Entrepreneurial Infrastructure, New Mexico advanced from 31st to 6th between 2002 and 2009. Chart from Milken Institute, 2010. http://www.milkeninstitute.org/publications/publications.taf?function=detail&ID=38801224&cat=resrep

[43] Presentation provided by Paul Goblet, SBIC, 2010.

[44] Additional information available in Appendix H.

[45] Separately administered.

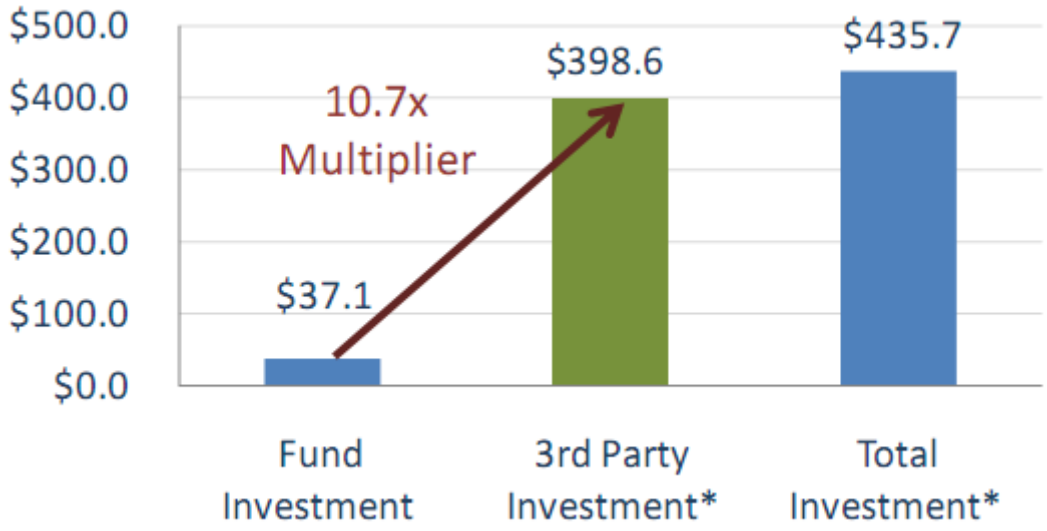
[46] http://en.wikipedia.org/wiki/Uniform_Prudent_Investor_Act

company). Later Sun Mountain Capital took over management of this fund.

The SIC's New Mexico investment programs have directly stimulated private venture capital investments in New Mexico companies of over $1 billion, leveraging outside funds by 6.3:1 in the PEIP program and 10.7:1 in the Co-Investment Program.

The economic impact the PEIP in terms of payroll and purchasing in New Mexico was estimated at $139M in 2009 alone.[47] These programs increase the capacity of the private sector to capitalize on our state research assets and should be maintained, and if possible expanded.

SIC Private Equity Investment Program (PEIP) Results



SIC Co-Investment Program Results

* Includes only financings directly participated in by this program.

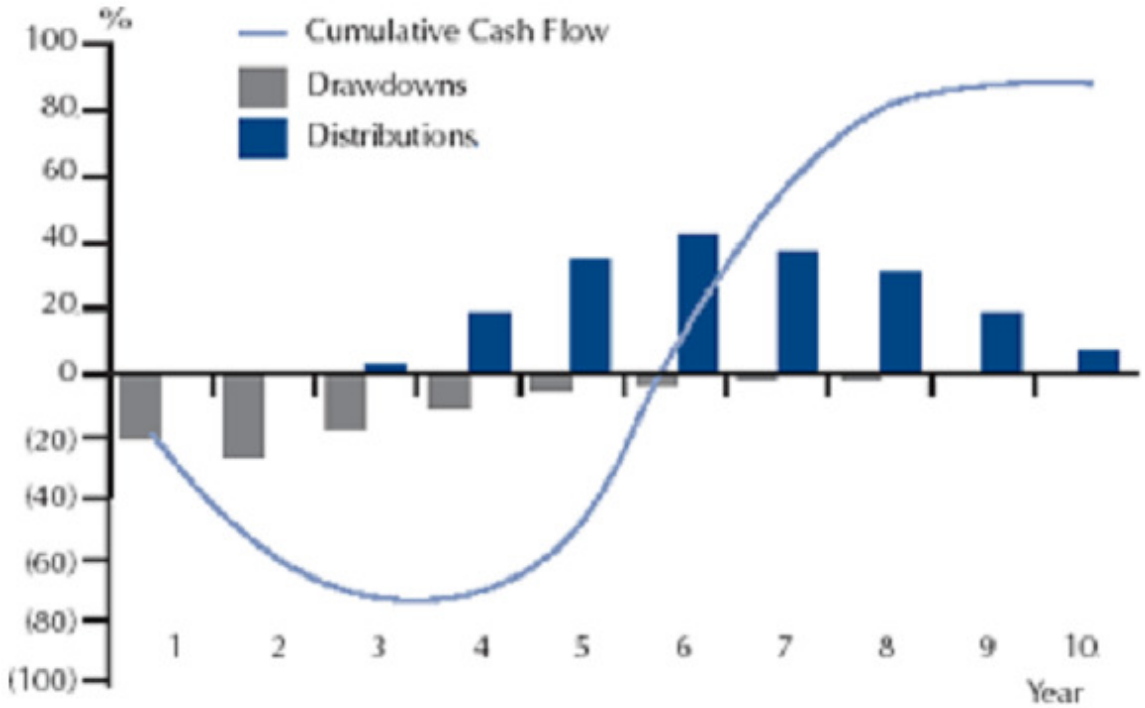
SBIC Program

The SBIC program is separately administered by the Small Business Investment Corporation and provides both equity and debt. The $31 million in equity provided by the SBIC has attracted over $62 million in additional private capital to nine New Mexico headquartered funds. The SBIC has been a primary catalyst for the establishment of New Mexico based venture capital funds. The NMSBIC is typically the first institutional investor and often the largest investor in these funds. Each fund was created to address very specific equity needs within the state and the SBIC's capital can only be invested in NM companies. The SBICs debt (loan) programs have invested over $28,800,000 in New Mexico small businesses with an annual loan loss ratio under 1%. There is no other western state that has created a small business lending system that comes close to broad impact of the SBIC's 1,900 loans over the last 6 years.[48]

[47] See the SIC website for presentations on the PEIP and the Co-investment Program: http://www.sic.state.nm.us/

[48] Presentation provided by Paul Goblet, SBIC, 2010.

Due to the global recession, venture capital investments nationwide have had to delay company exits.[49] This is also true of New Mexico investments. The result is that the apparent return of these investments appears low, but will most likely improve significantly as the economy improves and the venture funds can exit their companies. This is referred to as the "J Curve" phenomena.[50] It is important that we not judge the overall performance of these programs at this moment in time. As the economy comes back, the fund performance will also return.



The "J Curve"

Venture Capital in rural areas

A recent national study also shows that venture capital invested in rural areas performs as well as investments in urban areas.[51] This is certainly an important finding for a state like New Mexico, showing that there are opportunities in new ventures all across the state. The report found that a key factor in ensuring this performance was the availability of advisory services reflecting national best practices, like those provided by Technology Ventures Corporation, Northern New Mexico Connect and others here in the state.

Key weaknesses and gap

New Mexico's key weaknesses and gaps, and ways to address them, are discussed in detail in the recommendations section. A short summary is available in the SWOT Analysis table above.

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[49] See http://blogs.wsj.com/venturecapital/2010/08/06/venture-capitals-ticking-time-bomb/ and http://techcrunch.com/2010/05/14/venture-returns-2009/

[50] http://www.sic.state.nm.us/private_equity.htm

[51] http://patscruggs.com/assets/files/reports/The%20Role%20of%20Equity%20Capital%20in%20Rural%20Communities%203-10V2.pdf

TARGET MICRO-CLUSTERS AND ENERGY SUSTAINABILITY

Focus where the market and R&D assets intersect to maximize limited state funding

Readers may be curious if there are certain technology areas where New Mexico has strengths that should be emphasized. In some ways this a trick question because the only technology areas that should be emphasized are those where there is demonstrated market-pull, as was discussed earlier. But there is merit in considering whether there are opportunities to leverage limited state funding support as much as possible through targeting particular technology areas. This leveraging comes when there are aligned strengths in other parts of the economy that provide synergy. Alignment should be considered in the following areas:

- **R&D assets:** Does New Mexico have a community of leading researchers and technology in this area?
- **Existing startups and entrepreneurs:** Does New Mexico have entrepreneurs or existing startup companies commercializing closely related technologies?
- **Industry cluster:** Does New Mexico have a broad industry cluster in this technology area?
- **Workforce:** Is there a sufficient supply of trained workers to support the commercialization of this technology?
- **Existing market:** Is there a sizable market in New Mexico to provide early sales opportunities for this technology?
- **Market potential:** Does New Mexico have natural resources or other competitive advantages that could be developed into a larger market for these types of technology?

Supporting micro-clusters: A practical strategy

One practical strategy for allocating limited state support would be target to "micro-clusters." An economic or business cluster refers to geographic concentration of interconnected businesses, suppliers, and associated institutions in a particular field. Clusters are considered to increase the productivity with which companies can compete, nationally and globally.[52] An economic cluster might be mining, tourism, or real estate. Within the technology economy, a cluster might be found in areas like nanotechnology, information technology, bioscience, aerospace and "Energy Sustainability," which will be described below.[53] The state science and technology report *Technology* 21, identifies these clusters as particular areas of opportunity for New Mexico.[54] New Mexico has technology and science clusters in these areas, but it does not have globally competitive industry clusters in these areas, yet. As a result, we lack significant market-pull uniformly across these broad technology clusters.

Micro-clusters takes this analysis through an additional level of detail, seeking to identify particular sub-clusters that exist.[55] Particularly in a largely rural, small population state like New Mexico, while there may be few clusters where we

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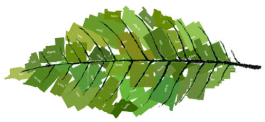
[52] http://en.wikipedia.org/wiki/Business_cluster

[53] See the *Technology 21* state report for information on these five technology clusters. Information is also available at http://www.edd.state.nm.us/scienceTechnology/intro/index.html.

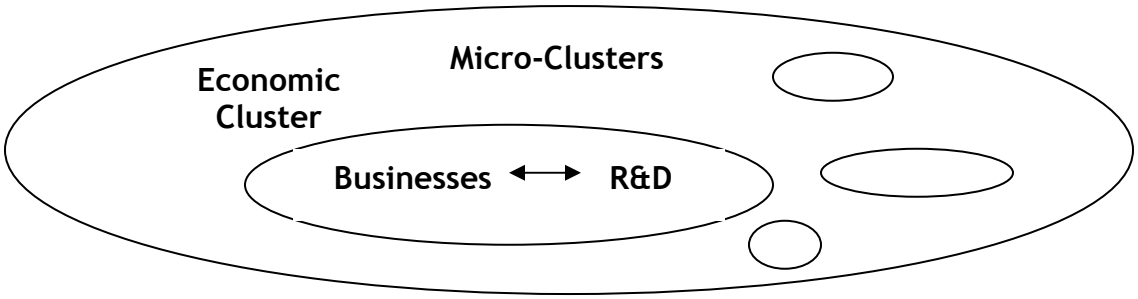
[54] http://www.edd.state.nm.us/publications/Technology21.pdf

[55] for some references to micro-clusters, please see this paper from the National Governor's Association, www.nga.org/cda/files/ATLANTAFORUM_MACKE**MICRO**.PDF, or this one from Community futures Alberta, www.ruraldiversification.com/.../CFA-RDI-**EconomicClusters**-01.pdf.



"compete nationally and globally," we may have numerous micro-clusters where this is the case. Being a small population state also makes it more difficult for us to muster the funding levels to make nationally competitive investments into entire clusters. Without an ability to make investments at the same level as more populous states like Colorado, California or Arizona, we may find that money is spent without achieving the desired results because we cannot be competitive.

The solution to this challenge is to narrow our focus to the level of economic micro-clusters, where we can compete globally and where we can begin to build cohorts of self-sustaining businesses. For example, New Mexico has a micro-cluster of 10 companies commercializing high-tech materials for energy applications, drawing on UNM's Center for High Tech Materials. Another micro-cluster exists in algal biofuels including Sapphire Energy, Incitor and research at NMSU, CEHMM, Los Alamos and Sandia. Others exist within the bioscience, nanotechnology and optics areas. We can deploy limited state funding to support these micro-clusters where our business community and R&D community intersect. This will ensure market-pull and best leverage public funds. Additional investigation is needed to fully inventory these economic micro-clusters, but the state science and technology report has a preliminary analysis in its appendices that can serve as a starting point.[56]



Energy Sustainability: A specific opportunity

"Over and over America has looked to the West to work out the future…Now, as the nation works out another future – a clean energy future – in order to create a more competitive "next economy," it should look once again to the Intermountain West." *Centers of Invention: Leveraging the Mountain West Innovation Complex for Energy Systems Transformation*, Mark Muro and Sarah Rahman, Brookings Institution, 2010.[57]

"Certain regions have grown into venture capital hubs for different industry sectors….Emerging specialty hubs include Tennessee for healthcare and financial services, New Jersey for biotechnology, and New Mexico and the Southwest for solar and renewable energies." *2009 Venture Impact: The Economic Importance of Venture Backed Companies to the U.S. Economy*

Energy Sustainability: Technologies that advance the development of sufficient and sustainable domestic energy sources.

[56] http://www.edd.state.nm.us/publications/Technology21appendices.pdf
[57] http://www.brookings.edu/papers/2010/0901_energy_muro_rahman.aspx

While New Mexico has R&D assets in technology clusters like nanotechnology, information technology, bioscience, and aerospace, it may be through commercializing technologies addressing *Energy Sustainability* where the state can really shine. The Clean Technology Commercialization Working Group recommends that additional emphasis be placed in this area. Energy Sustainability covers all those technologies that advance the development of sufficient and sustainable domestic energy sources. This includes any technologies that contribute to:

- **Renewable energy** including solar, wind, geothermal and biomass power;
- **Biofuels and bio-products,** especially from algae, dry-land farmed feedstocks, and waste products like dairy manure;
- **Energy efficiency** in buildings, appliances, equipment, materials and processes**;**
- **Smart grid solutions** that enable reliable integration of increasing amounts of renewable and distributed generation sources, energy efficiency and consumer information and choice;
- **Safe and secure nuclear energy.** Technologies that generate power while protecting people and the environment;
- **Efficiency and environmental improvements for fossil fuels and their use.** Technologies that promote environmental sustainability by reducing waste and the negative environmental impacts of these fuel sources on which we so heavily depend;
- **The energy/water nexus**. Energy and water are closely connected: energy is needed to collect and purify water and water is needed to generate energy. This is an especially important for an arid state like New Mexico.

The advantages of emphasizing *Energy Sustainability* is that it provides high leverage based on the criteria discussed at the beginning of this section:

- **There is a large base of R&D in this area**
  All three research universities and both national laboratories have substantial expertise in this area. See Appendix G for more information.

- **There are existing entrepreneurs and startup companies**
  Several of these have been mentioned earlier. A complete inventory should be performed to help catalog existing economic micro-clusters.

- **There is a mature industry cluster in fossil fuels and a rapidly growing cluster in renewable energy**
  New Mexico has a large and mature oil and gas industry that employs over 23,000 people and contributed 18% of the state budget in 2006[58].

  The renewable energy cluster has been a key focal area for the New Mexico Economic Development Department and the Governor's Green Jobs Cabinet. A comprehensive overview of the state's green economy was prepared in 2009, including five strategic recommendations. New Mexico has more strengths in this area than can be summarized in this document, however all are listed in the green economy report which is available online. [59] The top two recommendations from the report were to become the nation's leader in

[58] www.nmoga.org and http://newmexicoindependent.com/18244/forging-an-energy-policy-that-benefits-all-of-new-mexico
[59] http://www.edd.state.nm.us/greenEconomy/overview/index.html

renewable energy export (electricity, biofuels and products) and to develop the leading vertically integrated solar economic cluster.[60] Thousands of manufacturing and production jobs have been announced in this sector in the past two years and growth is projected globally.[61]

New Mexico's success in this area has been recognized by *Business Facilities* magazine, which ranked our state the #2 Solar Energy Manufacturing Leader and #5 Renewable Energy Industry Leader in the nation.[62] The state's progressive leadership, at state, federal and local levels, has resulted in the fastest green job growth in the Rocky Mountain West.[63]

While technologies with a national or global market will eventually provide the greatest economic development to the state, having a ready market in the state can help to ease the introduction of new technologies and provide an additional reason for these businesses to stay in New Mexico as they grow.

- **There is a trained workforce available, but education attainment needs improvement**
  New Mexico has a strong pool of engineers and scientists (fifth in the

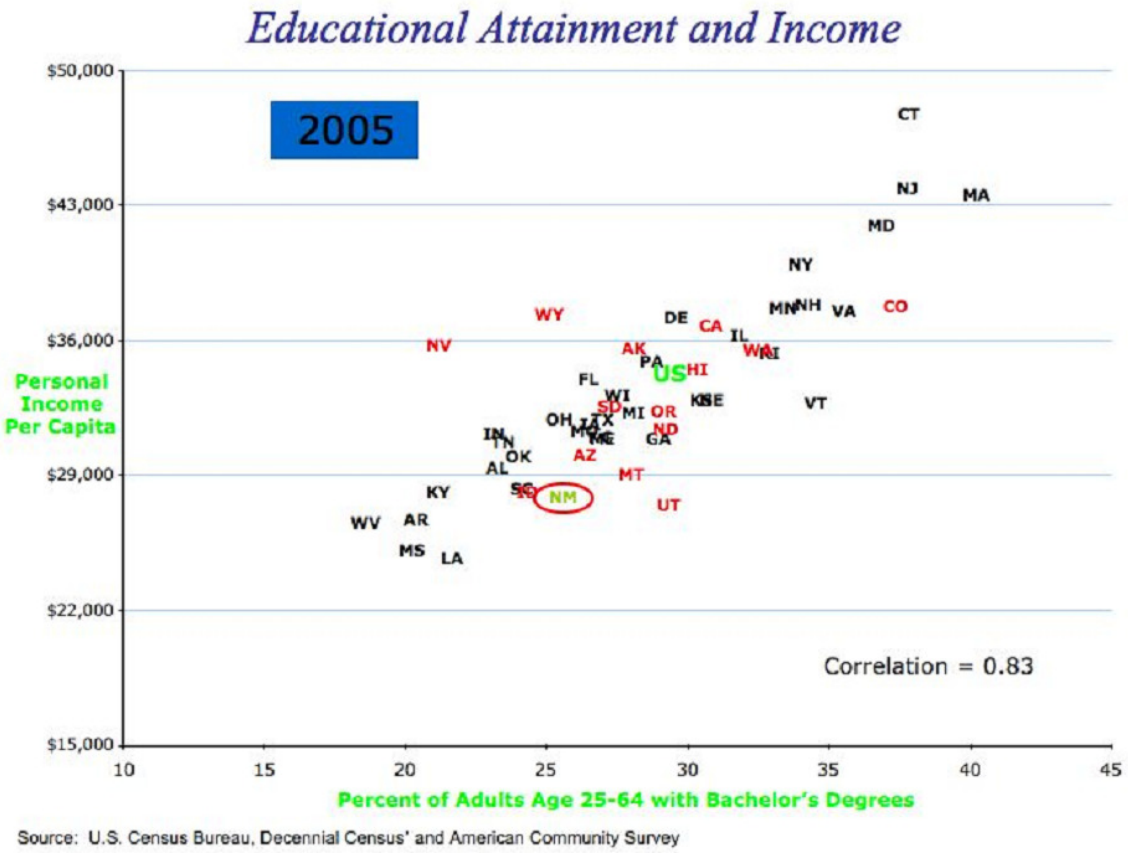
[60] Many of the recommendation from the Green Jobs Cabinet have been supported by the New Mexico First 2009 town hall on the state's energy economy. Additional information can be found at: http://www.nmfirst.org/townhalls/TH37_reports.html

[61] Source: New Mexico Economic Development Department. See also press releases from EDD and Governor Richardson's office.

[62] www.governor.state.nm.us/press/2010/aug/081210_03.pdf

[63] http://www.abqjournal.com/opinion/guest_columns/27212625opinion06-27-10.htm

nation[64]) and semiconductor manufacturing technicians, but a low educational attainment (48th in the nation[65]). Educational attainment improvements, especially in Science, Technology, Engineering and Math (STEM) disciplines, is needed. Additional entrepreneurial education is also needed. A targeted evaluation of the workforce in Energy Sustainability would provide additional information on specific strengths and gaps. Creating new job opportunities in this exciting sector with long term opportunities in the state will certainly also create a "market-pull" for New Mexico's students to pursue education that prepares them for these jobs.



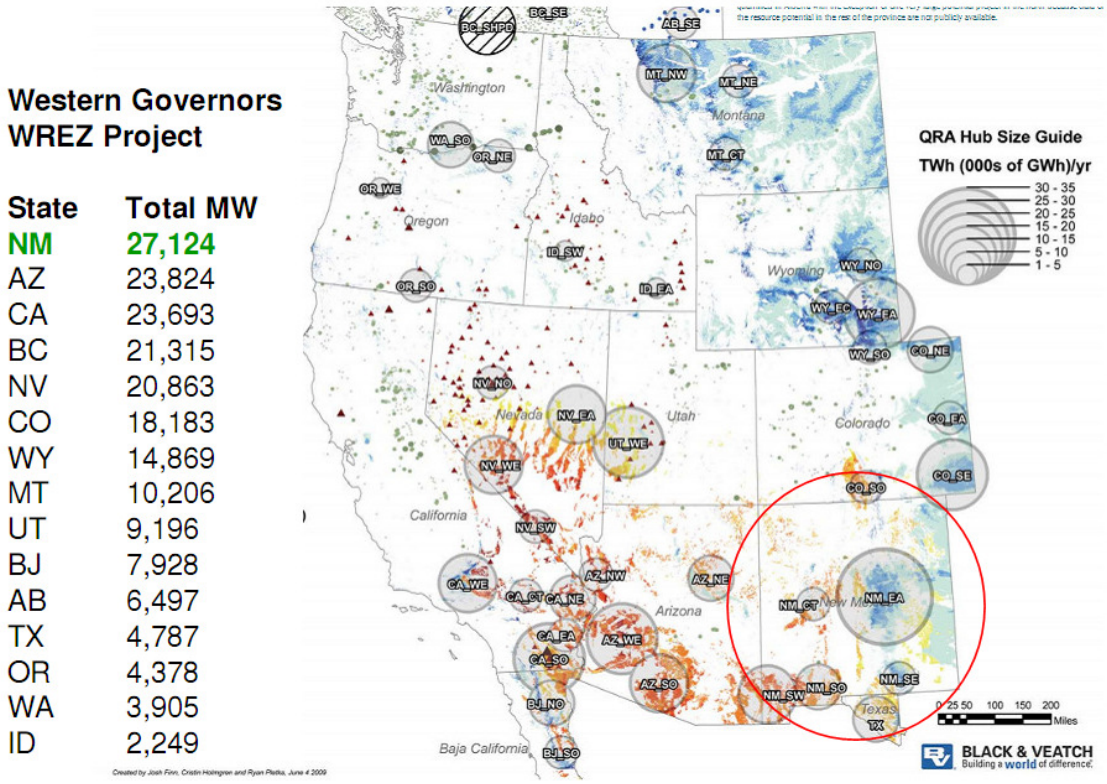
Source: U.S. Census Bureau, Decennial Census' and American Community Survey

- **There is an existing market** for fossil fuel technologies, given the large oil and gas industry in the state, and there is a growing market in renewable energy technologies as this sector grows globally. For example, New Mexico has nearly 800 MW of wind power in advanced stages of development or completed, and 400 MW of announced solar projects.[66] In addition, there is a small cluster of nuclear service companies in southeastern New Mexico.

- **There is strong market potential**
  The market potential for renewable energy technologies is large globally, and large in New Mexico specifically. For example, New Mexico's solar resource

[64] Cyberstates 2010 Report. http://www.techamericafoundation.org/cyberstates
[65] NSF State Indicators Data, 2010: # of bachelors degree conferred per 1000 indiivduals 18-24 years old. http://www.nsf.gov/statistics/seind10/c8/c8s7.htm
[66] http://www.edd.state.nm.us/publications/pureEnergyInnovationBrochure.pdf

ranks second in the nation. The cost of solar energy is projected to decline to the level of existing coal and natural gas power by 2015 in the southwest, which would dramatically increase the market for this technology. The Western Governor's Association estimates New Mexico renewable energy potential as the highest of any western state or province.[67]



Source: http://www.westgov.org/wga/initiatives/wrez/

Venture capital investments in Energy Sustainability: Substantial and growing

Venture capital investments in Energy Sustainability technologies are strong and growing, both nationally and in New Mexico. Clean tech investments have been a fast growing sectors in recent years nationally, as shown on this chart from the National Venture Capital Alliance.[68] The second chart below from the Cleantech Group shows clean tech venture investments by category from the second quarter of 2010 nationally.[69] Solar is by far the leading micro-cluster currently receiving venture funding.

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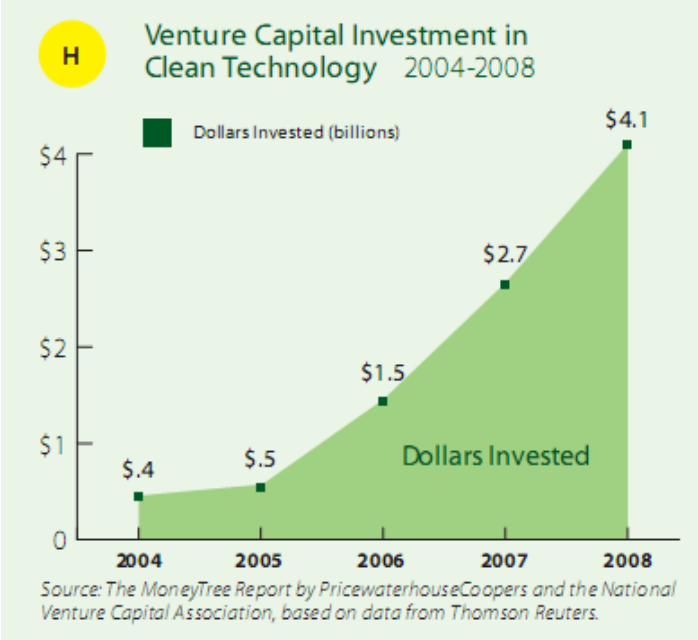
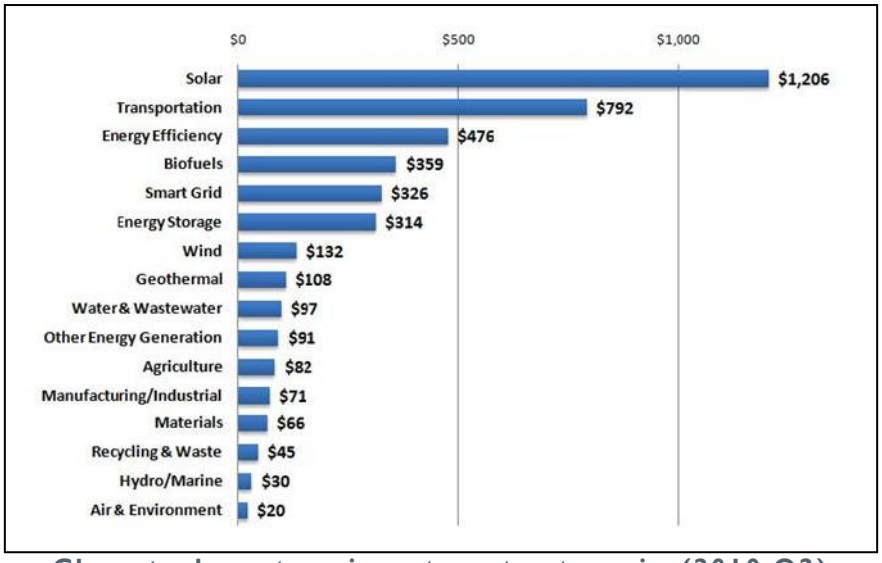
[67] Data from the National Renewable Energy Laboratory and the Western Governors Association WREZ report. Details in the New Mexico Green Economy Report: http://www.edd.state.nm.us/greenEconomy/governorsGreenJobsCabinetReport.pdf .

[68] http://www.nvca.org/index.php?option=com_docman&task=doc_download&gid=482&Itemid=93

[69] See http://latimesblogs.latimes.com/technology/2010/08/cleantech-investment-q2-2010.html and http://cleantech.com/research/2Q10im.cfm?mkt_tok=3RkMMJWWfF9wsRonv6vLZKXonjHpfsX%2B7%2BkuWLHr08Yy0EZ5VunJEUWy2oMASdQhcOuuEwcWGog8wwBdG%2B6BeYNI

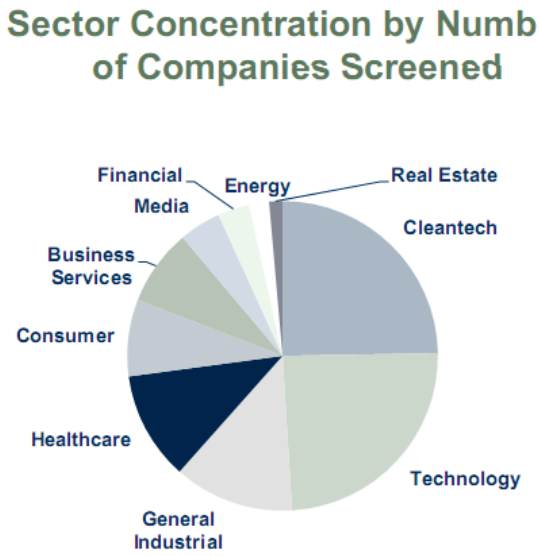


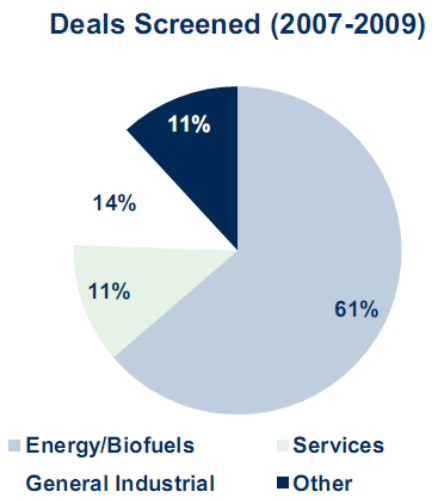


Clean tech venture investment categories(2010 Q2)

In New Mexico, venture capitalists are seeing strong deal-flow in Energy Sustainability areas, and expect this trend to continue. Approximately 25% of all deals are cleantech deals, and of those over 60% are in the energy and biofuels area.[70]

[70] New Mexico Venture Capital Association, 2009.
http://www.nmvca.org/download/NMVentureCapitalActivity2009.pdf





National industry analysts agree that New Mexico is an emerging leader in *Energy Sustainability*, as indicated by the quote from the IHS Global Insight report at the beginning of this section.

In summary, while there is no shortcut to evaluating and supporting micro-clusters where there are both existing business and technology resources, *Energy Sustainability* shows promise as a cluster in which to find those micro-clusters.

NEEDS, OPPORTUNITIES AND RECOMMENDATIONS

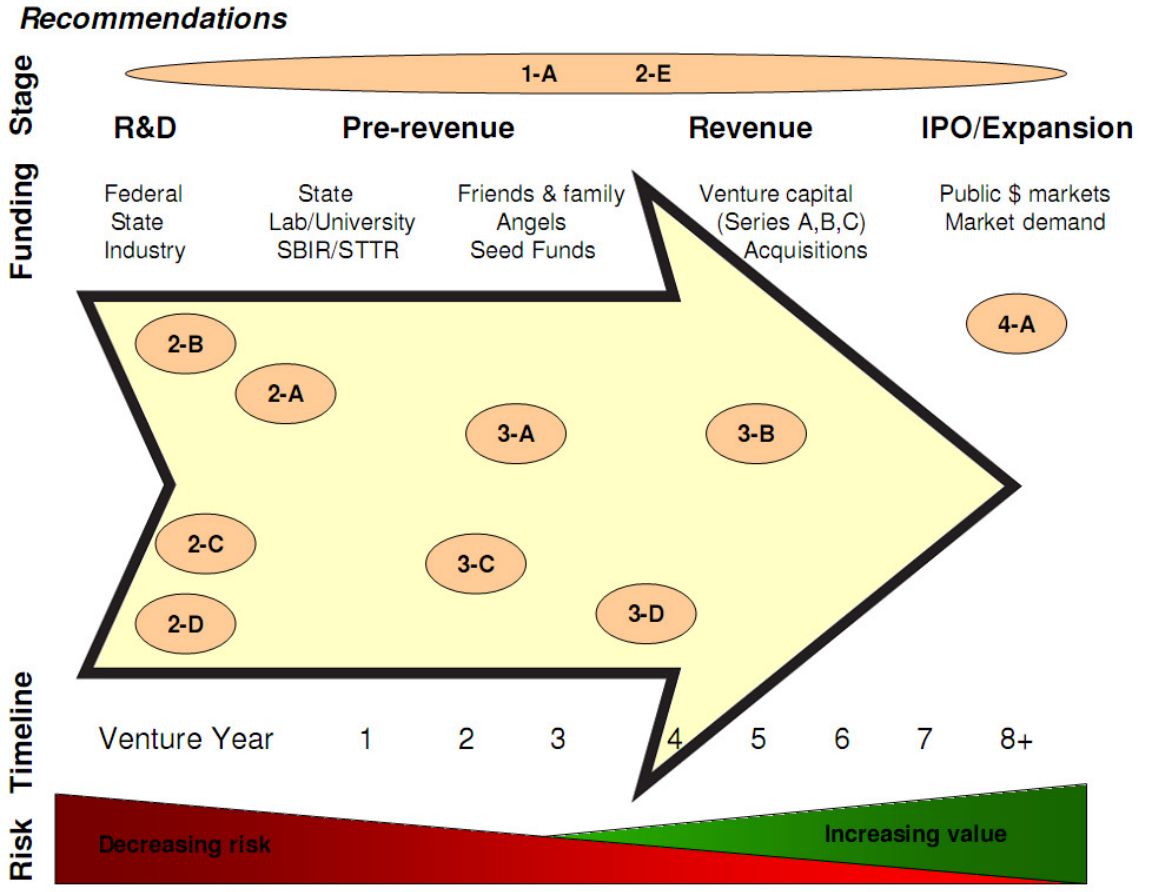
Addressing critical needs and opportunities

Despite the state's impressive array of strengths and assets, there are also important gaps. Priority needs that must be addressed include:

1. ***Improve statewide monitoring, evaluation, coordination and promotion of technology commercialization;***
2. ***Expand incentives to stimulate technology commercialization and industry engagement at our research institutions;***
3. ***Strengthen incentives to attract angel, venture capital and business R&D investments. Retain existing incentives and programs;***
4. ***Cultivate the market for targeted technology products in New Mexico***

Priority Recommendations

The diagram below shows which parts of the technology commercialization ecosystem are addressed by the recommendations outlined in this section. These detailed recommendations are also consistent with more general recommendations from other recent reports on New Mexico, including *Technology 21*[71] (2009), the state science and technology plan, and *The New Mexico Ecosystem Report*[72] (2009).



[71] http://www.edd.state.nm.us/publications/Technology21.pdf
[72] http://www.nmccap.org/files/New_Mexico_Ecosystem_Report_2009.pdf

1. Improve statewide coordination, promotion, monitoring and evaluation of technology commercialization

A. Establish an institution to provide statewide coordination, promotion, evaluation and monitoring. Secure sustained funding support

There is currently no private-public organization in New Mexico with the mission and resources to monitor and support the state's overall technology commercialization ecosystem. Such an organization must be established.

Fortunately, one possible organization already exists. In 2009, the legislature created the Research Applications Center (RAC) with stated purposes that would allow it to serve this need.[73] However, due to budget constraints, no funding was appropriated for its operations. During 2010 the New Mexico Economic Development Department has incorporated the RAC, convened its board and developed a draft business plan for its operations. This business plan calls for both funds for operations as well as funds to support technology maturation statewide. For the RAC to serve its intended purpose, sustained funding from a combination of state, business and philanthropic sources must be identified.[74] In addition, strong leadership from the business sector, particularly from successful entrepreneurs and venture investors, will be needed to ensure to the principles of market-pull are adhered to in its investments and programs.

The activities of the RAC would include:

1. Providing technology maturation matching grants to support technologies in proven micro-clusters.
2. Engaging and coordinating industry, venture capital, entrepreneurs, research institutions and economic development organizations statewide. An ongoing effort, similar to the Clean Technology Commercialization Working Group which prepared this report, would be beneficial. Develop a constituency for technology-based economic development and advocate for supportive policies and programs.
3. Benchmarking technology commercialization efforts in the state year to year, and against other states. Encourage adoption of best practices. Example metrics are identified in Appendix F.
4. Working with rural incubators, science and technology parks, colleges, agricultural extension offices and economic development organizations to build entrepreneurial and commercialization capacity in New Mexico's rural areas. This could include entrepreneurial training, helping new angel investing groups or technology maturation funds to form, providing information on new technology disclosures, sharing best practices on commercialization, supporting the formation of entrepreneurial peer groups, etc. While most

[73] http://legis.state.nm.us/lcs/_session.aspx?Chamber=S&LegType=B&LegNo=205&year=09

[74] State funding for initiatives like this is appropriate and essential given the economic development benefits to the state, but the form of the funding is also important. Appropriations from the General Fund can pay for staff and operation expenses, but multi-year appropriations are rare and more difficult to secure in a recession. Appropriations from the Severance Tax Fund can only be used for capital expenditures and must be individually logged and approved by the State Board of Finance. This process can take nearly a year once initiated. For these reasons they may be harder for fast-moving, cash-strapped startup companies to access. A package of funding from state, business and philanthropic sources that can meet the technology commercialization goals and processes described in this report must be identified.

new research will continue to be done at NMSU, NMT, UNM, and our national laboratories, the commercialization of technology can occur throughout New Mexico and should be supported wherever there are real market opportunities. For example, new agricultural, building, renewable energy and extractive industry solutions may find a ready initial market in rural New Mexico.

5. Promoting the state's assets to attract private investment and experienced entrepreneurs from both inside and outside New Mexico.
6. Supporting industry-linked entrepreneurial and Science, Technology, Engineering and Math (STEM) education efforts.

2. Expand incentives to stimulate technology commercialization and industry engagement at our research institutions

A. Legislatively create a state matching fund for technology maturation and provide recurring funding

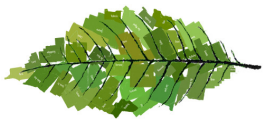
Allocate recurring state revenues to a Technology Maturation Fund. This fund would automatically provide 1:1 state matching grants up to $100,000 per technology through approved partner funds in New Mexico.

Technology maturation grants bridge the gap between institutional research dollars and private sector angel and venture capital investments. While New Mexico has two existing maturation funds (the Venture Acceleration Fund offered by Northern New Mexico Connect and the STC Acceleration Fund at UNM), the total annual funding across the entire state for these efforts is well under $1 million annually. Given the $6 billion in research spending the state, and the hundreds of millions in venture capital deployed here, this extremely small funding for technology maturation grants creates a bottleneck that limits new startups from forming, growing and creating jobs. It is in the economic development interest of the state to provide these grants. This investment will relatively quickly repay itself to the state general fund as these ventures form, grow and pay taxes.

This matching fund would stimulate the growth and impact of the two existing funds, as well as encourage the creation of new funds across the state. It is important to remember that technology maturation can occur in rural as well as urban areas, depending on the type of technology being considered. Therefore, supporting technology maturation funds at rural incubators, science and technology parks and colleges should be considered.

Approved partner funds would be required to meet criteria including an independent investment advisory board involving experienced entrepreneurs, venture capitalists and technology experts, strong conflict of interest policies, financial auditing and tracking of impact. Any grant provided by a partner fund in good standing would automatically be matched dollar for dollar up to $100,000. This structure would keep overhead to the state low and ensure that grants are made for market, not political reasons. Any technology that left the state would have to repay this grant. ROI and impact should be evaluated annually, with the understanding that it may take two to three years for the return to be generated. Successful partner funds should receive continued matching, but failing funds should have their matching terminated.

Matching of federal SBIR/STTR grants should also be strongly considered. These federal technology commercialization grants are competitive and a number of states like Texas, Kentucky and Michigan provide matching. Matching these federal awards with state funds will have similar benefits to matching New Mexico maturation funds.



B. Legislatively expand the New Mexico Small Business Assistance Program

The New Mexico Small Business Assistance Program (NM SBA) is an existing successful program that allows a wide range of New Mexico businesses in both rural and urban communities across the state to access free technical assistance from either Los Alamos or Sandia National Laboratories. This assistance can support technology maturation. (See Appendix H for more information.) This program is supported by state tax credits, authorized by the legislature, to these labs equivalent to the value of the support they provide. This program makes it possible for the laboratories to contribute their expertise to New Mexico businesses by providing the financial assistance necessary to satisfy full cost recovery.

There are three ways this program could be expanded to accelerate technology maturation:

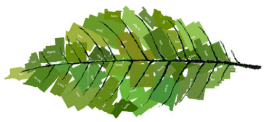
- **Increase the overall allocation**: This program is currently capped at $2.4 million in support to New Mexico businesses annually from each of the two national laboratories. This allocation is generally used to its full capacity each year. This allocation should be increased by $1 million for each laboratory to support additional businesses, and to provide capacity for the expanded program described below. Additional funding increases should be considered in the future if annual evaluations show a positive ROI and economic impact of the program.
- **Increase the cap on assistance per business:** Caps on assistance to each business are set at $10,000 for urban businesses and $20,000 for rural businesses.[75] This cap should be raised to $100,000 for promising businesses. This higher limit better matches the funding required for technology maturation. Current limits are insufficient to serve this need effectively. The ROI of this new pilot program should be evaluated.
- **Allow the program to reduce the cost of accessing national laboratory facilities:** The SBA Program could be used to reduce to cost to participating businesses of accessing national laboratory technical facilities for their technology maturation efforts. [76] These advanced facilities are a resource to state businesses, and this program would make accessing them more affordable for startup companies. A sub-program that reduced the cost of using these facilities by 50% up to $100,000 per company should be piloted for three years. If the ROI to the state in terms of economic development is positive, the program should be continued and expanded.

C. Work with university administrations and faculty to evaluate and incentivize industry-funded research and develop Proof of Concept centers

By its nature, industry-funded research supports technology commercialization. The research that industry funds addresses problems that accelerate their efforts to develop technologies for the marketplace. An effort should be made to inform

[75] It is currently possible to access addition funds through a consortium of several businesses, but it is not always possible to identify such a group, especially when the maturation of particular technologies is desired.

[76] By federal statute, national laboratories must charge full cost recovery rates for their use of facilities, which can be expensive.



university administrations and faculty about the importance of this industry-funded research for the economic development of the state and work with them to evaluate current levels of industry engagement and find appropriate ways to incentivize it further. A 2008 survey by the National Science Foundation[77] of R&D funding sources by research university shows the following in New Mexico:

	Industry Funded R&D	Industry as a Percentage of Total R&D
NMSU	$1,995,000 (140th)	1.44% (144th)
NMT	$5,990,000 (96st)	7.54% (25th)
UNM	$6,922,000 (88rd)	3.50% (87th)

What may be more relevant, however, is the industry-funded R&D specifically in the technology areas associated with proven micro-economic clusters within the state. This level of detail would require additional data gathering and analysis that is beyond the scope of this report, but will be very important in evaluating industry's engagement with New Mexico's universities.

Simply highlighting the importance of this category of research funding may stimulate its growth. In addition, there may be other ways for the encourage it. For example, the Florida High Tech Corridor Matching Grants Research Program[78], an award winning program[79], provides one-third matching of industry funded research at participating universities. New Mexico could institute a similar program. The incentive could be increased for businesses located in New Mexico as a way to strengthen the economic development benefits.

There may be other ways to encourage faculty to pursue work with industry. For example, university administrations could incentivize faculty to earn a portion of their income from outside sources, especially industry. (Currently, university faculty members in New Mexico by default receive 100% of their compensation through state "Instruction and General" funds.) In addition, the positive and negative effects of existing tenure criteria on industry engagement could be evaluated and benchmarked against best practices nationally. Programs like these should be explored with university administrations and faculty.

Finally, university "Proof of Concept" centers are a promising emerging strategy specifically designed to accelerate technology commercialization. Strengthening or developing such centers at New Mexico's universities, modeled after nationally-recognized programs like the von Liebig Center at the University of California San Diego and the Deshpande Center at the Massachusetts Institute of Technology, could provide valuable support for technology commercialization and industry engagement.[80] Fortunately existing centers like the STC Center at UNM and the Arrowhead Center at NMSU are providing a number of the key services identified as national best practices. Continued support for these centers to further expand and refine their offerings are a proven way to promote the commercialization of university technologies.

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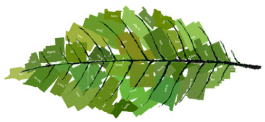
[77] http://www.nsf.gov/statistics/nsf10311/ Rankings are of the 170 universities with R&D budgets over $50 million. See Appendix I.

[78] http://www.floridahightech.com/research.php

[79] http://www.prlog.org/10933622-florida-high-tech-corridor-council-recognized-as-best-example-of-tech-based-economic-development.html

[80] Kauffman Foundation, 2010. sites.**kauffman**.org/pdf/POC_**Centers**_01242008.pdf



D. Amend the law authorizing state Research and Public Service Program (RPSP) funds to require that 10% of these funds go to support technology commercialization activities in state-identified priority areas

RPSP is a category of state funding to educational institutions to support off-campus activities and economic development goals and represents approximate 20% of all state funding they receive.[81] In 2009, this resulted in approximately $177 million in RPSP funding.[82] Currently, these funds are not targeted or managed as a portfolio at the state level. Ten percent of these funds, or approximately $17 million annually, should be required to be used to accelerate technology commercialization activities. These funds could be used to create and fund Proof of Concept centers like those described in the previous section. Strict controls to ensure the funding involved industry partners and market-pull for technology development and maturation activities should be enforced.

Funding for other activities that support technology commercialization should also be considered, especially those that engage students in the process. Funding might used for[83]:

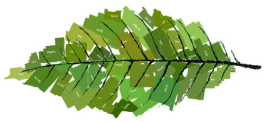
- Business plan competitions
- Entrepreneurial education and internships
- Technology maturation grants
- Technology incubators and lab space
- Startup assistance service
- Networking and match-making forums
- Industry-directed project-based science, technology, engineer and math (STEM) courses
- Applied research with industry partners
- Endowed professorships in priority micro-clusters
- Industry partnerships with local high schools
- Matching grants for industry-funded research
- Entrepreneurship summits

E. Coordinate education and workforce programs with these economic development goals and policies

Science, Technology, Engineering and Math (STEM) and entrepreneurial education is critical to developing a strong workforce in New Mexico. STEM initiatives of all types should be strongly supported, particularly those efforts that involve industry directly and are project-based. STEM and entrepreneurial education should be coordinated and aligned with economic development efforts. Education and training programs should be considered at the secondary and college levels, at research universities and New Mexico's other colleges and universities, and in both rural and urban areas.

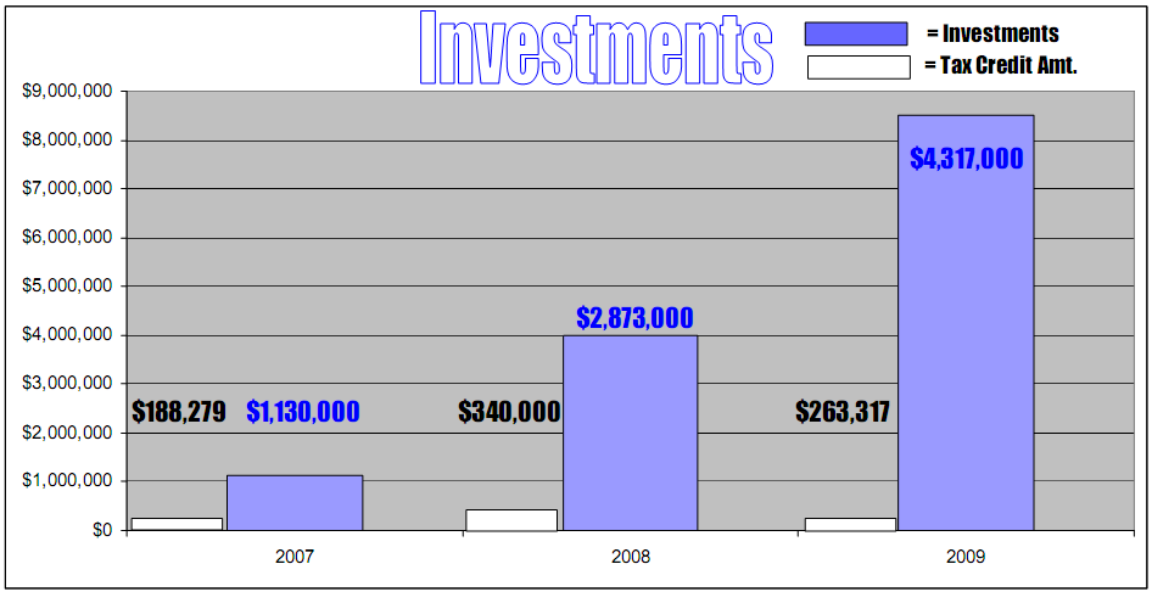
3. Strengthen incentives to attract angel, venture capital and business R&D investments. Retain existing incentives and programs

[81] Estimate provided by Dr. Kevin Boberg, NMSU.
[82] Data provided by the Higher Education Department. $884,845,000 total funding for higher education * .2 = approximately $177 million
[83] Not all of these opportunities may fall within RPSP guidelines, in which case I&G funds could be swapped with permission.



A. Improve the Angel Investment Tax Credit (AITC) and remove its sunset provision The AITC is a successful tax credit that needs to have its sunset extended in the 2011 legislative session to remain in effect. This credit provides a 25% credit on angel investments up to $100,000.[84] Through August 2010, over $8.5 million in private investments into New Mexico companies have been stimulated by this credit since 2007. Over 28 companies have been created and over 150 jobs through 96 separate investments, leveraging the state credit by over 10 times.[85]

- The AITC should have the sunset removed, as recommended by Tax and Revenue Department consultant James O'Neill.
- In addition, a provision to allow the credit to be "passed through" a venture fund to an investor should be added. This would allow investors to mitigate their risk by investing a portfolio of New Mexico companies through a professionally managed fund. This will also increase the use of the AITC.
- The aggregate allowed cap on the tax credit should be evaluated annually and increased as its capacity is reached.



Private investments made through the AITC

B. Reenact an improved Research and Development Tax Credit
New Mexico currently has no tax credit to encourage businesses to do their research and development in the state, while many competitor states do. At least 14 states, including many national leaders in this area like California, Texas, Georgia and Massachusetts, have this type of tax credit.[86] Our previous credit was difficult to access and seldom used, until it expired in 2009. An improved R&D tax credit should be created that follows national best practices, is competitive with other states, works for both rural and urban businesses, and addresses the failings of the previous credit. In addition, the credit should apply to a reasonably wide range of technology and product development activities to ensure that both high- and low- tech businesses can benefit.

[84] http://www.edd.state.nm.us/businessAssistance/incentives/index.html
[85] Data provided by the New Mexico Economic Development Department, Office of Science and Technology.
[86] See http://aysps.gsu.edu/frc/1919.html for more information.

Business-performed R&D is a critical part of the technology commercialization process and deserves strong support. Any research a business does, by its nature, moves technology towards the market. In addition, some startup businesses have been attracted out of New Mexico by R&D tax credits in other states and this would help to address that problem. Massachusetts, Maryland, Ohio, Kentucky and Washington were identified by the Working Group as states with strong R&D incentives that can lure New Mexico startups away. A fully refundable R&D tax credit, competitive with that of other states and reflecting national best practices should be created.[87] Refundability is important for startups, which may have no tax liability for several years because they may not have revenue during those initial years.

C. Retain and expand existing State Investment Council New Mexico targeted programs

The three State Investment Council programs that are targeted to support New Mexico startups should be retained.

- The Private Equity Investment Program (PEIP): Retain the program, maintain existing investments, and profitably exit from invested companies as the global economy recovers. Reinvest funds back into new ventures. Consider instituting clawback (repayment) penalties if insufficient funds are invested into New Mexico companies or if New Mexico based offices are closed. In such instances, require repayment of management fees paid to the participating private sector funds.
- The Co-Investment Program: Retain the program and wait for the global economy to improve to exit profitably from invested companies. Reinvest funds back into new ventures.
- The Small Business Investment Corporation Program (SBIC)[88]: Retain the program and wait for the economy to improve to profitably exit from invested companies. Reinvest funds back into new ventures.

These programs are described elsewhere in the document in more detail, but are all successful programs that have made a major impact the venture capital available in New Mexico. Through their influence, venture capital in New Mexico grew the fastest in the nation between 1997 and 2007, creating many jobs and generating new tax revenue.[89]

Consider increasing New Mexico targeted programs to support technology commercialization, especially in the area of Energy Sustainability

The purpose of New Mexico's three permanent endowment trust funds is to contribute recurring revenues for the operating budget of the state and to provide resources to various fund beneficiaries. The State Investment Council investment goals are to preserve the permanent endowment funds for future generations and to provide future benefits by growing the funds at a rate at least equal to inflation.[90] A large portion of the permanent funds comes from severance taxes from the oil and gas industries.

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[87] For a 2007 report on R&D tax credits and best practices, see http://aysps.gsu.edu/frc/1919.html.
[88] Separately administered.
[89] http://www.abqjournal.com/AED/292779nm03-12-08.htm
[90] Source: SIC. Land Grant Permanent Fund, Severance Tax Permanent Fund, and Tobacco Settlement Permanent Fund. http://www.sic.state.nm.us/permanent_funds.htm

As New Mexico looks to its future as an energy exporting state, it may be appropriate to use more of these funds to invest in technology commercialization and the growth of our Energy Sustainability economy. Investing in emerging energy technologies that can be deployed in New Mexico, like renewable energy and nuclear technologies, could help New Mexico to remain an energy exporter even as the predominant fuel sources that our country relies upon slowly shift. And if these technologies are commercialized here rather than other states, we can also grow our exports of products that serve these sectors.

Other states and countries are already investing in their economic futures with their endowment funds, and the existing New Mexico-targeted programs of the SIC have already had a positive impact. The Netherlands, another oil and gas producer, has programs like this called "Energy Transition" and "Energy Innovation" funded through their permanent funds.[91]

Any new program that involves the permanent funds must be carefully designed, assessed and the projected benefits carefully estimated. The state legislature may want to investigate the advisability and projected return on investment to the state of using the permanent funds in this way. Return to the state will be generated in the form of new business growth, new jobs, higher wages, and new tax revenue at the state and local level.

Other benefits, for example, the ability to diversify the economy and stabilize tax revenues, would have additional benefits to the state's citizens by protecting needed services from being cut in the face of revenue shortfalls. The risks of inaction should also be considered. Although it may be unpleasant to consider, federal funding for our national labs is never guaranteed, and oil and gas jobs may be adversely affected by national carbon regulations that are being proposed. This sort of scenario planning should be a part of the evaluation process.

E. Defer taxes from the sale of ownership in a startup if that money is reinvested in another New Mexico startup within 2 years

Many entrepreneurs are serial entrepreneurs, working on one venture after another. By allowing these entrepreneurs to defer taxes from the sale of their ownership stake in a company they are exiting if they reinvest those funds in another New Mexico startup within two years, New Mexico can create an incentive for these entrepreneurs to stay in the state and continue to be active. This program would have a parallel structure to the popular IRS 1031 exchange program in real estate.[92] This program would not cost the state any money in the long term, and has the potential to create additional revenue as more ventures are created and pay taxes.

4. Cultivate the market for targeted technology products in New Mexico

A. Encourage and support the growth of New Mexico's Energy Sustainability economy broadly, by continuing initiatives like the Green Jobs Cabinet

As described elsewhere in this document, New Mexico has a strong and growing Energy Sustainability economy, due in part to existing targeted economic

[91] http://www.senternovem.nl/energytransition/index.asp and http://ec.europa.eu/research/energy/pdf/nn/the-netherlands_annex-viii-report_en.pdf

[92] http://www.irs.gov/businesses/small/industries/article/0,,id=98491,00.html

development efforts, including Governor Richardson's Green Jobs Cabinet. This emphasis should continue to ensure that Energy Sustainability technology products developed in New Mexico can be sold, purchased and used here. This will help to retain companies in the state, help them grow, and result in the greatest leverage and sustainable job growth.

Supporting recommendations

This section outlines other recommendations that will support New Mexico's technology commercialization success.

Provide affordable access to technical lab space

Continue to work with our research institutions to find ways to provide affordable access to their technical labs. This may require improving burdensome access rules and processes. In addition, it may be appropriate to develop specific technology incubators to support growing micro-clusters. Both "wet" and "dry" lab space may be needed depending on what types of facilities are needed by businesses in these micro-clusters.

Enhance technology transfer efforts

- *Aggregate disclosures:* Technology commercialization may be accelerated by aggregating technology disclosures from all of New Mexico research institutions. This may be possible through "RSS feeds," a common web-based protocol.
- *Encourage and support entrepreneur-in-residence programs (EIR):* EIR programs allow experienced entrepreneurs to access and explore research assets at our research institutions. These market experts can help identify technologies for which there is market-pull. EIR programs should be structured to require disclosure of the entrepreneur's analysis, but allow them first right of refusal to license identified technologies.
- *Support helpful legal/regulatory changes*: Research institutions, especially our national laboratories, are bound by many restrictive laws and rules that limit technology commercialization efforts. The state should support these institutions in pursuing the changes necessary to accelerate commercialization.

Continue to provide entrepreneurial supports: New Mexico is home to many important organizations that support startups and entrepreneurs. Additional supports may be needed in rural areas in particular, to enable them to participate fully in New Mexico's technology economy. These organizations should be supported and their efforts extended where possible. The state should not undertake these activities directly, but instead support them indirectly.

Develop a larger pool of lawyers, human resource, and accounting professionals with startup experience

Entrepreneurs have noted that there is not a sufficiently large pool of these professionals with experience working with startup and technology companies. Directories should be compiled and training encouraged to ensure these critical supports are available in New Mexico.

Reach out to entrepreneurial communities in other states

Make use of person-to-person social networks to invite entrepreneurs and investors in other states to become engaged in New Mexico. Also reach out to experienced

professionals in the state who may not be currently engaged in technology commercialization efforts (e.g. retirees). By spreading our message through peer networks, where professionals know they can get accurate information from trusted sources, we can cost-effectively accelerate our progress. "Ambassadors" who are familiar with both New Mexico and these other communities can play a key role.

Retain and support the Office of Science and Technology at the Economic Development Department

While as much as possible should be done by the private sector and by non-state entities, it is important to retain a state office focused on New Mexico's technology economy, dedicated to balancing the interests of all state constituencies, and supporting the Governor's Office and the legislature in vetting and developing policy.

Market and promote successes

Success stories of all types should be promoted both within New Mexico and to audiences outside of New Mexico so that stakeholders have an accurate picture of our opportunities and progress.

Monitor federal initiatives and funding. Coordinate regionally to position New Mexico to receive funding.

The federal government is looking at a range of technology commercialization efforts and programs.[93] We must monitor these, and position ourselves for funding and support where available. Work regionally with other states as necessary and where it is in the state's interest to do so.

Support federal laboratories in their efforts to improve technology commercialization and engagement with New Mexico businesses

While national laws and federal laboratory policy are beyond the scope of this report, the state should support Los Alamos and Sandia Laboratories in implementing efforts identified by and for them in the areas of technology commercialization and engagement with the New Mexico business community. Opportunities in this area might include increasing access to laboratory facilities, expanding the ability of lab scientists to independently consult with New Mexico businesses, and streamlining technology transfer mechanisms.

Conclusion

These priority recommendations, if implemented, would accelerate the growth of high-wage technology jobs in New Mexico by addressing existing gaps in the state's technology commercialization ecosystem and ensuring that there is a pipeline that continuously develops our base of R&D into products being sold in the global marketplace.

[93] http://www.whitehouse.gov/assets/documents/SEPT_20__Innovation_Whitepaper_FINAL.pdf

GLOSSARY

Acquisition – Purchase of a company (e.g. a startup) by another company (e.g. larger, established company).

Agile programming - A group of software development methodologies based on iterative and incremental development, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams.[1]

Angel investments - An **angel investor** or **angel** (also known as a **business angel** or **informal investor**) is an affluent individual who provides capital for a business start-up, usually in exchange for convertible debt or ownership equity. A small but increasing number of angel investors organize themselves into **angel groups** or **angel networks** to share research and pool their investment capital.[2]

Applied research - Applied research is designed to solve *practical problems* of the modern world, rather than to acquire knowledge for knowledge's sake. One might say that the goal of the applied scientist is to *improve the human condition*.[3]

Bankers – Professionals who work at banks, often issuing loans, and sometime dealing with more complicated financial transactions (especially at investment banks).

Benchmarking - the process used in management in which organizations evaluate various aspects of their processes in relation to the best practice, usually within their own sector.[4]

Beta - the software development phase following alpha, named after the Greek letter beta. It generally begins when the software is feature complete. The focus of beta testing is reducing impacts to users, often incorporating usability testing. The process of delivering a beta version to the users is called **beta release**.[5]

Bootstrapping - Bootstrapping in business is to start a business without external help/capital. Startups that bootstrap their business pay for the growth of their company through internal cash flow and are cautious with their expenses. Generally at the start of a venture a small amount of money will be set aside for the bootstrap process.[6]

CEHMM Center – A research center in Artesia, NM with algal biofuels expertise.

CTCWG – Clean Technology Commercialization Working Group. The advisory group for this report.

Cleantech - Clean technology includes the renewable energy (wind power, solar power, biomass, hydropower, biofuels), information technology, green transportation, electric motors, green chemistry, lighting, and many other appliances that are now more energy efficient.[7]

Cluster (Economic cluster, Business cluster) is a geographic concentration of interconnected businesses, suppliers, and associated institutions in a particular field. Clusters are considered to increase the productivity with which companies can compete, nationally and globally.[8]

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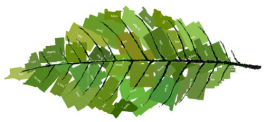
[1] http://en.wikipedia.org/wiki/Agile_software_development
[2] http://en.wikipedia.org/wiki/Angel_investor
[3] http://www.lbl.gov/Education/ELSI/research-main.html
[4] http://en.wikipedia.org/wiki/Benchmark
[5] http://en.wikipedia.org/wiki/Software_release_life_cycle
[6] http://en.wikipedia.org/wiki/Bootstrapping
[7] http://en.wikipedia.org/wiki/Clean_technology



Commercial demonstration – A test of a new technology at an appropriate scale and stage of development to demonstrate viability as a marketable product. Generally understood to be equivalent to "proof of concept."

Commercialization - The process or cycle of introducing a new product into the market.[9]

Deal flow - A term used by finance professionals such as venture capitalists, angel investors, private equity investors and investment bankers to refer to the rate at which they receive business proposals/investment offers[1]. The term is also used not as a measure of rate, but simply to refer to the stream of offers or opportunities as a collective whole.[10]

Debt: That which is owed; usually referencing assets owed, but the term can also cover moral obligations and other interactions not requiring money[11]. Debt often requires interest payments.

Demonstration – See Commercial demonstration.

Dilution (Equity dilution, stock dilution) is a general term that results from the issue of additional common shares by a company. This increase in common shares of a stock can result from a secondary market offering, employees exercising stock options, or by conversion of convertible bonds, preferred shares or warrants into stock. This dilution can shift fundamental positions of the stock such as ownership percentage, voting control, earnings per share, or the value of individual shares. A broader definition specifies dilution as any event that reduces an investor's stock price below the initial purchase price.[12]

Discovery research (basic or fundamental research) is driven by a scientist's *curiosity* or interest in a scientific question. The main motivation is to *expand man's knowledge* , not to create or invent something. There is no obvious commercial value to the discoveries that result from basic research.[13]

DOD - U.S. Department of Defense

DOE - U.S. Department of Energy

Early stage companies – Startup companies, especially those that have not yet earned revenue.

Economic development – Qualitative measure of progress in an economy. It refers to development and adoption of new technologies, transition from agriculture based to industry based economy, and general improvement in living standards.[14] Economic development activities seek to encourage these advances.

Energy Sustainability - Technologies that advance the development of sufficient and sustainable (economically and environmentally) domestic energy sources.

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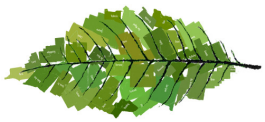
[8] http://en.wikipedia.org/wiki/Business_cluster
[9] http://en.wikipedia.org/wiki/Commercialization
[10] http://en.wikipedia.org/wiki/Deal_flow
[11] http://en.wikipedia.org/wiki/Debt
[12] http://en.wikipedia.org/wiki/Stock_dilution
[13] http://www.lbl.gov/Education/ELSI/research-main.html
[14] http://www.businessdictionary.com/definition/economic-development.html



Entrepreneur - A person who has possession of a new enterprise, venture or idea and assumes significant accountability for the inherent risks and the outcome.[15] The management professionals for startup companies are considered entrepreneurs.

Equity - The value of an ownership interest in property, including shareholders' equity in a business.[16]

Exit – The point at which an investor (usually a venture capitalist) sells his or her stake in a firm to realize his gains (or losses). Generally exit is a move planned at the time of investment decision and may also be included in the firm's overall plan. See also exit strategy.[17]

Read more: http://www.businessdictionary.com/definition/exit.html#ixzz0yUI5M4ZU

Initial Public Offering - Referred simply as an "offering" or "flotation", is when a company (called the *issuer*) issues common stock or shares to the public for the first time. They are often issued by smaller, younger companies seeking capital to expand, but can also be done by large privately-owned companies looking to become publicly traded.[18]

IPO – See Initial Public Offering.

Investment Bank - A financial institution that assists corporations and governments in raising capital by underwriting and acting as the agent in the issuance of securities. An investment bank also assists companies involved in mergers and acquisitions, derivatives, etc. Further it provides ancillary services such as market making and the trading of derivatives, fixed income instruments, foreign exchange, commodity, and equity securities.[19]

LANL – Los Alamos National Laboratory

Lean launch (lean startup) - A new venture model that seeks to very quickly and cheaply develop a "minimum viable product" to enter the market sooner and get customer feedback that can be used to iterate and refine the product. The hope is to reduce the number of years and amount of venture financing that is needed.[20]

Lean manufacturing - A production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination.[21]

Market analysis - The goal of a **market analysis** is to determine the attractiveness of a market and to understand its evolving opportunities and threats as they relate to the strengths and weaknesses of the firm.[22]

Market entry - The planned method of delivering goods or services to a target market and distributing them there.[23]

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[15] http://en.wikipedia.org/wiki/Entrepreneur
[16] http://en.wikipedia.org/wiki/Equity
[17] http://www.businessdictionary.com/definition/exit.html
[18] http://en.wikipedia.org/wiki/Initial_public_offering
[19] http://en.wikipedia.org/wiki/Investment_banking
[20] Lean startup was coined by serial entrepreneur Eric Ries. http://www.nytimes.com/2010/04/25/business/25unboxed.html Phase One Ventures is seeking to develop this model in New Mexico. http://www.phaseoneventures.com/
[21] http://en.wikipedia.org/wiki/Lean_manufacturing
[22] http://en.wikipedia.org/wiki/Marketing_analysis

Market-pull – Indicates that business has a need for a product and technology is developed specifically to fill that need.[24]

Micro-clusters – In the context of this report, a micro-cluster refers to the intersection of economic and technology micro-clusters, where an economic micro-cluster is a cohort of several closely-related businesses and a technology micro-cluster is a group of closely-related research and technology capabilities. Micro-clusters are subsets of broader clusters and are geographically based.

NMSU – New Mexico State University

NMT – New Mexico Tech University

NNSA – National Nuclear Security Administration. A branch of the U.S. Department of Energy. Both Los Alamos and Sandia National Laboratories are under the NNSA.

Ownership stake – See equity.

Pre-revenue company – A startup company that has not yet reached the point of profitability.

Product development (New product development) - A term used to describe the complete process of bringing a new product or service to market. There are two parallel paths involved in the NPD process: one involves the idea generation, product design and detail engineering; the other involves market research and marketing analysis. Companies typically see new product development as the first stage in generating and commercializing new products within the overall strategic process of product life cycle management used to maintain or grow their market share.[25]

Profitability - Ability of a firm to generate net income on a consistent basis. It is often measured by price to earnings ratio.[26]

Proof-of-Concept - Realization of a certain method or idea(s) to demonstrate its feasibility. It is usually considered a milestone on the way to a fully functioning prototype.[27]

Proof-of-Concept Centers - Centers advancing technology commercialization at research institutions, particularly universities. This concept is generally attributed to the Kauffman Foundation.[28]

Prototype - A first full-scale and usually functional form of a new type or design of a construction (as an airplane).[29]

Permanent Fund – One of three permanent endowment funds managed by the New Mexico State Investment Council.

RAC – See Research Applications Center.

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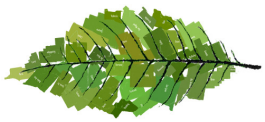
[23] http://en.wikipedia.org/wiki/Market_entry_strategy
[24] http://wiki.answers.com/Q/What_is_market_pull
[25] http://en.wikipedia.org/wiki/New_product_development
[26] http://www.businessdictionary.com/definition/profitability.html
[27] http://en.wikipedia.org/wiki/Proof_of_concept
[28] http://sites.kauffman.org/pdf/POC_Centers_01242008.pdf
[29] http://www.merriam-webster.com/dictionary/prototype



Rapid prototyping - The automatic construction of physical objects using additive manufacturing technology.[30] It is a technique that can be used to accelerate technology commercialization.

Return on Investment (ROI) - Known as **rate of return (ROR), rate of profit** or sometimes just **return**, ROI is the ratio of money gained or lost (whether realized or unrealized) on an investment relative to the amount of money invested.[31] ROI can be narrowly considered as pure financial return, or more broadly considered, to include other types of positive impacts generated. In the context of a state, these broader impacts can include things like job creation, economic development and new tax revenue.

Research Applications Center - A center created by the New Mexico legislature in 2009 (SB 205) to advance technology commercialization in the state.

Revenue producing company – A company that has achieved profitability (see profitability).

ROI – See Return on Investment

Round 1,2,3 Funding – See Series A, B, C Funding

SBIR (Small Business Innovation Research) - The U.S. Small Business Administration (SBA) Office of Technology administers the Small Business Innovation Research (SBIR) Program and the Small Business Technology Transfer (STTR) Program. Through these two competitive programs, SBA ensures that the nation's small, high-tech, innovative businesses are a significant part of the federal government's research and development efforts. Eleven federal departments participate in the SBIR program; five departments participate in the STTR program awarding $2billion to small high-tech businesses. The U.S National Science Foundation administers the SBIR.GOV site on behalf of the federal government.[32]

SNL- Sandia National Laboratories

State Investment Council – A state agency that manages state permanent endowment funds.[33]

STEM Education – Science, Technology, Engineering and Math[34]

STTR – Small Business Technology Transfer. See SBIR.

Seed and pre-seed capital (Seed funding, seed money) - Seed money, sometimes known as **seed funding**, **friends and family funding** or **angel funding** (and some times also as venture capital), is a securities offering whereby one or more parties that have some connection to a new enterprise invest the funds necessary to start the business so that it has enough funds to sustain itself for a period of development until it reaches either a state where it is able to continue funding itself, or has created something in value so that it is worthy of future rounds of funding.[35]

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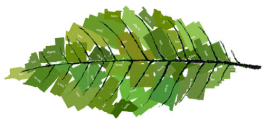
[30] http://en.wikipedia.org/wiki/Rapid_prototyping
[31] http://en.wikipedia.org/wiki/Rate_of_return
[32] http://www.sbir.gov/about/index.htm
[33] http://www.sic.state.nm.us/
[34] http://en.wikipedia.org/wiki/STEM_fields
[35] http://en.wikipedia.org/wiki/Seed_money



Series A, B, C Funding - A **Series A round** is the name typically given to a company's first significant round of venture funding in the Silicon Valley model of Startup company formation.[36] Series B and C are subsequent rounds of growth financing.

Startup (Startup company) - A company with a limited operating history. These companies, generally newly created, are in a phase of development and research for markets.[37]

Technology-based economic development – Economic development through

Technology commercialization - The process of maturing a technology, evaluating market potential, and introducing the resulting product into the marketplace.

Technology development – The process of making improvements to a technology towards some goal.

Technology maturation – In the context of this report, technology maturation refers to funding and efforts that move a technology from a research lab "bench top" to the point at which private investors are willing to invest in its continued development. Technology maturation fund helps to bridge the "Valley of Death."

Technology push - Technology has been developed first and the 'need' must be created or determined afterward.[38]

Technology transfer - Many companies, universities and governmental organizations now have an "Office of Technology Transfer", TTO (also known as "Tech Transfer" or "TechXfer") dedicated to identifying research which has potential commercial interest and strategies for how to exploit it.[39] Technology is generally transferred by licensing it for use, either exclusively, non-exclusively, or under other restrictions.

TVC – Technology Ventures Corporation

UNM – University of New Mexico

Use-inspired research – Research that is inspired by potential future uses. Use-inspired research is between basic and applied research. (Similar to **translational research**.)

Value chain - A value chain is a chain of activities for a firm operating in a specific industry.[40] It may also refer to a chain of activities across firms in a specific industry.

Venture capital - Investment provided as seed funding to early-stage, high-potential, growth companies and more often after the seed funding round as growth funding round (also referred as series A round) in the interest of generating a return through an eventual realization event such as an IPO or trade sale of the company.[41]

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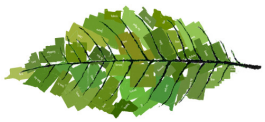
[36] http://en.wikipedia.org/wiki/Series_A_round
[37] http://en.wikipedia.org/wiki/Startup_company
[38] http://wiki.answers.com/Q/What_is_market_pull
[39] http://en.wikipedia.org/wiki/Technology_transfer
[40] http://en.wikipedia.org/wiki/Value_chain
[41] http://en.wikipedia.org/wiki/Venture_capital



APPENDIX A

Technology Commercialization Working Group Participants

Economic Development

Fred Mondragon
Cabinet Secretary
NM Economic Development Department

Greg Fisher
Director of Economic Development
Roosevelt County CDC

Linda Kay Jones
VP for Institutional Advancement
Western New Mexico University

Ed Burckle
Chief Executive Officer
Regional Development Corporation

Venture Capital

Stephanie Spong
President
New Mexico Venture Capital Association

Brian Birk
Managing Partner
Sun Mountain Capital
Lee Rand (alternate)

David Blivin
Managing Partner
Cottonwood Ventures

Bruce Wiggins
Partner
Noribachi

Research

Hal Morgan
Senior Manager, Industrial Partnerships
Sandia Laboratories

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Division Leader
Technology Transfer Division
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Van Romero
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University of New Mexico

Kevin Boberg
Director and CEO, Arrowhead Center
New Mexico State University

Thomas Bowles
Governor Richardson's Science Advisor

Entrepreneurs / Technology users

Sherman McCorkle
President
Technology Ventures Corporation

Hong Hou
Chief Executive Officer
Emcore

Charles Call
Chief Executive Officer
Mesosystems

National Science Foundation State Indicators Data, 2010.

http://www.nsf.gov/statistics/seind10/c8/c8s7.htm
http://www.nsf.gov/statistics/nsf10311/
http://www.bea.gov/regional/gsp/

Financial Research and Development Inputs | Science and Technology in the Economy

State	Population (2007)	GDP $ millions (2008)	R&D as Share of Gross Domestic Product (Percent) 2007	Rank	Federal R&D Obligations per Individual in S&E Occupation (Dollars) 2007	Rank	State and local government-financed R&D expenditures at universities and colleges Per Capita (Dollars) 2008	Rank	Business-Performed R&D as Share of Private-Industry Output (Percent) 2007	Rank	High-Technology Share of All Business Establishments (percent) 2006	Rank	Net High-Technology Business Formations as Share of All Business Establishments (percent) 2006	Rank	Venture Capital Disbursed per $1,000 of Gross Domestic Product (Dollars) 2008	Rank	Venture Capital as a Percentage of Total R&D (percent)	Rank	Venture Capital Deals as Share of High-Technology Business Establishments (percent) 2006	Rank	Venture Capital Disbursed per Venture Capital Deal ($millions) 2008	Rank
United States		$14,165,565	2.62		19,888		11		2.20		8.35		0.18		2.00		0.0763%		0.58		7.43	
New Mexico	1,969,915	$79,901	7.53	1	95,724	1	13	19	0.91	32	7.76	22	0.21	20	0.87	19	0.0116%	40	0.25	22	3.65	33
California	36,553,215	$1,846,757	4.31	7	28,283	9	9	32	4.02	6	9.77	9	0.30	12	7.72	2	0.1791%	1	1.81	2	9.19	5
Colorado	4,861,515	$248,603	2.90	12	18,893	16	4	47	2.52	11	11.19	3	0.33	6	3.27	3	0.1128%	3	0.57	8	8.13	8
North Carolina	9,061,032	$400,192	2.36	19	12,765	25	20	6	2.02	15	7.62	25	0.31	11	1.15	13	0.0487%	14	0.37	18	9.00	6
Utah	2,645,330	$109,777	2.21	22	14,901	21	11	24	1.93	17	9.52	10	0.56	2	1.76	7	0.0796%	6	0.60	5	5.87	18
Arizona	6,338,755	$248,888	2.04	26	22,915	14	9	30	1.79	18	8.68	16	0.32	10	0.84	20	0.0412%	15	0.24	23	10.40	4
Texas	23,904,380	$1,223,511	1.55	30	12,295	26	19	7	1.35	25	9.35	11	0.24	18	1.05	17	0.0677%	9	0.40	13	8.79	7
Nevada	2,565,382	$131,233	0.61	49	11,107	33	5	45	0.49	42	9.79	7	0.34	5	0.10	44	0.0164%	35	0.12	36	2.10	41
Wyoming	522,830	$35,310	0.41	51	4,439	50	11	22	0.14	51	7.72	24	0.42	4	0.04	45	0.0098%	43	0.06	43	1.50	44

Analysis prepared by Brendan Miller, NM EDD.

APPENDIX C

Gross Domestic Product by State and by Selected Large Industry

State	2008 Current Dollars (millions)	Utilities (NAICS 22)			Construction (NAICS 23)			Government (NAICS 92)			Manufacturing (NAICS 31-33)			Wholesale trade (NAICS 42)			Retail trade (NAICS 44-45)			Transportation, and warehousing (NAICS 48-49)			Information (NAICS 51)		
		Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank
United States	**14,165,565**	**306,024**	2.16%		**581,537**	4.11%		**1,740,939**	12.29%		**1,637,671**	11.56%		**818,787**	5.78%		**885,486**	6.25%		**414,858**	2.93%		**621,986**	4.39%	
New Mexico	79,901	1,899	2.38%	19	3,473	4.35%	20	13,859	17.35%	8	5,267	6.59%	41	2,694	3.37%	47	5,202	6.51%	26	2,177	2.72%	35	2,112	2.64%	37
Utah	109,777	1,378	1.26%	47	5,343	4.87%	10	15,178	13.83%	24	13,018	11.86%	22	5,499	5.01%	36	7,956	7.25%	14	3,806	3.47%	20	3,834	3.49%	22
Arizona	248,888	4,609	1.85%	35	13,269	5.33%	7	32,383	13.01%	25	19,527	7.85%	39	13,893	5.58%	27	19,474	7.82%	8	6,828	2.74%	34	6,662	2.68%	35
Wyoming	35,310	1,435	4.06%	2	2,154	6.10%	2	4,491	12.72%	28	1,081	3.06%	48	1,223	3.46%	46	1,886	5.34%	46	2,126	6.02%	3	483	1.37%	51
Colorado	248,603	3,252	1.31%	46	12,099	4.87%	11	30,608	12.31%	30	15,899	6.40%	42	13,760	5.53%	28	14,748	5.93%	36	6,387	2.57%	37	21,137	8.50%	1
California	1,846,757	33,143	1.79%	39	67,770	3.67%	39	216,764	11.74%	33	181,134	9.81%	33	105,131	5.69%	21	118,624	6.42%	27	42,747	2.31%	42	112,752	6.11%	5
Texas	1,223,511	41,738	3.41%	5	58,853	4.81%	13	129,976	10.62%	40	158,803	12.98%	19	76,378	6.24%	12	71,988	5.88%	38	41,214	3.37%	21	46,334	3.79%	16
Nevada	131,233	2,071	1.58%	42	10,665	8.13%	1	13,364	10.18%	44	5,740	4.37%	46	5,110	3.89%	45	9,913	7.55%	10	4,259	3.25%	23	2,364	1.80%	50

State	2008 Current Dollars (millions)	Finance and insurance (NAICS 52)			Real estate, renting, and leasing (NAICS 53)			Professional and technical services (NAICS 54)			Administrative and waste services (NAICS 56)			Health care and social assistance (NAICS 62)			Accommodation and food services (NAICS 72)			Other services, except government (NAICS 81)			Other: Agriculture, Mining, etc.	
		Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	Number	%	Rank	%	Rank
United States	**14,165,565**	**1,064,895**	7.52%		**1,783,514**	12.59%		**1,095,570**	7.73%		**426,451**	3.01%		**1,019,662**	7.20%		**396,212**	2.80%		**326,796**	2.31%		7.38%	
New Mexico	79,901	2,352	2.94%	49	7,683	9.62%	33	6,482	8.11%	11	2,236	2.80%	23	5,432	6.80%	33	2,352	2.94%	15	1,664	2.08%	38	18.79%	4
Utah	109,777	9,474	8.63%	11	12,294	11.20%	27	7,859	7.16%	17	3,007	2.74%	26	6,177	5.63%	47	2,916	2.66%	24	3,311	3.02%	2	7.95%	21
Arizona	248,888	17,699	7.11%	19	40,032	16.08%	4	15,723	6.32%	24	10,965	4.41%	1	19,363	7.78%	23	8,473	3.40%	8	4,878	1.96%	46	6.07%	25
Wyoming	35,310	899	2.55%	51	2,521	7.14%	49	1,039	2.94%	50	421	1.19%	51	1,414	4.00%	51	1,105	3.13%	12	578	1.64%	50	35.27%	1
Colorado	248,603	14,692	5.91%	24	31,531	12.68%	15	24,298	9.77%	5	8,149	3.28%	8	14,861	5.98%	42	7,892	3.17%	11	5,877	2.36%	21	9.42%	14
California	1,846,757	107,587	5.83%	26	308,737	16.72%	3	174,627	9.46%	7	56,470	3.06%	16	115,596	6.26%	39	52,098	2.82%	19	42,196	2.28%	26	6.03%	27
Texas	1,223,511	66,767	5.46%	33	104,649	8.55%	38	83,341	6.81%	20	38,280	3.13%	13	69,458	5.68%	46	29,443	2.41%	38	25,113	2.05%	42	14.81%	7
Nevada	131,233	10,018	7.63%	14	18,588	14.16%	10	6,801	5.18%	35	3,752	2.86%	22	6,628	5.05%	49	18,539	14.13%	1	2,337	1.78%	49	8.45%	18

Percentages are of total GDP
Ranks are state rankings in decending order by percentage of GDP

Analysis prepared by Brendan Miller, NM EDD.
Source: Bureau of Economic Analysis, *Survey of Current Business*, annual (related Internet site <http://www.bea.gov/regional/gsp/>).

APPENDIX D

Years	Initiative	Activities	Total funding	Approximate Funding in 2010 Dollars	Multiyear appropriation?	Role of private sector	Outcome
1975 - 1991	NM Research and Development Institute	State sponsored R&D, especially in energy. Some commercialization emphasis in later years.	$34,945,200	$82,432,015	No	Little involvement in decision making. 25 companies funded, some survived.	Over 5:1 return on investment estimated. Created one of the first state-funded seed capital programs.
1983 - 1987	Centers of Technological Innovation	Technical vocational education, specialized support services and improved transportation.	$2,200,000	$6,395,145	No	Little involvement	Unknown
1983 - 1998	Center of Technological Excellence	Startup funding for five Centers spread across the three research universities. Goal of creating world class research centers.	$29,000,000	$59,135,467	Yes - Six Years	Primarily academic research. Little industry involvement. Largely failed to attract industry participation or meet economic development goals.	Two Centers survived. Center for High Tech Materials has demonstrated 18.8:1 return on investment in research funding attracted. 86 patents (20% of UNM portfolio) and $5M in royalty income. 10 company spin-offs.
1998	NM Commission of Higher Education	Proposed a tech transfer consortium, identification and dissemination of commercializable technology, endowed faculty chairs, create incentives for tech transfer.	Never funded/implemented		N/A	N/A	May have influenced later efforts.
1989	Enhancing New Mexico's Leadership adhoc planning group	Proposed creation of private, nonprofit to coordinate tech-based economic development, tax incentives for tech businesses, mandates to universities for tech commercialization.	Never funded/implemented		N/A	No involvement in planning	N/A
1989	Science and Technology Commercialization Commission	Stressed the need to move from a grants to a market economy. Proposed seed capital and SBIR matching.	Never funded/implemented		N/A	Unknown	May have influenced later efforts.
1992	Governor's Technical Excellence Committee	Proposed creation of Office of Technology Partnerships in Economic Development Department, creation of public-private coordination institute, create industry cluster action teams, make Governor's science advisor permanent, establish technology and business legislative committee, support for manufacturing, space and environmental technologies.	Some resources targeted to identified industries.		No	Professional Aerospace Contractors Association and Association of Commerce and Industry representatives.	"Not substantial"
1992-2010	Office of Science and Technology	Division created at the Economic Development Department. Originally called the Technology Enterprise Division.	$10,321,200	$13,538,771	No	Works directly with industry	Unkown

1994 - 1996	State Match Fund	Provided state matching funds for technology proposals submitted to the federal government.	$3,400,000	$4,841,836	No	No involvement	Unknown
1996	Governor's Science and Technology Advisory Committee	Proposed NM Technology Commercialization Alliance	No funding. Alliance for the Commercialization of Technology was created but short lived.		No	Unkown	Encouraged/mandated State Investment Council to implement venture capital programs
2003 - 2007	NM Technology Research Collaborative	Initiated by the Technology Ventures Corporation. Later funded by the state to support commercialization development.	$3,100,000	$3,351,644	No	Not represented on the board.	$3,616,000 in matching funds.
2007 - 2008	Energy Innovation Fund	Funds to directly support promising energy technology commercialization development.	$3,400,000	$3,574,196	No	No involvement in investment decisions.	$3,400,000 in direct matching. $123,000,000 in new investment attracted.
2008 - 2010	NM Computing Applications Center	Purchase Encanto Supercomputer. NMCAC operations and business development.	$19,900,000	$19,900,000	No	Intel, Cerelink on the board.	$111,000,000 in new research funding attracted. Several corporate partnerships.
1993 - 2010	NM State Investment Council PEIP	Co-invest in New Mexico tech companies using state investment funds	$250,500,000 currently invested **	-	Yes	Co-invests with lead private sector funds.	57 NM companies funded.$139M of payroll and purchases by companies invested in, in 2009. 6.3:1 outside investment attracted. Investment exits have been delayed by global recession. $1B cummulative economic impact.
2007 - 2010	NM State Investment Council Co-Investment Fund	Co-invest in New Mexico tech companies using state investment funds	$37,100,000 investment **	-	Yes	Co-invests with lead private sector funds.	$398,600,000 outside investment attracted (10.7:1 leveraging)

Notes: Information from 1975 - 2003 cited from *Science and Technology in New Mexico* report, prepared for the NM EPSCoR State Committee by Leslie Padilla, September 2003.
Data from 2003-2007 sourced from Technology Research Collaboratrive documents
Data from 2007 - 2010 provided by the Governor's Office and State Investment Council documents.
** SIC funds are true investments. Other figures represent spending.

Summary prepared by Brendan Miller, NM EDD. (August 2010)

APPENDIX E

Initiative	Key Activities	Investment	Return on Investment	Source
Science Foundation Arizona	SFAZ innovation grants encourage collaboration between industry, government and the academic sector to leverage financial resources and human capital skills that yield measurable returns.	$77.6M between 2007 and 2009, $50M of which was invested in research initiatives.	Leveraged $152.8M non-state investment with an ROI of over 3:1. Created 1200 jobs and 16 companies. Supported STEM education. One company startup per $11.7M invested, compared with one per $100.9M average across AZ universities.	2010 Annual Report
Colorado Collaboratory	Accelerate commercialization through industry, university, national lab collaboration.	Approximately $3M annually	6:1 return on investment	2010 Annual Report
Utah Science, Technology and Research (USTAR) Economic Development Initiative	Research and research equipment funding, technology commercialization and economic development outreach programs	In 2006, the Utah Legislature allocated $179 million to USTAR, $15 million in annual research funding, $4 million to support economic outreach programs, and $160 million toward the construction of new research facilities.	80 new startup companies out of the University of Utah since 2006. Roughly 13,300 jobs and an estimated $468 million in wages and salaries are attributed to start-up and spin-off companies directly associated with Utah's research universities. The tax revenue impact was $37.5 million. Local units of government received almost $7 million. For every $1M invested, 39 jobs, $732,000 in income, $1.5M in business activity, and $59,000 in new state revenue.	USTAR website
Austin Technology Incubator	ATI works with early stage technology companies to increase their odds of success and decrease their time to capital and markets.	Unknown	In 2008-09, $20M economic impact and 110 jobs created. $10M in capital raised. 11 companies graduated.	Information provided by the Director of the ATI Clean Energy Department
Ohio Third Frontier	Commercialization research funds, entrepreneurial support and seed funding, product development assistance, subsidized loans, incubators, tax credits for research, co-investment funds, internships.	$1.6B over 10 years	$6.6B economic return on $681M invested to date. 41, 300 jobs created, $2.4B in new wages/benefits. Nearly 10:1 return on investment.	Making an Impact Evaluation, 2009.
Ben Franklin Technology Partners (PA)	Provide entrepreneurs with capital, knowledge and networks. Facilitate industry/university collaborations.	Between 2002 - 2006 $140M was invested.	Between 2002 - 2006, state tax revenues were increased by 3.5:1 on the state's investment. 10,615 jobs-years created by client companies and 32,832 job-years overall.	2009 Performance Profile
Georgia Research Alliance	Recruiting Eminent Scholars, commercialization planning grants.	$41 million in 2007	58 Scholars recruited, 24 nationally recognized centers of excellence created, $2B in new federal and private investment leveraged, 125 companies created, 4000 jobs created.	2007 Annual Report
Washington Technology Center	Funding suport and access to capital, facilitate research collaboration, business service support, access to lab facilities.	$5 million in 2009	In 2009, $875,000 invested in technology commercialization, provided microfabrication lab access to 21 companies, assisted in 128 SBIR applications, assisted angel investors invested $2.4M, hosted innovation summit, assisted 195 companies, helped companies access $30M investment leveraging state funds 11:1.	2009 Annual Report
Energy Alliance (portions of PA, OH, WV)	Seed fund, business assistance, alpha lab, commercialization grants, internship program.	$43M invested in 125 companies.	$750M investment attracted: leveraging of 17.4:1	Innovation Works website

Summary prepared by Brendan Miller, NMEDD, with research assistance from Charles Chu.

APPENDIX F

Metrics for Evaluating Success

Evaluating the success of New Mexico's technology commercialization efforts year to year and comparing them to results in other states is an important recommendation in this report. This evaluation will ensure that programs generate the desired impact, or suggest areas for improvement. The metrics listed below are examples to be considered. A comprehensive suite of metrics should be designed and tracked yearly. Metrics should allow comparison to other states and be consistent with national surveys, like those prepared by the Milken Institute[42] and the federal government.

Economic Development

- Number of new startups (may not be technology-based)
- Number of startups terminated or bankrupt
- Number of technology businesses
- Number of technology businesses in targeted micro-clusters
- Number of technology businesses receiving less than half their revenue from the federal or state government
- Net number of new jobs generated by startups
- Net number of new jobs generated by technology businesses
- Median wage of jobs generated by startups
- Median wage of jobs generated by technology businesses
- Estimated state taxes generated by startups
- Estimated state taxes generated by technology businesses
- Total value of technology products both manufactured and purchased in New Mexico
- Total value of technology products manufactured in New Mexico and sold outside the state

Research and Development

- Industry-funded R&D (by research institution)
- New Mexico industry-funded R&D (by research institution)
- Laboratory hours accessed by private industry (by research institution)
- R&D in targeted micro-clusters (by research institution)
- Academic citations in targeted micro-clusters (by research institution)
- Patents issued in targeted micro-clusters (by research institution)
- Licensing income in targeted micro-clusters (by research institution)
- Business-performed R&D

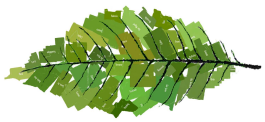
Maturation Funding, Angel and Venture Capital

- Total funding for technology maturation
- Angel investments in New Mexico
- Private venture capital investments in New Mexico
- Private venture capital investments in targeted micro-clusters
- Private venture capital investments in New Mexico from outside the state

Entrepreneurial Culture

- Number of repeat entrepreneurs
- Number of repeat angel/venture investors
- Total student-hours of entrepreneurial training delivered
- Public media citations for "New Mexico" and "entrepreneur," "technology," "startup," "venture," etc.

[42] http://www.milkeninstitute.org/



APPENDIX G

Energy Sustainability capabilities at our research institutions

These capabilities were self-identified by the representatives from these five institutions on the Clean Technology Commercialization Working Group.

New Mexico State University

NMSU has Energy Sustainability capabilities through its Institute for Energy and the Environment. http://iee.nmsu.edu/index.html. Particular areas and programs include:

- Biomass power
- Solar power
- Wind energy
- Brackish groundwater desalination
- Environmental mitigation for fossil fuels
- Nuclear modeling

Affiliated centers and projects:

- **WERC** is a consortium for environmental education and technology development. The consortium's mission is to develop the human resources and technologies needed to address environmental issues. WERC has come to be widely recognized for its commitment to the nation's environment and natural resources. http://www.werc.net/
- **NAABB**: NMSU is part of the **National Alliance for Advanced Biofuels and Bioproducts**, a consortium of **universities and research institutions** awarded $44 million by the U.S. Department of Energy to commercialize algae into a biofuel. The funding is part of the American Recovery and Reinvestment Act passed last year by Congress. The consortium is led by the **Donald Danforth Plant Science Center**, a nonprofit science center located in St. Louis that focuses on human health and agricultural production. According to the Danforth Center, biofuels generate more jobs than any other sector of sustainable energy. As the industry grows, there is potential for hundreds of thousands of new jobs nationally. http://research.nmsu.edu/naabb/
- **SWTDI:** The **Southwest Technology Development Institute** (SWTDI) was founded in 1977 as a renewable energy research and development center. The Institute is a non-profit, university-based organization housed in the College of Engineering at New Mexico State University (NMSU) in Las Cruces, New Mexico. The Institute's focus is on the development, transfer, promotion, and commercialization of renewable energy technologies. SWTDI provides contract services for systems analysis, program implementation, business development, feasibility studies, market studies, computer modeling, and educational computer kiosks.

  SWTDI has accumulated extensive domestic and international experience with a variety of renewable energy technologies. SWTDI expertise includes photovoltaic, solar thermal, wind, geothermal, alternative fuels, evaporative air-conditioning, micro-hydroelectric, aquaculture, biomass, energy efficiency, minority education, traffic monitoring, environmental systems, bioremediation, and waste management. SWTDI is an internationally recognized applied research and development center for solar and wind energy systems, geothermal research, energy systems simulation, resource assessment, and environmental analysis. http://www.nmsu.edu/~tdi/
- **PROSPER:** The PROSPER project is a research and policy initiative designed to enhance fossil fuel energy production in an environmentally progressive manner that contributes to the economic development of the state and creates a strong vibrant economy that better serves the needs of New Mexico. http://arrowhead.nmsu.edu/arrowheadcenter/prosper/index.html
- **CEMRC:** The Carlsbad Environmental Monitoring & Research Center is a division of the College of Engineering at New Mexico State University. This 26,000 ft^2 radiochemistry facility includes environmental and general radiochemistry laboratories, a special plutonium-uranium lab, an *in vivo* bioassay facility, mobile laboratories, computing operations and offices. The facility can

perform a wide range of environmental and radiochemistry work, characterization, monitoring, and feasibility studies in support of performance assessment, radiological and environmental training and education, subsurface flow and transport experiments, nuclear energy issues, and issues involving Homeland Security particularly those involving radiation dispersal devices (RDDs or dirty bombs). http://www.cemrc.org/

New Mexico Tech

New Mexico Tech enters the newest age of energy exploration with a long tradition of research towards understanding and more effectively harnessing renewable methods for creating energy. As the United States explores new means of energy, New Mexico Tech continues to be a trailblazer at the forefront in all areas of energy research and exploration.

New Mexico Tech has a long history in energy research, and has created and utilized its many research centers for discovering better ways of fueling our world. Since 1977 the Petroleum Recovery Research Center (PRRC)has been investigating more efficient methods of finding and taking carbon-based fuels from the earth. Sharing its technology with industry, the PRRC's mission has been to assist others in better and improved petroleum recovery. Now the PRRC is the lead organization for the southwest partnership on carbon sequestration funded by the Department of Energy. The PRRC is using its knowledge in extraction to develop methods to return carbon to the subsurface.

Another NMT Research Center, the Institute for Complex Additive Systems Analysis (ICASA), is investigating how price changing occurs in the wholesale energy market, a topic of utmost importance as the global price spike in gasoline demonstrated in 2008. Researchers at ICASA have created the Power Trader, a simulator to better understand price fluctuations in the energy market and the societal factors that cause them.

Quickly establishing itself as an important research center on the national level is the New Mexico Center for Energy Policy (NMCEP) located in Hobbs, NM. The NMCEP's mission is to become a community-centered response to the challenge of national energy security in the United States. Instead of energy leaders trekking to Washington D.C. to discuss local energy policies, the NMCEP will become an outlet for encouraging and facilitating discussions at a local level. To this end the NMCEP has already produced two important and timely energy conferences that combined have drawn audiences of over 800 regional and national leaders in various fields of energy production, research and policy (see a complete list of all NMT Research Organizations).

New Mexico Tech's most valuable resource is the collection of expert researchers carrying out important studies within these and other centers affiliated with NMT. Throughout the school, research faculty are exploring new ideas that are sure to shape future growth in renewable energy policy, generation and transmission, and interests range from research in hydrothermal energy to solar energy (see a complete list of researchers and their interests). Even students are carrying on important work in renewable energy, such as the project for creating a reduced cost heliostat.

As the focus of the energy industry narrows on renewable energy, there is little doubt that the gaze will fall squarely on New Mexico Tech. Research excellence is a tradition at NMT, and one which will continue into the new age of renewable energy. http://www.nmt.edu/energy-research-at-new-mexico-tech/590-moving-ahead-in-energy

CONVENTIONAL ENERGY

Oil & Gas	Coal	CO2 Sequestration	Nuclear
Petroleum Research and Recovery Center (PRRC)	Bureau of Geology	Petroleum Research and Recovery Center (PRRC)	Bureau of Geology
Bureau of Geology	Gretchen Hoffman	Bureau of Geology	Dana Ulmer-Scholle
Ron Broadhead	Catherine Snelson	Reid Grigg	Peter Scholle
Catherine Snelson		Catherine Snelson	Van Romero
Liangyiang Li		Fred Phillips	
Peter Mozley		Tom Kieft	
Tom Engler		Peter Mozley	

RENEWABLE ENERGY

Bio Fuels	Wind	Solar	Hydrogen	Storage	Geothermal	Green Grid	Policy and Economics
Corey LeClerc	Osman Inal	Michael Heagy	Deidre Hirschfeld	Deidre Hirschfeld	Earth & Environmental Sciences	IERA	Center for Energy Policy
Snezna Rogelj	Nadir Yilmaz	Osman Inal	Corey LeClerc		Bureau of Geology	Ahmed Hasen	Dan Fine
Frank Huang		Michael Hensley			IRIS PASSCAL Instrument Center	Mushtaq Khan	Robert Caudle
Osman Inal					Rick Aster	Kevin Wedeward	Michael Hensley
					Mark Person	Richard Sonnenfeld	Van Romero
					Marshal Reiter		Peter Anselmo
					Richard Chamberlin		Toshiyuki Sueyoshi
					Nigel Blamey		
					Gary Axen		
					Tom Engler		

University of New Mexico

UNM has energy sustainability research through a number of the science departments, all departments in the School of Engineering, and three major centers:

- the Center for High Technology Materials (CHTM),
- the Center for Emerging Energy Technologies (CEET),
- the Center for Micro-Engineered Materials (CMEM), and
- the Water Resources Program.

The major areas include nuclear, solar (both concentrated solar and photovoltaics), smart grid, biofuels, and water. Research expenditures in these areas is estimated at approximately $30 – 40 million annually.

Overall annual UNM research expenditures, including the Health Sciences Center is approximately $250 million.

Annual tech transfer expenditures (through STC.UNM) average approximately $3 million annually.

Three laboratories can be accessed by private businesses:

- The UNM School of Engineering Manufacturing Training and Technology Center (MTTC) clean room
  http://www-mep.unm.edu/mttc_cleanroom.php
- CHTM facilities: http://www.chtm.unm.edu/facilities.html
- CMEM facilities: http://www.unm.edu/~cmem/facilities/facilities.htm

Los Alamos National Laboratory

LANL's core capabilities in materials science, chemistry, geosciences and predictive modeling provide the opportunity for LANL to become a technical leader and a preferred provider in clean energy concepts and materials.

Strengths

- Leveraged simulation and modeling capabilities
  - Fluid dynamics for wind and maybe solar (cloud cover prediction, wind turbine durability and wind farm design)
  - Network theory and modeling for grid modeling
  - Fundamental condensed matter theory applied to photovoltaics, solid state lighting, and superconductivity
- National facilities
  - CINT (photovoltaics EFRC, solar fuels, biofuels, superconductivity, and solid state lighting)
  - National High Magnetic Field Laboratory (superconductivity and catalysis)
  - Lujan Center (fuel cells, geothermal, biofuels, superconductivity, and energy storage)
  - Joint Genome Institute (biofuels)
  - Stable Isotope Resource (biofuels, solar fuels)
- Materials and Chemistry capabilities (60% of non-nuclear energy effort at LANL is based on materials & chemistry capabilities)
  - Materials science (solid state lighting, fuel cells, hydrogen, carbon sequestration, solar, and superconductivity)
  - Chemistry, especially materials synthesis (solar, superconductivity, hydrogen, and solid state lighting) and catalysis (biofuels, fossil fuels, carbon sequestration, hydrogen, combustion, and fuel cells)
- Civilian Nuclear program dominated by emphasis on fuel cycle

Primary Weakness

- A National Nuclear Security Administration Lab – Lack of Energy Branding

LANL Energy Sustainability Areas of R&D Expertise

Broad Application	Approximate Annual Funding ($M)
Solar Photovoltaics	5
Wind	2
Geothermal	1

Fossil	**14**
Biofuels	**14**
Civilian Nuclear	**48**
Carbon Capture and Sequestration	**6**
Fuel Cells	**11**
Smart Grid	**12**
Hydrogen	**6**
Superconductivity	**9**

Los Alamos Laboratory and Sandia National Laboratories, by statute that affects all national laboratories, cannot invest more than 0.5% of their operating funds in technology transfer efforts.[43] For a national laboratory like Los Alamos or Sandia with a budget on the order of $2 billion, this means that no more than $10 million of those funds can be used to promote technology commercialization and associated economic development. What's more, funds for these efforts come out of the laboratory's overhead budget, which means that it competes with human resources, accounting and other essential services for resources. Being a part of overhead, tech transfer thereby contributes to the cost of doing business, which is generally something that the laboratories seek to minimize.

These laboratories can reinvest royalties from licensed technologies into technology transfer and LANL currently does this. This currently results only in approximately $350,000 in addition resources at LANL.

Sandia National Laboratories

Energy Security: Sandia's work in Energy Security comprises both Laboratory Directed R&D and engagements with the Department of Homeland Security, Department of Defense, Department of Energy, Nuclear Regulatory Commission and others. Sandia also has an active Industrial Partnerships Program in the area of Energy Security including 19 active CRADA partners and 54 other partnerships. Our partners are from the oil and gas industry, renewable energy, and battery manufacturers. With our partners, Sandia is engaged in addressing

- deployment of low-carbon energy sources
- mitigating and adapting to climate changes
- protecting against terrorism and natural disasters and reducing oil dependence.

Applications areas where we are working include

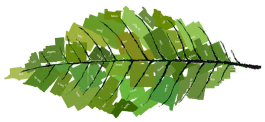
- border security,
- microgrid,

[43] Source: LANS Prime Contract Section I-127 (c) 1. "The Contractor shall establish and carry out its technology transfer efforts through appropriate organizational elements consistent with the requirements for an Office of Research and Technology Applications (ORTA) pursuant to paragraphs (b) and (c) of Section 11 of the Stevenson-Wydler Technology Innovation Act of 1980, as amended (15 U.S.C. 3710). The costs associated with the conduct of technology transfer through the ORTA including activities associated with obtaining, maintaining, licensing, and assigning Intellectual Property rights, increasing the potential for the transfer of technology, and the widespread notice of technology transfer opportunities, shall be deemed allowable provided that such costs meet the other requirements of the allowable costs provisions of this Contract. In addition to any separately designated funds, these costs in any fiscal year shall not exceed an amount equal to 0.5 percent of the operating funds included in the Federal research and development budget (including Work For Others) of the Laboratory for that fiscal year without written approval of the contracting officer."

- portable power,
- Safety, storage, transportation, and waste management.

In addition, Sandia is a leader in basic energy sciences areas such as combustion and solid state lighting.

Sandia Programs	Approximate Annual Funding ($M)
ENERGY EFFICIENCY	**14**
Buildings	
Hydrogen Initiative	
Industrial Science & Technology	
Vehicle Technologies	
ENERGY SECURITY & RELIABILITY	**13**
Energy Storage	
Energy Surety	
SCADA	
FOSSIL ENERGY	**14**
Coal	
Oil & Gas	
SPR	
RENEWABLE ENERGY	**36**
Biomass Program	
FEMP	
Geothermal	
Renewable Energy Systems	
Solar Energy	
Wind Energy & Water Power	
SPECIAL INITIATIVES	**3**
Water	



APPENDIX H

New Mexico's Technology Commercialization Ecosystem: Organizations and Initiatives

This section provides some additional detail on organizations that are currently a part of the state's technology commercialization ecosystem. They are listed in alphabetical order by organization or category.

Air Force Research Laboratory, Kirtland Air Force Base

Kirtland Air Force Base is home to two directorates of the Air Force Research Laboratory: Directed Energy and Space Vehicles. These first of these two develops, integrates, and transitions science and technology for directed energy to include high-power microwaves, lasers, adaptive optics, imaging and effects to assure the preeminence of the United States in air and space. http://www.kirtland.af.mil/afrl_de/ The second develops and transitions high pay-off space technologies supporting the warfighter while leveraging commercial, civil and other government capabilities. http://www.kirtland.af.mil/afrl_vs/

Business Associations

New Mexico is home to several independent industry groups for clean energy and clean technology businesses. Venture capital and angel groups are listed separately. Business associations include: New Mexico Renewable Energy Industry Association, U.S. Green Building Council: New Mexico Chapter, Southwest Biofuels Association, New Mexico Recycling Coalition, New Mexico Optics Industry Association, New Mexico Biotechnology and Biomedical Association, and New Mexico Technology Council.

Coronado Ventures Forum

Coronado Ventures Forum (CVF) was founded in 1994 in response to the need in New Mexico to educate investors and entrepreneurs on the process of early-stage, private equity funding, and to provide a gathering point for these two communities to come together and network. The organization's goals are twofold: Education and Networking. http://www.cvf-nm.org/

Economic Development Organizations

In addition to the State Economic Development Department, communities across New Mexico have economic development organizations that work for them. A list can be found at http://www.edd.state.nm.us/linksLists/index.html

Finance New Mexico

Finance New Mexico is your resource for funding and knowledge to start or grow a business in New Mexico. Sponsored by a partnership of public and private entities, all of which share the goal of increasing economic development, Finance New Mexico provides you with tools to help your business thrive. http://www.financenewmexico.org/

Fraunhofer CFV Solar Test and Research Laboratories

On May 26th, 2010, Fraunhofer CSE announced that it was entering into a partnership with the Canada-based CSA Group, Germany's VDE Testing and Certification Institute, and the Fraunhofer ISE to create the CFV Solar Test Laboratory consortium. Under the terms of this partnership, all four parties will invest in and share ownership of a new testing facility specifically designed to meet the future needs of the solar

photovoltaic industry. Construction of this new facility is projected to begin in late 2010. Once complete, it will test products to ULC/ORD-C1703, UL 1703 and IEC 61730 safety standards, as well as IEC 61215 and IEC 61646 performance standards.

On June 16th, 2010, it was announced that the CFV Solar Test Laboratory would be located at Mesa Del Sol in Albuquerque, New Mexico. In addition to performing experimental work there, Fraunhofer ISE and CSE will ensure that the new test facility will be set up and operated with the latest PV technologies in mind. Roland Schindler, Executive Director of Fraunhofer CSE and Senior Researcher at ISE, remarked, "The new certification test facility will be another way for Fraunhofer to contribute to the market introduction of innovative, cost-saving PV technologies." http://cse.fraunhofer.org/about-the-cse/swtc/

High Altitude Discovery District

New Mexico has earned an international reputation for its science and technology innovation. Yet, the successful commercialization of the multi-billion annual spending of research and development has been elusive and difficult to harness toward the economic progress of the state. In 2009, a small delegation of visionary individuals and organizations started an initiative to change this fact. They raised capital, secured a strategically-located facility and began to develop the HADD organization. Contact: Michelle Hoeft, http://presencesantafe.com/presenceteam.html.

Incubators

New Mexico is home to several business incubators. A list can be found here: http://www.edd.state.nm.us/linksLists/index.html.

Los Alamos National Laboratory

Los Alamos National Laboratory is a premier national security research institution, delivering scientific and engineering solutions for the nation's most crucial and complex problems. Our primary responsibility is ensuring the safety, security, and reliability of the nation's nuclear deterrent. The Los Alamos of today emphasizes worker safety, effective operational safeguards & security, and environmental stewardship, while outstanding science remains the foundation of the Laboratory.

In addition to supporting the Lab's core national security mission, our work advances bioscience, chemistry, computer science, earth and environmental sciences, materials science, and physics disciplines. http://www.lanl.gov/about.shtml

Northern New Mexico Connect

Northern New Mexico Connect is the principal economic development investment of Los Alamos National Security LLC and Los Alamos National Laboratory. Our collection of coaching, networking, research, technical assistance and investment activities help businesses reach the next level of success and create an entrepreneurial culture in northern New Mexico.
We work with entrepreneurs and companies in diverse industry sectors and at various stages of development. Our clients distinguish themselves through their willingness to try new approaches—to innovate—and to be leaders and trailblazers—pioneers.
http://www.nnmconnect.net/Home/tabid/253/Default.aspx

Our programs include:

- **Venture Acceleration Fund** invests in creating and growing Northern New Mexico businesses that have an association with LANL technology or expertise. It funds up to $100,000 per project to businesses that use technology for commercial applications with market demand. Use of VAF awards includes activities such as proof of concept, prototyping, product engineering, customer acquisition and market validation.
- **Market Intelligence** helps entrepreneurs and businesses make better decisions. Market Intelligence analysts first meet with entrepreneurs to discuss and refine their

needs, ideas and questions. The analysts then customize research of sophisticated data sources for the business.

- **Springboard** provides expert coaching for companies facing a strategic decision such as securing funding, verifying a business model, building a management team, or penetrating a new market.
- **New Mexico Small Business Assistance Program** offers technical assistance to New Mexico small businesses. Businesses with a technical challenge that requires national laboratory expertise can seek assistance from scientists or engineers at Los Alamos and Sandia national laboratories. Such projects include testing, design consultation, and access to special equipment or facilities. Other types of technical assistance may be provided through the Manufacturing Extension Partnership and the UNM Anderson Schools of Management.
- **LINK** uses a community's own networks and resources to harness social capital for entrepreneurs. A community-based facilitator meets with the entrepreneur to understand his or her needs, then provides connections to networks and resources that help start, grow or improve the business.
- **Networking and Education:** Northern New Mexico Connect believes that education and networking are critical to the success of any business. We frequently team with our partners to sponsor events that benefit New Mexico companies and contribute to our entrepreneurial culture. One example is Ignite NM: http://www.ignite-nm.com/.
- **Strategic Partnerships:** Northern New Mexico Connect collaborates with many partners to support our entrepreneurial community.

New Mexico Angels

New Mexico Angels' mission is to provide opportunities where its members can obtain outstanding financial returns by investing in early-stage companies in New Mexico and the Southwest Region and accelerating them to market leadership. We work with the venture capital community and angel groups in the Southwestern area. http://www.nmangels.com/

New Mexico Small Business Investment Corporation

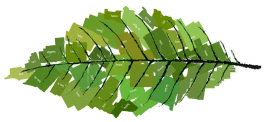
The New Mexico Small Business Investment Corporation (NMSBIC) was created by state legislation in 2000 to provide equity or loan capital to small businesses in New Mexico. Support for this legislation rested on the knowledge that small businesses - those with 25 or fewer employees - are the backbone of the state, sustaining the economies of local communities where they are located. Most new jobs in the state have been generated by small businesses, and small firms represent the majority of business enterprises in New Mexico.

Over 47 million dollars in NMSBIC funds is distributed through our funding partners and is passed on directly to the New Mexico small businesses that need it. Through this fund, New Mexico businesses are better able to finance expansion, create and retain jobs, and increase their livelihood.

Through our lending and equity partners we have made nearly 1,500 loans all over the state and found equity investments for over 30 small businesses. If you are looking for capital to start or expand your business, use the search tool at FinanceNewMexico.org . To see all of our partners, go to FinanceNewMexico.org/partners. SBIC website: http://www.nmsbic.org/

New Mexico Clean Technology Commercialization Working Group

This working group was convened by the New Mexico Economic Development Department in responsible to Executive Order 2010-001 and is responsible for this report.
http://www.edd.state.nm.us/greenEconomy/overview/index.html



New Mexico Colleges and Universities (non-research)

New Mexico is home to many colleges and universities in addition to the three research universities. These institutions provide a range of educational programs at the post-secondary level. http://www.hed.state.nm.us/

New Mexico Computing Applications Center (NMCAC)

NMCAC's mission is to create clean and green well-paying jobs in New Mexico by driving the development of high-tech industries. The NMCAC accomplishes its mission by coupling the State's remarkable depth and breadth of talented people, natural resources, culture, and highly favorable business environment with the power of world-class high-performance computing.

The NMCAC provides innovative and effective solutions to complex challenges by creating partnerships between businesses and organizations that include Sandia and Los Alamos National Laboratories, New Mexico's institutions of higher education, and New Mexico's forward-looking state government. This network draws on the full range of talent in the state while also driving progressive education, workforce and community development efforts that are critical to successfully growing high-tech businesses.

Our primary business model is to work with a business to develop new applications that are of importance to New Mexico. While we will assist companies in moving from the development stage to the production stage, our primary value is in our intellectual resources — the supercomputer is simply a tool that the R&D staff use in achieving our objectives of technology-based economic and workforce development. Target industries include aerospace, life sciences, environment and digital media. http://newmexicosupercomputer.com/

New Mexico Consortium

The New Mexico Consortium (NMC) is a non-profit corporation formed by the three New Mexico research universities under a teaming agreement with The University of California (UC) to partner with Los Alamos National Laboratory (LANL) to advance scientific research and education in New Mexico. http://newmexicoconsortium.org/

The NMC

- Leverages the strengths of three research universities to achieve common goals,
- Builds joint programs in support of common interests,
- Develops strategic partnerships with government, industry and other universities in support of the partnership, and
- Provides common organization and facilities to support these initiatives.

New Mexico Economic Development Department (NM EDD)

NM EDD is the state's economic development department, responsible for helping New Mexico businesses grow and attracting additional companies to the state through technical assistance, introductions, regulatory assistance, business incentives, and work with communities. The Department has several divisions, and additional information can be found at: http://www.edd.state.nm.us/. Information on incentives is also available.

Green Economy Initiative

The Green Economy Initiative was created and the Green Economy Manager was hired in September 2008. Through this initiative the growth of New Mexico's clean energy and clean technology is advanced. http://www.edd.state.nm.us/greenEconomy/overview/index.html

Office of Science and Technology (OST)
OST oversees science and technology economic development and works with both companies, investors and research institutions in the state. OST administers the Angel Investment Tax Credit.
http://www.edd.state.nm.us/scienceTechnology/intro/index.html

New Mexico Energy Innovation Fund

The Energy Innovation Fund was created to accelerate the development of innovation and enable faster commercial adaptation of clean energy technologies in New Mexico.
http://www.governor.state.nm.us/MEDIA/PDF/Energy%20Innovation%20Fund.pdf

New Mexico First

New Mexico First engages people in the democratic process. The organization brings together people from all walks of life to identify practical solutions to the state's toughest problems. Each year, New Mexico First focuses on one public policy issue.

In 2009, the policy focus was growing New Mexico's energy economy. More than 200 New Mexicans participated in the Town Hall, which took place over a two-day period and reached consensus on 18 recommendations. A background report is available at:
http://www.nmfirst.org/townhalls/TH37_reports.html, the final recommendations can be found at:
http://www.nmfirst.org/townhalls/TH37_reports.html, and their implementation report at:
http://www.nmfirst.org/townhalls/documents/TH38ImplementationProgressRpt.doc.

New Mexico Green Grid Initiative

The Green Grid Initiative is a consortium of New Mexico's research universities, labs, utilities, rural electric co-ops, the NMCAC, Intel and other private sector companies, and the Japanese government. The Green Grid Initiative seeks to establish our state as the preeminent test bed for smart grid solutions and result in the first statewide smart grid with high renewable energy penetration in the nation. The Japanese government has invested $30 million of its own funds into two demonstration projects in New Mexico based on the strength of our research and other assets. New Mexico is the only state with such an international partnership. Over $100 million in additional investments has been stimulated by this Initiative and work is ongoing. http://www.edd.state.nm.us/scienceTechnology/renewableEnergy/index.html

New Mexico Green Jobs Cabinet

The New Mexico Green Jobs Cabinet (GJC), formed by Governor Richardson through Executive Order 2009-002, convenes eight state agencies and engages non-profit and business partners to foster green economic and workforce development statewide and support national energy independence. The GJC has developed a Green Economy Report including an inventory of assets and opportunities and a strategic plan to leverage them. This report identified five bold strategic goals with detailed supporting recommendations: 1) be the leader in renewable energy export, 2) be the center of the North American solar industry, 3) lead the nation in Green Grid innovation, 4) remain a center of green building and energy efficiency excellence, 5) develop a highly skilled and ready-to-work workforce.

The GJC is currently implementing thirteen focused initiatives to advance this agenda, as directed by Governor Richardson through Executive Order 2010-001. These efforts will produce many benefits including a simplified permitting guide for green businesses; commercialization of clean technology; evaluation and improvement of state competitiveness; development of statewide biofuel and geothermal strategic plans; implementation of PACE (Property Assessed Clean Energy) districts; strengthened coordination with the Public Regulation Commission; promotion of sustainable and organic agriculture as well as green opportunities for Tribal communities.
http://www.edd.state.nm.us/greenEconomy/overview/index.html

New Mexico State Investment Council

The State Investment Council (SIC) is a non-cabinet level agency charged with managing New Mexico's Permanent Funds. According to the terms of the legislation, responsibility for the investment of the Land Grant Permanent Fund (LGPF) was transferred to the State Investment Officer, subject to the policy direction of the State Investment Council. The State Investment Council was assigned the responsibility for managing the Severance Tax Permanent Fund (STPF) in 1983. In 2000 the SIC began to manage the Tobacco Settlement Permanent Fund, and in 2006 the Legislature created the Water Trust Permanent Fund with a $40 million allocation. New Mexico's Endowment Funds are assets that represent the depletion of the state's natural resources and are intended to provide permanent and continuing benefits for all New Mexicans, both present and future. The State Investment Council seeks to optimize the Funds to insure that future generations receive the same benefits as current beneficiaries, and to professionally invest the Funds as provided by law to generate the maximum benefits over time to provide a current revenue source for the state's general fund. http://www.sic.state.nm.us/

The SIC oversees several investment programs that reinvest state funds specifically into New Mexico's economy. The three relevant to technology commerealization are:

- **New Mexico Private Equity Investment Program (PEIP) and New Mexico Co-investment Program**

  State Investment Officer (SIO) may invest in New Mexico private equity funds upon the approval of the Private Equity Investment Advisory Committee and the State Investment Council. A New Mexico private equity fund must establish and staff a full-time office in the state. In addition the private equity fund must agree to invest or cause to be invested in New Mexico companies, an amount equal or greater to the state's commitment to their fund. The State Investment Council may also make equity and/or debt investments directly in New Mexico businesses. The mechanism the SIC currently uses for direct investments is The New Mexico Co-Investment Partnership, a New Mexico private equity fund managed by Sun Mountain Capital. Sun Mountain is the fund's general partner, while also acting as the SIC's advisor for New Mexico private equity fund investments. The SIC's direct investments in New Mexico companies may represent no more than 51% of the investment capital in a business and must be made in conjunction with one or more qualified co-investors. To date, these investments in qualified New Mexico companies range from $1 million to $20 million. http://www.sic.state.nm.us/private_equity.htm

- **New Mexico Small Business Investment Corporation**

  See separate listing above.

New Mexico State University

A comprehensive land-grant institution of higher learning, New Mexico State University is dedicated to teaching, research, and service at the undergraduate and graduate levels. NMSU is a NASA Space Grant College, a Hispanic-serving institution and is home to the only **Honors College** in New Mexico. http://www.nmsu.edu/

Arrowhead Center

The Arrowhead Center is the economic and business development leader for New Mexico State University, helping to create an environment for small businesses to grow and thrive. Arrowhead Center utilizes a comprehensive approach to generating jobs, wealth, and an enhanced quality of life in New Mexico, synergizing the resources of the state's land-grant institution to better the lives of New Mexicans. http://arrowheadcenter.nmsu.edu/

The Arrowhead Center performs wide-ranging services that contribute to the creation and expansion of small businesses in New Mexico. These services and products include:

- Business assistance, including business plan development

- Entrepreneurship education and training
- Analysis of policy issues affecting New Mexico
- Incubating businesses in the Arrowhead Business and Research Park and TECHSTART programs
- Identification of labor and training needs associated with commercial enterprises
- Spin-off of commercially viable business concepts and technologies
- Protection of, licensing, and commercialization of NMSU intellectual property
- Connection of key players in the business and economic development process
- A business plan competition: Innoventure

School of Engineering
One of the College of Engineering's greatest strengths is its extensive research programs. Our faculty research efforts have earned widespread recognition and brought millions of dollars of funding to the college. Beyond that, research provides our students with invaluable practical experience and the opportunity to work closely with mentoring professors. Core areas of expertise include aerospace, energy, telecommunications, transportation, and water.

New Mexico Tech

New Mexico Tech enters the newest age of energy exploration with a long tradition of research towards understanding and more effectively harnessing renewable methods for creating energy. As the United States explores new means of energy, New Mexico Tech continues to be a trailblazer at the forefront in all areas of energy research and exploration.

New Mexico Tech has a long history in energy research, and has created and utilized its many research centers for discovering better ways of fueling our world. Since 1977 the Petroleum Recovery Research Center (PRRC)has been investigating more efficient methods of finding and taking carbon-based fuels from the Earth. Sharing its technology with industry, the PRRC's mission has been to assist others in better and improved petroleum recovery. Now the PRRC is the lead organization for the southwest partnership on carbon sequestration funded by the Department of Energy. The PRRC is using its knowledge in extraction to develop methods to return carbon the subsurface.

Another NMT Research Center, the Institute for Complex Additive Systems Analysis (ICASA), is investigating how price changing occurs in the wholesale energy market, a topic of utmost importance as the global price spike in gasoline demonstrated in 2008. Researchers at ICASA have created the Power Trader, a simulator to better understand price fluctuations in the energy market and the societal factors that cause them.

Quickly establishing itself as an important research center on the national level is the New Mexico Center for Energy Policy (NMCEP) located in Hobbs, NM. The NMCEP's mission is to become a community-centered response to the challenge of national energy security in the United States. Instead of energy leaders trekking to Washington D.C. to discuss local energy policies, the NMCEP will become an outlet for encouraging and facilitating discussions at a local level. To this end the NMCEP has already produced two important and timely energy conferences that combined have drawn audiences of over 800 regional and national leaders in various fields of energy production, research and policy (see a complete list of all NMT Research Organizations).

New Mexico Tech's most valuable resource is the collection of expert researchers carrying out important studies within these and other centers affiliated with NMT. Throughout the school, research faculty are exploring new ideas that are sure to shape future growth in renewable energy policy, generation and transmission, and interests range from research in hydrothermal energy to solar energy (see a complete list of researchers and their interests). Even students are carrying on important work in renewable energy, such as the project for creating a reduced cost heliostat.

As the focus of the energy industry narrows on renewable energy, there is little doubt that the gaze will fall squarely on New Mexico Tech. Research excellence is a tradition at NMT, and one which will continue into the new age of renewable energy. http://www.nmt.edu/energy-research-at-new-mexico-tech/590-moving-ahead-in-energy

New Mexico Tech Foundation
The New Mexico Tech Foundation handles technology transfer and licensing for the university.

New Mexico Technology Commercialization Council

The New Mexico Commercialization Council (NMTCC) is a volunteer effort comprised of top leadership from each of the State's five primary research centers, along with other state and national thought leaders from the public and private sectors with experience and commitment to the idea that successful technology commercialization can provide the foundation for long term sustainable economic development success. The Council produced a report, "Energy from the Sun: A Clean Technology-Based Economic Development Vision for New Mexico" in April 2010. Contact David Blivin, dave@cottonwoodtechnologygroup.com, for more information.

New Mexico Venture Capital Association

The New Mexico Venture Capital Association (NMVCA) was formed in 2004 as a trade association for the venture capital and private equity firms that do business in the state of New Mexico. The association provides networking, educational and advocacy services for its member organization. Membership is open to venture capital and private equity firms that invest in New Mexico. There are five main purposes, or goals, of the New Mexico Venture Capital Association:

- Facilitate intra-industry communication
- Provide a unified public voice
- Sponsor and support public policy initiatives (Legislative advocacy)
- Gather statistics on New Mexico venture capital investments, and
- Educate potential institutional Limited Partners

The organization is managed by a volunteer board of directors consisting of representatives of the member firms. NMVCA's operations are divided into committees along the lines of the above areas of emphasis. http://www.nmvca.org/. A list of member companies can be found at: http://www.nmvca.org/member-companies.php. Impact information is available at: http://www.nmvca.org/about-economicimpact.php.

New Mexico Water Innovation Fund

The WIF is designed to fund pilot projects that demonstrate highly innovative technologies that address compliance issues with arsenic, fluoride or radionuclides and water conservation. Short range projects with technology that can be successfully demonstrated and then transferred elsewhere in New Mexico are being sought.
www.nmenv.state.nm.us/cpb/.../RFI-**WaterInnovation**Projects-FINAL.pdf

Research Applications Center

The RAC was established by the New Mexico legislature in 2009 (SB 205) with the following purposes:

A. promote the public welfare and prosperity of the people of New Mexico;
B. foster economic development in the area of intellectual property within New Mexico;
C. attract investments that will drive technological innovations in New Mexico;
D. create high-value technology jobs in New Mexico with appropriately trained employees to fill such jobs;

E. forge links, critical partnerships and collaboration among New Mexico's business communities, universities, private foundations, national laboratories and government through the development of a research applications center;
F. support educational initiatives in science, technology, engineering and mathematics in the state to ensure the availability of the future work force required to meet the goals of the New Mexico Research Applications Act; and
G. engage in cooperative ventures related to the use of research and development applications, including the use of research and development applications as a means of enhancing state and local resource development and promoting innovative technological advances in the areas of economic, community and work force development; education; science; technology; engineering; mathematics; research and development; conservation; and health care, within New Mexico.

Through the New Mexico Economic Development Department's Office of Science and Technology, the RAC was incorporated and the board convened for the first time in the spring of 2010. A draft business plan has been developed and work to establish the Center is ongoing. Contact Brendan Miller, Brendan.Miller@state.nm.us for more information.

Sandia National Laboratories

Since 1949, Sandia National Laboratories has developed science-based technologies that support our national security. Today, the 300+ million Americans depend on Sandia's technology solutions to solve national and global threats to peace and freedom.

Through science and technology, people, infrastructure, and partnerships, Sandia's mission is to meet national needs in five key areas:

- **Nuclear Weapons**
  ensuring the stockpile is safe, secure, reliable, and can support the United States' deterrence policy
- **Defense Systems & Assessments**
  addressing new threats to national security
- **Energy, Climate & Infrastructure Security**
  ensuring the stable supply of energy and resources and protection of infrastructure
- **International, Homeland & Nuclear Security**
  focusing on the protection of nuclear assets and nuclear materials, and addressing nuclear emergency response and nonproliferation worldwide
- **Homeland Security & Defense**
  helping to protect our nation against terrorism

Sandia is a government-owned/contractor operated (GOCO) facility. Sandia Corporation, a Lockheed Martin company, manages Sandia for the U.S. Department of Energy's National Nuclear Security Administration. We seek collaborative partnerships on emerging technologies that support our mission. http://www.sandia.gov/about/index.html

Sandia Science and Technology Park

"The Sandia Science and Technology Park is Albuquerque's high-technology community, ideally situated adjacent to Kirtland Air Force Base and the multi-billion dollar, multi-program engineering and science facilities of Sandia National Laboratories." It is one of the first technology parks associated with a national laboratory and was awarded "Outstanding Research Park of the Year" by the Association of University Research Parks in 2008.

Technology Ventures Corporation

TVC was formed in 1993 as a non-profit charitable foundation by Lockheed Martin Corporation as part of the management contract for Sandia National Laboratories. Its mission is to commercialize federally

funded technologies. Goals: job creation, business formations, and equity funding. Beginning in 2002, under a DOE cooperative agreement, TVC extended its commercialization activities to support at various times other energy laboratories including INL, ANL, BNL, ORNL, SRNL, LANL, and LLNL.

TVC® services include technology and market assessments, entrepreneurial training, business case development, and equity investor development. Since its founding, TVC has helped form 100 new companies, secure more than $1.1 billion in private-sector funding in more than 200 funding events, and create more than 13,000 jobs. In New Mexico, these numbers are 86 new companies, more than $750 million in funding, and approximately 8,000 jobs.

The companies TVC assists are commercializing a wide range of technologies, from alternative energy to advanced computing, from life sciences to nanotechnology. New Mexico companies include Emcore Corporation, Altela, Enerpulse, Hyperion Power Generation, Wellkeeper, Aspen Avionics, and Wavefront Sciences, to name just a few.

The primary vehicle for showcasing both seed and early stage companies are TVC's Equity Capital Symposia. To date, one-third of the presenting companies have received funding—a noteworthy achievement, especially since TVC clients do not pay any fees (or equity compensation) for assistance.

In addition to supporting entrepreneurs, TVC has been an innovator in its own right with respect to technology development and commercialization on several levels:

- ***Innovation:* America's *Journal of Technology Commercialization*** TVC is the publisher of this bimonthly magazine, which is free to qualified subscribers and now has a circulation of more than 15,500. (Formerly *TechComm*) www.innovation-america.org
- **Sandia Science & Technology Park** TVC co-founded this nationally recognized research park that, when fully developed, will have up to 12,000 people employed at technology-based companies. www.sstp.org

For more information, check out www.techventures.org, or contact Randy Wilson, Program Management Director, at 505-843-4287.
http://techventures.org/

University of New Mexico

The University is the state's flagship research institution. UNM research injects millions of dollars into New Mexico's economy, funds new advancements in healthcare, and augments teaching – giving students valuable hands-on training in state-of-the-art laboratories.

Offering more than 210 degree and certificate programs, UNM has 94 bachelor's degrees, 74 master's degrees and 40 doctoral programs. The Health Sciences Center is the state's largest integrated health care treatment, research and education organization.

Among the University's outstanding research units are the High Performance Computing Center, Cancer Center, New Mexico Engineering Research Institute, Center for High Technology Materials, Design Planning Assistance Center ,Environmental Law and Policy and the Center for Non-Invasive Diagnosis.

During the fiscal year 2006-2007, the University received $72.6 million in private support. Budgeted consolidated revenues for 2007-2008 are $1.84 billion. In fiscal year 2006-2007, UNM faculty and staff generated more than $298 million in contracts and grants. Also, UNM doctors and nurses provided more than $370 million in patient care services and $152.6 million in uncompensated patient care. Information on research can be found here: http://www.unm.edu/research/. UNM's main page: www.unm.edu

School of Engineering

The School's nine affiliated research centers enjoy international reputations, are closely linked to interdisciplinary advanced degrees, and serve as catalysts for collaboration with partners in the public and private sector. These are the Advanced Materials Laboratory, the Center for Advanced Research Computing (CARC) ,the Center for Biomedical Engineering (CBME), the Center for Emerging Energy Technologies (CEET), the Center for High Technology Materials (CHTM) , the Center for Micro-Engineered Materials (CMEM), the Center for Nuclear Nonproliferation Science and Technology (CN2ST), the Institute for Space & Nuclear Power Studies (ISNPS), Manufacturing Training and Technology Center (MTTC) , the UNM Aerospace Institute, and the Manufacturing Engineering Program (MEP).
http://www.soe.unm.edu/research/centers.html

Anderson School of Business
The faculty and staff of Anderson School of Management are dedicated to excellence in teaching, research, and service. This commitment is focused on ensuring the success of our 1,500 students. The Anderson School offers a Management of Technology concentration and courses in Entrepreneurship.
Highlights of the past year include:

- Continued high graduation rate (86%) at the undergraduate level.
- One of the nation's leading programs of ethical and socially responsible conduct - recognized by the Aspen Institute as one of the top 20 programs in the world.
- Top 20 recognition as a leading Hispanic-serving MBA program.
- A Technology Business Plan Competition involving ten teams of graduate students competing for $40,000 in prizes. http://techbizplan.mgt.unm.edu/
- An Executive MBA program filled with leaders from all sectors of the business and government communities.
- Record attendance at the annual Anderson Alumni Hall of Fame recognition dinner.
- A nationally recognized Information Assurance program in partnership with local, state, and national law enforcement agencies.
- Top placement in national student marketing competitions.
- A full schedule of presentations by business leaders at the new Paul R. Jackson Student Center.
- Recognition by US News + World Report for being one of the top 25 MBA programs for enrollment of women and ethnic minorities.
- The Native American Career Fair, an annual event that has become a premier venue to connect Native American students and employers with the Anderson community.

STC.UNM
STC.UNM (STC) is a nonprofit corporation formed by and owned entirely by the **University of New Mexico (UNM)** (formed in 1995 by the Regents of UNM) to protect and transfer its faculty inventions to the commercial marketplace. STC licenses innovative technology developed at UNM, including optics, microfluidics, and high performance materials as well as therapeutics, diagnostics, medical devices, and drug discovery tools. http://stc.unm.edu/

White Sands Missile Range

White Sands Missile Range provides Army, Navy, Air Force, DoD, and other customers with high quality services for experimentation, test, research, assessment, development, and training in support of the Nation at war.
http://www.wsmr.army.mil/wsmr.asp

WIRED

The goals of the New Mexico WIRED project are to foster entrepreneurship, generate talent and encourage innovation in public policy. The New Mexico WIRED project will inspire and support the innovative development and expansion of green manufacturing in New Mexico which includes advanced manufacturing, green building, clean and renewable energies, aerospace, microelectronics and optics. http://www.dws.state.nm.us/NMWIRED.html

TechMaker is a project of WIRED: a dynamic curriculum for entrepreneurs and aspiring entrepreneurs that literally maps out the tech transfer process. Using interactive maps that cover each step of the process – from prototyping to marketing. http://techmaker.org/

APPENDIX I

TABLE 21. State and local government-financed R&D expenditures at universities and colleges, by geographic division and state: FY 2003–08. http://www.nsf.gov/statistics/nsf10311/

(Dollars in thousands)

Division and state	Population	2003	2004	2005	2006	2007	2008	2008 Rank	2008 Per Capita	2008 Per Capita Rank
United States	301,621,157	2,646,601	2,879,161	2,940,248	2,962,054	3,142,509	3,417,995		$0.01133	
North Dakota	639,715	3,760	28,498	31,158	32,349	35,409	37,729	27	$0.05898	1
Montana	957,861	21,506	21,279	21,119	22,218	23,348	28,382	31	$0.02963	2
Louisiana	4,293,204	105,214	113,921	115,247	99,949	105,079	117,859	9	$0.02745	3
South Dakota	796,214	9,826	10,877	12,739	15,848	14,005	17,457	37	$0.02193	4
Arkansas	2,834,797	55,395	44,931	47,006	50,625	52,858	59,044	17	$0.02083	5
North Carolina	9,061,032	117,158	123,972	147,634	138,796	145,920	185,470	4	$0.02047	6
Texas	23,904,380	338,573	355,653	354,813	409,255	430,984	457,214	1	$0.01913	7
Kansas	2,775,997	40,117	46,142	50,021	49,150	45,616	52,782	23	$0.01901	8
Iowa	2,988,046	51,078	50,647	48,954	50,318	57,321	54,402	22	$0.01821	9
Virginia	7,712,091	76,661	85,427	96,739	104,458	127,766	131,799	8	$0.01709	10
Idaho	1,499,402	18,749	20,770	25,334	25,643	25,497	22,093	34	$0.01473	11
Ohio	11,466,917	39,511	152,245	167,576	150,297	178,154	168,555	6	$0.01470	12
Kentucky	4,241,474	48,960	52,458	52,451	54,237	56,468	61,911	15	$0.01460	13
Hawaii	1,283,388	11,822	8,815	7,077	8,933	15,534	18,192	36	$0.01417	14
Oklahoma	3,617,316	40,582	34,287	37,115	39,099	44,663	51,033	24	$0.01411	15
New York	19,297,729	159,682	195,519	220,872	201,856	257,032	255,632	3	$0.01325	16
District of Columbia	588,292	2,893	3,776	3,635	4,477	5,173	7,631	47	$0.01297	17
Mississippi	2,918,785	37,397	52,693	36,840	35,180	32,198	37,466	28	$0.01284	18
New Mexico	1,969,915	14,913	13,435	15,277	25,002	21,896	25,179	33	$0.01278	19
Minnesota	5,197,621	59,826	50,813	50,836	53,684	57,742	63,375	13	$0.01219	20
Oregon	3,747,455	38,016	37,291	41,583	44,585	45,754	45,363	25	$0.01211	21
Wyoming	522,830	1,993	1,993	2,203	2,616	6,131	5,993	49	$0.01146	22
Maryland	5,618,344	60,819	61,218	67,795	63,793	54,154	62,967	14	$0.01121	23
Utah	2,645,330	22,677	24,715	20,203	20,632	25,486	29,280	30	$0.01107	24
Pennsylvania	12,432,792	93,992	99,142	115,862	121,033	120,154	136,596	7	$0.01099	25
Florida	18,251,243	118,531	199,642	156,003	168,787	165,493	176,522	5	$0.00967	26
Georgia	9,544,750	85,361	83,728	77,701	82,124	69,975	91,603	10	$0.00960	27
Tennessee	6,156,719	54,507	53,679	63,449	52,281	53,248	58,301	19	$0.00947	28
Washington	6,468,424	20,015	40,995	42,640	42,394	47,038	61,204	16	$0.00946	29
Arizona	6,338,755	39,564	24,650	25,200	29,386	37,000	58,045	20	$0.00916	30
Indiana	6,345,289	51,364	54,007	60,879	62,211	57,417	58,634	18	$0.00924	31
California	36,553,215	283,213	269,373	256,669	266,411	284,047	333,026	2	$0.00911	32
Maine	1,317,207	13,386	12,730	10,128	8,811	7,531	11,865	42	$0.00901	33
Delaware	864,764	3,745	3,529	5,296	4,989	5,717	7,661	46	$0.00886	34
Rhode Island	1,057,832	6,764	7,085	8,778	8,032	8,094	8,441	44	$0.00798	35
Wisconsin	5,601,640	50,480	41,301	45,299	36,584	39,562	44,961	26	$0.00803	36
Nebraska	1,774,571	12,014	12,102	12,650	10,881	10,304	12,053	41	$0.00679	37
Michigan	10,071,822	95,152	84,069	75,038	74,875	65,090	66,139	12	$0.00657	38
New Jersey	8,685,920	66,571	58,323	56,803	57,502	56,248	57,331	21	$0.00660	39
South Carolina	4,407,709	21,673	19,312	32,504	34,467	45,462	28,183	32	$0.00639	40
Illinois	12,852,548	93,543	72,130	66,830	67,673	71,144	75,460	11	$0.00587	41
Missouri	5,878,415	33,606	37,099	41,495	33,429	35,579	33,780	29	$0.00575	42
Connecticut	3,502,309	9,307	7,070	7,793	9,196	13,438	17,432	38	$0.00498	43
New Hampshire	1,315,828	7,709	7,323	6,006	9,425	8,716	6,579	48	$0.00500	44
Nevada	2,565,382	8,024	11,784	4,263	7,695	9,141	12,202	40	$0.00476	45
West Virginia	1,812,035	3,263	4,826	4,114	5,283	7,393	7,865	45	$0.00434	46
Colorado	4,861,515	30,808	14,420	20,962	18,030	19,397	19,680	35	$0.00405	47
Alaska	683,478	5,036	3,103	2,704	2,392	1,819	1,824	50	$0.00267	48
Massachusetts	6,449,755	43,373	41,699	45,166	18,199	17,130	16,923	39	$0.00262	49
Alabama	4,627,851	6,765	9,369	8,889	9,989	12,510	9,594	43	$0.00207	50
Vermont	621,254	3,440	5,006	5,161	5,681	385	267	51	$0.00043	51

NOTE: Because of rounding, detail may not add to total.

SOURCE: NSF/Division of Science Resources Statistics, Survey of Research and Development Expenditures at Universities and Colleges, FY 2008.

APPENDIX J

TABLE 31. R&D expenditures at universities and colleges, ranked by all R&D expenditures, by source of funds: FY 2008
Universities with R&D expenditures greater than $50 million. http://www.nsf.gov/statistics/nsf10311/
(Dollars in thousands)

Rank	Institution	All R&D expenditures	Federal government	State and local government	Industry	Institution funds	All other sources	Percent Industry	Industry Funding Rank	Percent Industry Rank	State Funding Rank
	All institutions	51,908,726	31,231,220	3,417,995	2,870,147	10,434,984	3,954,380	5.53%			
7	Duke U.	766,906	451,317	19,320	152,073	90,965	53,231	19.83%	1	2	48
10	OH State U. all campuses	702,592	335,121	99,329	127,604	102,631	37,907	18.16%	2	3	6
11	PA State U. all campuses	701,130	406,528	67,916	99,074	125,995	1,617	14.13%	3	6	9
14	MA Institute of Technology	659,626	495,008	802	87,220	10,586	66,010	13.22%	4	7	152
8	U. WA	765,135	614,069	10,634	74,002	40,965	25,465	9.67%	5	19	72
36	Purdue U. all campuses	429,988	176,592	50,145	63,843	137,708	1,700	14.85%	6	4	13
12	Stanford U.	688,225	509,477	13,557	59,645	53,178	52,368	8.67%	7	21	66
28	U. Southern CA	519,543	348,713	6,905	58,328	105,597	0	11.23%	8	13	93
27	GA Institute of Technology all campuses	522,136	281,184	15,517	55,592	168,333	1,510	10.65%	9	15	60
9	U. PA	708,244	482,321	17,192	50,894	61,327	96,510	7.19%	10	38	54
6	U. CA, San Diego	842,027	490,963	30,649	49,878	141,291	129,246	5.92%	11	54	33
5	U. CA, Los Angeles	871,478	471,932	22,600	47,096	186,194	143,656	5.40%	12	64	43
2	U. CA, San Francisco	885,182	472,642	27,623	46,476	158,133	180,308	5.25%	13	70	36
20	TX A&M U.	582,365	245,607	124,139	43,421	157,163	12,035	7.46%	14	31	2
30	U. TX Austin	493,294	324,287	20,318	42,513	80,872	25,304	8.62%	15	23	47
18	U. CA, Berkeley	591,770	249,163	43,969	41,568	168,035	89,035	7.02%	16	41	21
47	NC State U.	366,137	131,412	113,385	41,311	79,840	189	11.28%	17	12	3
4	U. MI all campuses	876,390	592,768	4,953	40,696	192,650	45,323	4.64%	18	77	114
44	U. MD Baltimore	379,407	169,026	18,178	40,670	103,337	48,196	10.72%	19	14	50
22	U. TX M. D. Anderson Cancer Ctr.	558,503	194,889	149,429	40,625	100,042	73,518	7.27%	20	34	1
1	Johns Hopkins U., The[a]	1,680,927	1,425,100	6,694	39,183	86,669	123,281	2.33%	21	122	96
16	U. CA, Davis	642,519	268,957	56,078	33,575	215,037	68,872	5.23%	22	71	12
19	U. FL	584,170	230,999	111,114	31,811	175,266	34,980	5.45%	23	63	4
13	U. MN all campuses	682,662	364,137	62,266	28,605	123,238	104,416	4.19%	24	83	10
45	U. Rochester	375,218	276,268	10,918	27,151	38,572	22,309	7.24%	25	37	71
67	U. HI Manoa	271,835	194,508	17,578	26,921	28,132	4,696	9.90%	26	18	53
68	SUNY Albany	270,414	108,747	56,121	25,560	45,761	34,225	9.45%	27	20	11
15	Cornell U. all campuses	653,996	358,944	75,460	25,544	123,011	71,037	3.91%	28	87	8
78	U. Miami	241,775	165,986	5,376	24,715	15,590	30,108	10.22%	29	16	110
43	U. TX Southwestern Medical Ctr. Dallas	390,349	201,480	49,262	22,960	34,701	81,946	5.88%	30	55	14
48	Scripps Research Institute, The	366,047	265,657	1,610	22,811	55,827	20,142	6.23%	31	48	139
64	U. South FL	278,419	169,911	28,840	22,501	57,121	46	8.08%	32	26	35
39	IN U. all campuses	411,939	186,711	6,836	22,223	132,605	63,564	5.39%	33	65	95
54	SUNY Buffalo all campuses	338,300	157,578	16,823	21,433	96,916	45,550	6.34%	34	47	57
3	U. WI Madison	881,777	474,440	36,830	20,796	270,406	79,305	2.36%	35	121	27
29	U. IL Urbana-Champaign	501,279	266,912	36,930	20,722	161,848	14,867	4.13%	36	84	26

TABLE 31. R&D expenditures at universities and colleges, ranked by all R&D expenditures, by source of funds: FY 2008
Universities with R&D expenditures greater than $50 million. http://www.nsf.gov/statistics/nsf10311/
(Dollars in thousands)

Rank	Institution	All R&D expenditures	Federal government	State and local government	Industry	Institution funds	All other sources	Percent Industry	Industry Funding Rank	Percent Industry Rank	State Funding Rank
46	VA Polytechnic Institute and State U.	373,281	135,578	100,311	20,475	96,331	20,586	5.49%	37	62	5
34	Baylor C. of Medicine	449,301	262,498	3,505	20,051	68,290	94,957	4.46%	38	80	128
42	LA State U. all campuses	391,234	150,298	89,055	18,767	108,652	24,462	4.80%	39	74	7
62	CO State U.	295,235	208,925	12,860	18,068	43,938	11,444	6.12%	40	50	67
25	U. CO all campuses	535,556	437,393	6,043	17,971	44,440	29,709	3.36%	41	97	103
74	U. TN all campuses	250,188	120,289	48,222	17,247	50,416	14,014	6.89%	42	44	16
79	U. of Medicine and Dentistry NJ	230,347	122,061	12,440	17,174	53,930	24,742	7.46%	43	32	68
57	U. CA, Irvine	324,552	178,299	16,691	17,111	68,775	43,676	5.27%	44	69	58
60	OR Health & Science U.	301,396	232,208	4,569	16,612	25,229	22,778	5.51%	45	61	120
52	U. NE all campuses	349,220	136,317	8,801	16,328	157,690	30,084	4.68%	46	75	84
69	AZ State U.	259,503	125,558	22,856	16,126	84,065	10,898	6.21%	47	49	42
125	U. Central FL	108,067	55,771	5,664	16,037	30,595	0	14.84%	48	5	108
85	U. CA, Santa Barbara	203,719	111,601	4,184	15,542	41,024	31,368	7.63%	49	29	124
84	Carnegie Mellon U.	210,619	170,978	3,633	15,274	13,900	6,834	7.25%	50	35	127
99	U. MA Worcester	178,614	145,113	895	15,192	2,626	14,788	8.51%	51	24	151
32	Northwestern U.	483,881	264,984	4,280	15,103	151,759	47,755	3.12%	52	101	122
72	U. UT	253,891	171,737	1,374	14,466	51,106	15,208	5.70%	53	57	144
33	Harvard U.	453,028	383,330	2,088	14,446	0	53,164	3.19%	54	99	134
87	Wake Forest U.	199,915	146,298	18,795	14,362	7,058	13,402	7.18%	55	40	49
93	U. OK all campuses	192,070	91,578	17,590	13,934	56,408	12,560	7.25%	56	36	52
61	Mt. Sinai School of Medicine	296,380	253,319	2,488	13,811	7,115	19,647	4.66%	57	76	133
21	Washington U. St. Louis	563,967	393,918	15,331	13,580	88,979	52,159	2.41%	58	120	61
91	Clemson U.	195,195	56,535	24,188	13,573	97,131	3,768	6.95%	59	42	40
81	IA State U.	224,368	102,771	44,000	13,373	56,908	7,316	5.96%	60	53	20
94	Medical U. SC	189,369	102,187	1,428	13,106	66,737	5,911	6.92%	61	43	142
23	Columbia U. in the City of New York	548,704	461,029	9,958	12,724	48,349	16,644	2.32%	62	123	78
75	Wayne State U.	249,210	115,904	10,338	12,719	74,893	35,356	5.10%	63	72	74
31	Yale U.	487,285	374,551	4,245	12,692	23,330	72,467	2.60%	64	114	123
17	U. Pittsburgh all campuses	595,627	456,172	14,807	12,397	83,439	28,812	2.08%	65	131	63
159	Northeastern U.	59,911	36,497	1,618	12,296	9,500	0	20.52%	66	1	138
58	Rutgers, The State U. NJ all campuses	323,404	140,399	36,474	12,216	102,424	31,891	3.78%	67	89	28
24	U. AZ	545,869	277,897	31,370	11,325	186,912	38,365	2.07%	68	132	32
41	U. MD College Park	395,037	236,417	26,148	11,140	109,100	12,232	2.82%	69	107	38
113	Tufts U.	139,528	95,620	926	11,058	11,387	20,537	7.93%	70	28	149
139	Rush U.	89,513	40,942	22	10,997	34,544	3,008	12.29%	71	9	167
133	U. of Notre Dame	97,171	66,812	930	10,971	18,458	0	11.29%	72	11	148
50	MI State U.	356,767	152,907	47,068	10,955	128,808	17,029	3.07%	73	102	18

TABLE 31. R&D expenditures at universities and colleges, ranked by all R&D expenditures, by source of funds: FY 2008
Universities with R&D expenditures greater than $50 million. http://www.nsf.gov/statistics/nsf10311/
(Dollars in thousands)

Rank	Institution	All R&D expenditures	Federal government	State and local government	Industry	Institution funds	All other sources	Percent Industry	Industry Funding Rank	Percent Industry Rank	State Funding Rank
40	U. AL Birmingham, The	404,615	303,084	296	10,182	67,623	23,430	2.52%	74	115	163
35	Emory U.	441,222	291,126	7,029	9,961	55,678	77,428	2.26%	75	124	92
26	U. NC Chapel Hill	525,843	373,098	23,911	9,900	118,934	0	1.88%	76	137	41
80	U. CT all campuses	225,904	119,915	10,295	9,564	68,006	18,124	4.23%	77	82	75
108	VA Commonwealth U.	148,655	95,369	14,534	9,440	24,380	4,932	6.35%	78	46	64
55	U. KY all campuses	336,669	154,811	48,013	9,253	98,723	25,869	2.75%	79	110	17
56	U. IL Chicago	335,138	196,520	11,987	9,015	94,521	23,095	2.69%	80	111	70
83	MS State U.	210,951	105,327	34,178	8,525	62,921	0	4.04%	81	85	30
105	U. MA Amherst	152,884	79,736	4,699	8,182	49,556	10,711	5.35%	82	67	117
158	U. ND all campuses	65,027	46,620	2,946	8,105	5,324	2,032	12.46%	83	8	130
132	Thomas Jefferson U.	99,275	76,034	6,440	7,986	4,267	4,548	8.04%	84	27	100
154	Southern IL U. Carbondale	67,094	17,499	8,813	7,955	31,055	1,772	11.86%	85	10	83
127	U. AR main campus	102,784	31,531	46,292	7,566	15,399	1,996	7.36%	86	33	19
90	U. TX Health Science Ctr. Houston	197,252	129,277	15,040	7,519	26,698	18,718	3.81%	87	88	62
53	U. Cincinnati all campuses	344,046	221,186	20,493	7,513	77,348	17,506	2.18%	88	127	46
37	Vanderbilt U.	422,622	331,296	402	7,434	58,008	25,482	1.76%	89	142	162
49	U. Chicago	357,278	284,616	7,608	7,025	29,650	28,379	1.97%	90	135	90
59	NY U.	310,699	199,363	6,126	7,005	40,420	57,785	2.25%	91	125	102
65	WA State U.	276,806	97,668	48,653	6,923	110,854	12,708	2.50%	92	116	15
88	U. NM main campus	197,630	134,783	4,328	6,922	48,143	3,454	3.50%	93	92	121
120	MT State U. Bozeman	120,155	70,386	24,619	6,459	18,691	0	5.38%	94	66	39
63	U. IA	293,564	229,903	9,122	6,433	32,549	15,557	2.19%	95	126	81
70	U. VA all campuses	257,651	219,429	1,140	6,414	18,780	11,888	2.49%	96	117	147
98	U. TX Medical Branch	180,026	122,009	6,668	6,403	28,640	16,306	3.56%	97	91	97
96	Dartmouth C.	186,938	121,306	4,904	6,376	39,690	14,662	3.41%	98	95	116
71	Boston U.	255,022	235,153	576	6,343	0	12,950	2.49%	99	118	157
124	U. NH	113,877	83,769	1,509	6,074	16,422	6,103	5.33%	100	68	140
145	NM Institute of Mining and Technology	79,437	64,322	3,665	5,990	5,197	263	7.54%	101	30	126
161	U. TX Dallas	59,300	21,383	18,040	5,969	6,667	7,241	10.07%	102	17	51
117	U. CA, Riverside	129,605	53,780	6,577	5,829	51,147	12,272	4.50%	103	79	98
92	Princeton U.	194,757	125,102	1,459	5,746	51,947	10,503	2.95%	104	103	141
136	Temple U.	92,486	58,686	5,121	5,595	17,672	5,412	6.05%	105	52	112
147	U. RI	77,457	50,377	7,728	5,568	13,784	0	7.19%	106	39	89
86	U. TX Health Science Ctr. San Antonio	201,323	121,758	4,983	5,567	50,406	18,609	2.77%	107	109	113
134	FL International U.	95,706	52,838	6,432	5,497	30,939	0	5.74%	108	56	101
73	SUNY Stony Brook all campuses	252,745	106,419	29,990	5,396	103,869	7,071	2.13%	109	128	34
66	CA Institute of Technology	272,881	243,624	1,979	5,340	6,771	15,167	1.96%	110	136	136

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Rank	Institution	All R&D expenditures	Federal government	State and local government	Industry	Institution funds	All other sources	Percent Industry	Industry Funding Rank	Percent Industry Rank	State Funding Rank
160	U. Toledo	59,583	29,201	6,506	5,159	15,793	2,924	8.66%	111	22	99
118	U. DE	125,179	84,628	7,318	5,058	23,003	5,172	4.04%	112	86	91
51	U. GA	350,299	102,817	43,312	5,001	188,166	11,003	1.43%	113	150	22
143	U. Dayton	81,275	64,515	9,049	4,968	2,093	650	6.11%	114	51	82
163	MI Technological U.	58,763	29,868	617	4,893	22,730	655	8.33%	115	25	156
38	Case Western Reserve U.	416,077	305,483	14,286	4,873	57,782	33,653	1.17%	116	155	65
112	WV U.	139,770	68,147	4,649	4,782	60,591	1,601	3.42%	117	93	118
119	OK State U. all campuses	121,226	41,051	31,776	4,372	43,072	955	3.61%	118	90	31
148	Rensselaer Polytechnic Institute	77,295	47,109	10,078	4,337	13,134	2,637	5.61%	119	59	77
116	U. CA, Santa Cruz	135,261	69,742	6,866	4,279	36,229	18,145	3.16%	120	100	94
140	U. Houston	84,490	43,162	9,160	4,136	23,288	4,744	4.90%	121	73	80
110	UT State U.	146,128	88,884	26,933	4,089	20,019	6,203	2.80%	122	108	37
138	NJ Institute of Technology	89,792	40,087	4,918	4,078	30,871	9,838	4.54%	123	78	115
121	U. AR for Medical Sciences	117,440	62,035	8,292	4,020	27,075	16,018	3.42%	124	94	86
166	TX Tech U.	57,902	19,698	16,840	3,970	13,336	4,058	6.86%	125	45	56
115	KS State U.	137,543	52,984	41,367	3,922	31,338	7,932	2.85%	126	106	23
109	Auburn U. all campuses	146,984	54,748	2,719	3,841	81,243	4,433	2.61%	127	112	131
156	Old Dominion U.	66,538	28,298	5,335	3,757	29,148	0	5.65%	128	58	111
100	U. SC all campuses	172,378	98,576	2,039	3,435	53,077	15,251	1.99%	129	134	135
144	TX A&M U. System Health Science Ctr.	79,687	33,044	1,415	3,431	32,328	9,469	4.31%	130	81	143
95	OR State U.	188,056	113,614	37,823	3,373	29,928	3,318	1.79%	131	141	25
82	U. KS all campuses	215,364	122,401	5,881	3,342	74,579	9,161	1.55%	132	147	106
162	SUNY Binghamton	59,017	14,402	8,207	3,274	27,662	5,472	5.55%	133	60	87
135	U. ME	95,042	40,931	10,140	3,228	39,512	1,231	3.40%	134	96	76
102	Brown U.	157,670	95,145	713	2,768	54,807	4,237	1.76%	135	143	154
106	Woods Hole Oceanographic Institution	150,720	117,587	427	2,744	12,543	17,419	1.82%	136	140	161
103	George Washington U.	157,145	119,100	4,607	2,538	11,099	19,801	1.62%	137	145	119
150	Rice U.	74,254	54,959	465	2,470	9,026	7,334	3.33%	138	98	160
107	U. Louisville	148,936	72,711	12,300	2,390	41,541	19,994	1.60%	139	146	69
101	Medical C. WI	165,529	111,602	701	2,380	35,732	15,114	1.44%	140	148	155
123	U. VT	115,421	89,717	267	2,330	18,753	4,354	2.02%	141	133	164
77	U. MO-Columbia	244,639	108,131	15,715	2,140	107,782	10,871	0.87%	142	160	59
130	Drexel U.	100,911	65,198	5,870	2,138	20,044	7,661	2.12%	143	130	107
76	Rockefeller U.	247,505	81,557	242	2,060	147,196	16,450	0.83%	144	162	165
114	NM State U. main campus	138,427	86,636	17,186	1,995	30,707	1,903	1.44%	145	149	55
149	U. WY	74,720	28,372	5,993	1,951	37,071	1,333	2.61%	146	113	104
157	U. AL Huntsville, The	65,396	47,068	789	1,868	9,132	6,539	2.86%	147	105	153

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129	U. NV, Reno	102,073	66,165	5,918	1,747	27,525	718	1.71%	148	144	105
111	Georgetown U.	142,623	111,590	1,331	1,736	11,694	16,272	1.22%	149	154	146
89	Yeshiva U.	197,311	143,866	0	1,731	39,505	12,209	0.88%	150	159	169
167	Medical C. GA	57,085	39,486	7	1,672	10,846	5,074	2.93%	151	104	168
153	U. OR	67,378	55,190	911	1,434	6,274	3,569	2.13%	152	129	150
169	C. of William and Mary all campuses	55,090	25,645	3,830	1,360	19,859	4,396	2.47%	153	119	125
137	U. MS all campuses	90,095	65,799	201	1,223	16,434	6,438	1.36%	154	152	166
104	Tulane U.	153,242	109,152	8,309	1,084	19,455	15,242	0.71%	155	164	85
165	U. MT-Missoula, The	58,032	34,407	2,535	1,079	15,857	4,154	1.86%	156	138	132
122	ND State U. all campuses	115,513	50,038	34,783	1,037	25,976	3,679	0.90%	157	158	29
155	U. MD Baltimore County	66,802	50,561	1,719	951	12,134	1,437	1.42%	158	151	137
170	U. NV, Las Vegas	50,775	41,505	3,313	943	5,014	0	1.86%	159	139	129
142	U. ID	81,532	45,301	21,394	908	11,948	1,981	1.11%	160	157	45
152	San Diego State U.	69,974	36,267	8,058	889	17,863	6,897	1.27%	161	153	88
151	George Mason U.	72,542	50,392	5,513	835	10,844	4,958	1.15%	162	156	109
146	GA State U.	77,709	26,257	22,584	677	24,721	3,470	0.87%	163	161	44
97	FL State U.	182,314	110,618	9,787	638	52,386	8,885	0.35%	164	166	79
168	St. Louis U. all campuses	56,644	49,434	502	455	60	6,193	0.80%	165	163	159
141	Naval Postgraduate School	83,314	82,302	542	415	0	55	0.50%	166	165	158
131	U. CA Office of the President	100,034	101	40,551	298	49,195	9,889	0.30%	167	167	24
164	U. LA Lafayette	58,667	12,426	10,370	0	19,681	16,190	0.00%	170	170	73
128	U. AK Fairbanks all campuses	102,761	90,280	1,353	0	0	11,128	0.00%	169	169	145
126	Uniformed Services U. of the Health Sciences	106,179	67,345	0	0	34,106	4,728	0.00%	168	168	170

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